CULTURE NOT NUMBERS:
DILEMMAS AND DISCOURSES OF THE
UNDERREPRESENTATION OF WOMEN IN COMPUTING

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Where are the women in computing? This dissertation explores the underrepresentation of women in computing as a cultural issue. After considering the role of women in the history of computing, it examines contemporary interventions to address gender bias and promote gender diversity in the tech sector and Silicon Valley. Not for profit organizations operate as intermediaries that work to raise awareness of gender bias and facilitate institutional alignment on diversity policy and practice across corporate, academic, and the public sectors. This research used a multi-method approach that included critical discourse analysis, participant observation, and qualitative method. Moments of discourse were analyzed to reveal and illuminate dilemmas such as the phenomenon of unconscious bias and the prospect and dilemma of male allies for culture change. Also explored was the tension between focusing on diversity metrics vs. mounting intervention to produce durable culture change the face of deeply entrenched attitudes and practices that push back overt and subtle ways. Gendered occupational identities and biased institutional practices reverberate through the tech sector and more broadly in the structures of society. The conclusion raises uncomfortable questions, such as whether the work on gender diversity is ever "done,"

and who will continue to put pressure on companies to reconcile tensions between

business performance and social justice.

BIOGRAPHICAL SKETCH

I remember a time when women received computer science degrees and worked as programmers and software developers at historic peak levels of women's participation in computing. Having entered computing in 1986 as a programmer and systems analyst at Corning Incorporated, I note my experience as a woman in computing of the 1980s working in a corporate IT group. As seen in Appendix L, I was a member of software development group in 1989 at Corning Inc. that was approximately 50 percent female programmers[1]. This was a time when members of my team collaborated without wondering why so few women in computing. During the same time period, I was required to complete a corporate diversity training program as part of the company's "valuing diversity" initiative that was framed around the theme of "women and men as colleagues." While this training was not particularly targeted at computing, Corning was acknowledged as a notable company for diversity initiatives during this period.

After almost a decade in corporate, I pursued a new path in academia. It was 1994 at the dawn of the Word Wide Web when I became a senior software engineer at Cornell University. I became the only female developer in my new group at Mann Library and I didn't question this as unusual or significant. After two years I moved to my next position in the "digital library research group" in the Cornell computer science department, still not reflecting on what had happened to women's participation in computing since the 1980s. In 1997 I was a member of the Digital Library Research Group where I became the lead system architect and the developer of the software known as Fedora, the Flexible Extensible Digital Object Repository Architecture (Payette & Lagoze, 1998; Payette & Lagoze, 2000; Payette & Staples, 2002). After a series of

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[1] I'm the one with the pink suit and the fake cigar with my feet on the desk, a notable moment of gender parody (parity) for the programming team.

conference papers and successful grants, I led Fedora into becoming a successful open source

project and became the founding CEO of a 501(c)3 not-for-profit organization that is the home

base for a suite of open source software offerings for libraries, archives, and other knowledge

institutions that are providing access to and preserving digital content (see DuraSpace at

https://duraspace.org/).

It was during my time as CEO of DuraSpace that I developed an interest in pursuing

academic research on key questions of the social impact of Web-era software development

cultures. Having been the only female developer on my own open source software project

(Fedora), and one of very few female developers in the broader "digital library" community, I

realized that I first must ask the question - *"where are the women?"* At this point I applied to

the PhD program at Cornell University to pursue interdisciplinary study across the fields of

Communication, Science and Technology Studies, and Information Science. After being

accepted into the Department of Communication, I transitioned the leadership of DuraSpace to

the next generation and began my quest to study the historical and contemporary issues that affect

the underrepresentation of women in in computing. I spent the first two years of my PhD (2011-

1013) in full-time study to develop the rich scholarly grounding that was essential to pursue the

research of this dissertation. This included the history of women in computing as a special area

of interest in my STS minor. For the next five years in the Department of Communication, I

continued research for my PhD while also returning to technical career positions, first at the

University of Michigan (2014-2015), then at the Cornell University Library as the Director of

Information Technology for Research and Scholarship (2016-2018).

In memory of Dr. Dennis Luke Payette

ACKNOWLEDGMENTS

There are so many people who encouraged me to pursue this project known as my later-in-life PhD.   Many of them know that I was originally hoping to pursue a PhD in the early 1990s but the vision of the "digital library" that was emerging on the Web took me down a different path.   Since then, I have worked with so many wonderful colleagues at the intersections of computer science, information science, and research libraries. Finally, in 2011 the time had come for me to finally take on doctoral study with an open field of research questions about the implications of the systems that we are building and deploying in the Web era.   For all those who supported and encouraged me to take this intellectual journey, I am eternally grateful and I will continue to use this knowledge in practice for positive social change.

To begin, I would like thank my husband Carl Lagoze for his love, support, and positive spirit in our life together and in our intellectual partnership.   What a joy to explore new pathways and inspire each other along the way.   As for our life in research, it began with our early work on digital libraries that ultimately led to both of us making the academic turn into PhDs programs and new research paths that integrate the technical with the social.   I also wish to anoint Carl as "Dr. Chef" since he embraced cooking as a hobby and made great meals for me during key stages of my PhD!

I am very fortunate to have an amazing PhD Committee, with each member bringing a unique scholarly perspective when advising me in the interdisciplinary approach of my research.   First, I would like to thank Lee Humphreys, the Chair of my Committee, for her leadership, wisdom, and devotion to rigorous qualitative research.

Lee's wonderful combination of intellect, kindness, and feminist perspective made the period of writing my dissertation an experience that was intellectually challenging and personally meaningful. I would also like to recognize Ron Kline as both mentor and kindred spirit who, like me, first began his career in technology before pursuing his scholarly path in the history and ethics of technology. Ron is one of the most generous scholars I have known who enthusiastically devoted his time throughout my years as an STS minor[2]. Steve Jackson invited me into the circle of scholars who were deliberating on issues of "Knowledge Infrastructure." This influenced me as both a technologist and a scholar to frame my work in the area of digital preservation from the standpoint of an "ethic of care" and technological renewal. Steve also influenced my thinking on technology and policy which became an important theme for my dissertation. I save my thanks to Tarleton Gillespie for last, since he was the first faculty member with whom I began my PhD journey. Tarleton encouraged me to apply to the PhD program in the Department of Communication and he advised me in the early stages of my PhD. Tarleton's deep thinking always inspired me and he introduced me to theories of discourse, which ultimately became a key theoretical pillar for my analysis of socio-technical systems and my dissertation research. To all my Committee members, I express my deepest gratitude and admiration. Also, I would like to thank all of the amazing faculty, graduate students, and researchers I worked with at Cornell University and University of Michigan during my PhD years.

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[2] Ron advised and encouraged me during the process of writing and publishing my first history paper. See: Payette, Sandy. "Hopper and Dijkstra: Crisis, Revolution, and the Future of Programming." *IEEE Annals of the History of Computing*, vol. 36 no. 4, 2014, pp. 64-73. *Project MUSE*, muse.jhu.edu/article/564925.

I would not have achieved this PhD without the support of my family and my "family of friends." Thank you to my family members who were "on the ground" with me through the key stages of my PhD, especially Lucy Lagoze, Stacey Payette, Pam and Su Rubinoff, and Howard Lagoze. I am especially grateful to my most special friends Anne Kenney, Oya Rieger, Geri Gay, and Thorny Staples who began as colleagues in the early digital library era and then became my life-long friends!! Each of you are sources of inspiration and joy and you have each uplifted me in your unique ways. Also special thanks to dear friends Sara Hess, Jeff Furman, Mike Jackson and Karen Jackson of Ithaca. You have all been there with me and Carl from the beginning and have believed in me every step of the way. Outside of Ithaca, I send my thanks and gratitude to my friends Chuck Friedman, Patti Abbott, and Dharma Akmon of Ann Arbor, Michigan. Also, I would also like to acknowledge my longest friendship in the Finger Lakes Region, the multi-talented Robin Burnett who encouraged me to do my PhD since 1990 and continues to be a model of how to find joy in life. Finally, I am eternally grateful for the devotion of my mother Jeannine Payette and my late uncle Dennis Payette who provided the modeling for a love of knowledge, which is the foundation for my ability to have accomplished this PhD.

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CHAPTER 1
Introduction: No Hiding Behind the Pipeline Problem

Beginning in the early 1990s, a new archetype of computing professional emerged from the startup culture of Silicon Valley - the "male geek-as-entrepreneur."   The dominant Web-based computing culture both created and reinforced a fast-moving competitiveness that was not in conversation with issues of gender and diversity policy. Rather, timing, risk, and immediacy were key concerns and the "right type" of person was viewed as essential to success or failure of a company.   The right type of person was increasing seen as a particular type of technical male (Neff, Wissinger, & Zukin, 2005).

The identity of computing as a male-dominated field is not a new phenomenon. In his account of the masculinization and professionalization of computing, Ensmenger (2010b) revealed how men became dominant in computing departments of established computer companies in the late 1960s and 1970s.   But, today's men of Silicon Valley are not the same "computer boys" described by Ensmenger (2010a).   This time, the computer boys were "hacking" in garages and starting companies. They appeared in the development of the first microcomputers and in the emergence of the Internet and the Web as the technological foundation for the plethora of applications we see today.   A new era of computing had emerged that was built on risk and entrepreneurship, creating an environment akin to a "wild west" operating outside the bounds of diversity policy and practice.

While women were central in the history of computing and the origins of software development, the absence of women in key technical and leadership roles in Web-era

companies is alarming. The underrepresentation of women in computing became increasingly visible through the 1990s, and blatantly obvious in the 2000s, distinguishing the computing sector as a persistent anomaly when compared with other disciplines in science, technology, engineering, and mathematics (STEM). Indeed, computer science is the one STEM area that has continued to have a downward trend in the percentage of women over multiple decades.

The scope of this problem in the tech workplace was not widely appreciated until 2014 when top tech companies publicly released their diversity statistics (Kimmelman, 2014; Milian, 2014). This happened only after pressure from the press and from activists such as Jesse Jackson who even appeared at corporate board meetings to provoke the issue of lack of diversity in the tech sector (Dickey, 2016; Hardy, 2014). When the diversity data was revealed, the numbers were both unsurprising and alarming, with giants such as Google, Facebook, and Microsoft reporting extremely low percentages of women in technical positions.

Why So Few Women? Why it matters and how is it being addressed?

In fact, in a period of time when women made advances in a wide variety of careers, the percentage of women in the roles of programmer, systems analyst, software engineer, and similar positions in tech had been in decline since peak rates prior to the emergence of the World Wide Web. Figure 1 shows this decline in the overall percentage of women in computing occupations (Aschraft & Blithe, 2009; L. Barker, 2010).
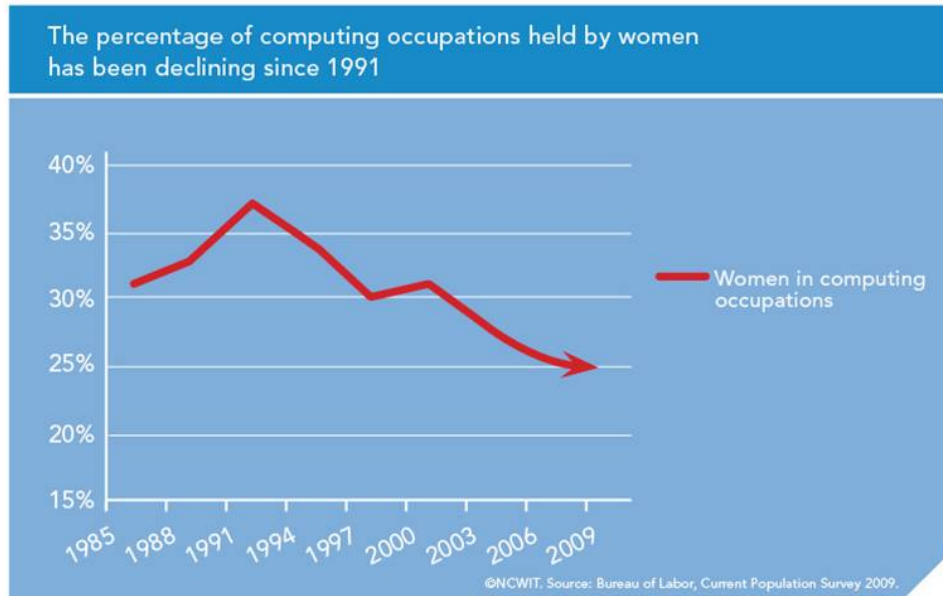
Figure 1. Trends in women in computing occupations (graphic courtesy of NCWIT)

The problem of underrepresentation of women is not limited to the corporate sphere. Even in the domain of "peer production communities" where individuals collaborate to build free and open software (Benkler, 2006; Coleman, 2013; Kelty, 2008), the percentage of women developing software is shockingly low. For instance, one study found that only 1.5 % of open source developers were women (Nafus, D., Leach, J., & Krieger, 2006). Many open source projects operate outside of the bounds of traditional organization structures, and this makes it harder to track diversity and institute corrective policy. The implications of the lack of gender diversity in open source development communities are especially troublesome given the vast portfolios of open source software that are components that form the substrate of Web architecture as well as a myriad of open source software platforms and user-facing applications. From a social perspective, this gender disparity is paradoxical given the ethos of open source communities that value collaboration, sharing, transparency, and a type of software development that is, in

theory, open to anyone to contribute. Despite this discourse of openness, in practice there is a lack of diversity in open source, and only a few scholars have specifically addressed this phenomenon through research on gender and open source communities (Lin, 2006; Mendez et al., 2018; Nafus, 2011; J. Reagle, 2015).

For decades, the "pipeline" argument has been one of the dominant narratives of diversity in STEM and the term has been frequently invoked as a causal factor for the gender imbalances in computing. As a metaphor, the "pipeline" puts the focus upstream on the *supply* of qualified candidates for computing job*s*. Such a supply-side perspective could be narrowly translated into the following reductionist logic: there are not enough qualified women for companies to hire into computing jobs because there are too few qualified women with training in computer science emerging from academic degree-granting programs.

As illustrated in Figure 2, when the percentage of women majoring in computer science is compared with other STEM fields, we see a proportionally lower percentage of women in computing (Bartol & Aspray, 2006). The percentage of women majoring in computer science was initially on the rise through the 1970s and 1980s, but then suffered a precipitous decline during the very periods in which the microcomputer became established in the marketplace and, later, when the World Wide Web ushered in the Silicon Valley "dot.com era" of technology startups. Especially striking in the diagram is the continuous *increase* in the proportion of women in medicine and physical sciences starting in the 1970s and extending beyond the point in the 1980s when computer science started to decline.

What Happened To Women In Computer Science?
% Of Women Majors, By Field

Medical School ■ Law School ■ Physical Sciences ■ Computer science
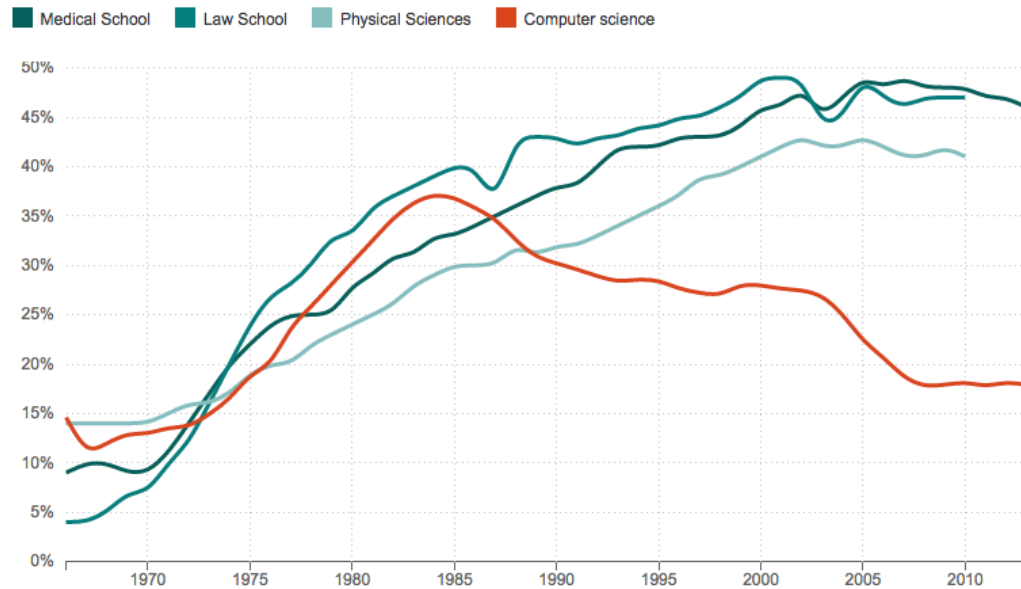
Source: National Science Foundation, American Bar Association, American Association of Medical Colleges
Credit: Quoctrung Bui/NPR

Figure 2. What happened to women in computer science?[3]

Following the assumptions of the pipeline argument, a dominant way of
measuring the impact of diversity initiatives across computing since the 1990s has been
to count the number of women receiving college degrees in particular disciplines and
correspondingly count the number of women being hired by companies. Camp (1997)
characterized the situation of the underrepresentation of women in computing as "the
incredible shrinking pipeline," bolstering her argument with data from government
agencies that showed a decline in the proportional representation of women receiving
degrees in computer science. However, Camp did not provide answers as to *why* the

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[3] Source:https://www.npr.org/sections/money/2014/10/21/357629765/when-women-stopped-coding

percentage of women has declined and called upon the computer science community to do more research on this phenomenon.

Beyond the Pipeline Argument

The pipeline metaphor reinforces a focus on counting and metrics that plays nicely into an economic and corporate viewpoint that favors quantitative measures of diversity in organizations. The supply-side articulation of the diversity problem in information technology and computer science was criticized by Jesse (2006) who observed that there was a "deeper problem with the pipeline metaphor… a problem of creating demand." (p. 239). Others have critiqued the data-centric views of the pipeline as lacking a theoretical frame for understanding the underrepresentation of women in STEM (Blickenstaff, 2005; Soe & Yakura, 2008). Despite such critiques, companies in the tech sector still focus on colleges and universities as the primary feeders for job candidates in computing and frequently invoke the pipeline metaphor as if the academy were a source in a production process that makes the products that companies can then consume. If it were just an issue of supply and filling the pipeline with women, then other paths for improving the representation and opportunities for women in design and development positions in tech could be ignored or sidelined. These other paths require continually seeking knowledge on issues of gender and tech and using that knowledge to mount new types of interventions to address the cultural issues that relate to the underrepresentation of women in tech. This requires an understanding of the dynamics of gender and power, specifically in the context of women in computing. This is especially important since the emergence of the Internet and Web, where the gender imbalances in tech companies is significant. This dissertation provides a view into who has power, how

it is invoked, how it is resisted, and how culture plays a key role. It also focuses on the transformative dynamics of power in the quest for positive social change in tech.

Culture change happens in the face of deeply entrenched cultures that push back on change in both overt and subtle ways. The analysis of discourse in this dissertation will reveal both subtle and the hidden biases that reverberate through institutional practices in the tech sector and more broadly in the structures of society. It also identifies areas of friction, tension, and contradiction that can be signs that illuminate barriers, or signs of confrontation of challenges, or signs of the path to reconciliation and a commitment to culture change.

My research was influenced by theories of discourse and used a fusion of critical discourse analysis (CDA) and qualitative methods including participant observation, interview and document analysis. Through these methods I surfaced key themes that had high prominence in the discourses of gender and computing during the period 2014-2017: *unconscious bias*, *male allies*, the meaning of *diversity data* and prospect of *culture change*. Discourse analysis can illuminate the suppression of knowledge (e.g., obfuscation of the meaning behind diversity data). It can also reveal tensions and contradictions such as when a male advocate for women also embodies unconscious bias, or the tension between data-centric diversity paradigms and identity-focused and cultural paradigms. My overall goal was to analyze both visible and hidden elements of discourse to contribute to the knowledge that illuminates gender issues in tech and informs new pathways for pro-social change in tech. As an overly simplistic metaphor, the pipeline-as-metric can leave aside nuanced questions such as what social factors inhibit women

from entering computing companies? what constrains the advancement opportunities for women in computing? and why women are leaving computing after they have obtained a technical job in the computing workplace?   While data on degree granting and rates of hiring are indeed useful to reveal the state of gendered trends, these data alone give little insight into the meaning of the trends.

Even if we were to embrace the metaphor of the pipeline, we still must ask about the deeper reason for the shortage of women in computing and why has it varied over time.   This is not an easy question to answer. The pipeline argument, itself, does not reveal much about the status of women who actually *did enter* the computing workforce. The common practice of collecting and reporting of diversity data in *aggregate* does not reveal the specific *types* of computing jobs that women occupy, further obscuring who has the highest status and highest paid roles in tech companies.   In the workplace there is a long history of job segregation, with high percentages of women often found in lower status and lower paying jobs. Overall, the pipeline is not forthcoming for answering a number of relevant questions: why aren't women advancing in their jobs? why are they not getting the most creative projects in software development? or why are they leaving the computing workplace altogether?

Social science research communities have taken a more multi-dimensional perspective on gender and computing by looking at the multiple intersecting social and cultural factors that influence the underrepresentation of women.   Starting with the K-12 perspective, researchers have provided insights as to why more boys than girls are both encouraged and attracted to computers and programming, which in turn increases the

likelihood that more boys than girls will have confidence and experience when applying to computer science programs, and even afterwards if they are accepted to them. (Margolis & Fisher, 2002; Margolis, Fisher, & Miller, 1999).   This begins to explain how early cultural factors influence gendered identities in computing, but there is still a large gap in our understanding of the full trajectory necessary to explain what's happening in the workplace today.   Other scholars have conducted research on historical and cultural factors that shape identities of computing including: identify formation around the profession; factors that discourage women from entering computing, and experiences that influence women to leave computing after they actually have entered the profession (K. L. Ashcraft & Ashcraft, 2015; Hayes, 2010b; Misa, 2010b).

How can we emerge into a new era of diversity that moves computing towards an ideal of gender parity and the eradication of gender bias in the production of the technologies that increasingly touch upon so many aspects of our social and economic lives? To help understand this, I situate myself amid the emerging body of critical and qualitative research that examines *why and how* women are underrepresented in computing and what *interventions* can be mounted to correct the downward trend. This type of research moves beyond the pipeline argument and to provide the meaning behind the numbers.

Not-for-Profit Organizations as Intermediaries

Inspired by the role not-for-profits in serving the public good, I became aware of an emerging ecosystem of organizations that were established to improve opportunities for women in technology, and specifically in computing. I refer to this, broadly, as the

Women in Technology (WIT) Ecosystem. As depicted in Figure 3, the organizations in

this ecosystem offer a range of programs that include: education, consulting, advocacy,

community building, positive identity building, working with companies, breaking down

structural barriers, teaching women to code, helping women discover new career

opportunities, combating bias and discrimination, and inspiring girls to pursue in

computer science.

Figure 3. WIT Ecosystem: Not-for-Profits for Women in Computing

The two most mature not-for-profit organizations in the ecosystem are the Anita

Borg Institute (ABI) and the National Center for Women in Information Technology

(NCWIT). These served as primary sites for my research and provided a discursive and

observational lens for my analysis of contemporary issues of gender and computing.

NCWIT convenes an annual "Summit" where leaders deliberate, share best practices, and

strategize on how to take action. Similarly, the Anita Borg Institute (ABI) produces a

flagship event known as the Grace Hopper Celebration for Women in Computing (GHC), which is recognized as the world's largest annual gathering for women in computing. ABI and NCWIT are *intermediaries* that bring together leaders and employees of corporations, faculty and students in academia, as well as leaders of not-for-profit organizations and public sector and government agencies. Both NCWIT and ABI work for the public good, yet they must navigate the complexities of convening and partnering with different constituencies and stakeholders that operate from different paradigms and motivations while still sharing the common goal of increasing the representation of and opportunities for women in tech.

While NCWIT and ABI produce events that bring together coalitions working for the common cause for gender equality, they still must navigate some tricky gender scenarios where intentions and actions of the participants don't align as expected. Such moments are explored in the core empirical chapters, with cases such as the discourse that publicly exposed of a moment of unconscious bias of a prominent male CEO, and a discussion panel of male allies promoting allegiance with women while tensions became apparent on social media, with unexpected consequence and even a moment of surprise. These and other moments also show how not-for-profits like NCWIT and ABI must navigate a "mission-market" tension (Sanders, M., 2015; Young 2005; Young and Aranson, 2010; Valentinov, 2011) when positioning as intermediaries in the terrain of diversity interventions. While they operate as not-for-profits with a mission for the public good, they must also negotiate and reach a common ground with corporations about how to intervene on issues of diversity while still navigating paradigms of productivity and profit. This involves engaging multiple tactical approaches to

improving diversity in tech, including engagement with corporations on business issues, educating about the research about bias and diversity, and acknowledging the pipeline argument while exposing the meaning diversity metrics. This all must be done while advocating for social justice and initiating interventions for women in computing that put the focus on cultural change.

As described earlier, I selected NCWIT and ABI as primary sites for observation. NCWIT describes itself as a "change leader network," which means it *convenes, equips, and unites*" member institutions from both industry and academia. In addition to its annual "Summit," NCWIT also produces and disseminates "evidence-based" resources (e.g., reports, brochures, fact sheets, educational materials) to educate leaders about gender issues, with translations of academic research into actionable steps. Similarly, the Anita Borg Institute (ABI) states that its mission is to "*connect, inspire and guide*" women in the field of computing with its main event being the Grace Hopper Celebration for Women in Computing (GHC). The GHC conference is produced in cooperation with the Association of Computing Machinery (ACM), the main scientific society in computing.   Attendance at GHC has grown exponentially from a few hundred in the late nineties and early 2000s to 4,500 in 2013 to over 15,000 in 2017. More detailed profiles of these not-for-profit organizations is found in Appendices A and B

The importance of my using ABI and NCWIT as an observational lens is that they are structurally positioned to engage with companies, universities, other many other types organizations in both the private and public sectors. From their positioning outside companies and universities, they both produce and disseminate new understandings of

gender bias, facilitate discussions about gender, technology, and diversity, and engage with companies on issues of institutional practice and policy. They offer exposure to new discourses in computing, while also translating the academic research that is behind the latest keywords of diversity (e.g., "unconscious bias," "implicit bias," "male advocates," "culture," "inclusion," "diversity data"). I used the major events of ABI and NCWIT as opportunities to observe and engage with institutional leaders about issues of diversity policy, workplace practices (e.g., recruiting, hiring, retention, advancement); and cultural change (e.g., workplace environment).

By operating at the intersecting borders where members of the educational and corporate sectors meet, ABI and NCWIT create discursive spaces where cross-sector leaders convene, share experiences, develop ideas, and deploy solutions. They engage with different communicative and structural paradigms to address cultural issues around gender diversity and computing. They also mount focused interventions aimed at educating these organizations on root causes of gender bias, promoting best practices for using diversity data, and explaining why social change matters in the area of gender and computing. I observed how not-for-profit organizations can serve as sites of power where alignment and common ground can be achieved, but also where tensions and contradictions are revealed through the inherent power of discourse. One way that NCWIT and ABI invoke such power is by being the framers of the discourses on issues of gender and tech. Through their programs they both produce, re-constitute, and disseminate discourse; they educate on how to talk about issues of gender bias; they provide forums for communities to convene and engage in discourse as a practice and to transform elements of discourse into new practices and policy.

My empirical analysis is grounded in the relationship between discourse and practice, where the elements of discourse help reveal the dynamics and tensions of interventions on the ground - how institutions that are positioning for change, how the agency of individuals matters, and how coalitions and alliances assert structural power to improve opportunities for women in tech. In the core chapters, I speak as the analyst using methods of critical discourse analysis to identify and examine moments that reveal tension, contradiction, and dilemma around issues of gender.   My identification and analysis of *discursive moments of "crisis"* helped reveal the complexity within the terrain of diversity interventions. As intermediaries, ABI and NCWIT worked to facilitate the alignment of discourse and practice across and within corporate, academia, and the public sectors. My analysis shows how tricky this can be, and I focused on moments of discourse that revealed tensions and dilemmas such as: a tension in the nature of unconscious bias while also being a male ally for women in tech; and how organizations can be in alignments on their goals but have tension in the means of fulfilling them; and how institutional paradigms (e.g.., metrics-focused vs. culture-focused interventions) for addressing the problem of gender diversity in tech may by based on how the problem is being defined.

My analysis was influenced by the theories of discourse of Foucault (1981) and, my methodology was inspired by Fairclough (1992) who provided an understanding of the role of discourse in the process of social change. I embrace an expansive definition of discourse as a means of unraveling language, metaphors, and social interactions surrounding gender and computing. Borrowing from Edwards (1996), discourse can be thought of as

"a way of knowledge, a background of assumptions and agreements about how reality is to be interpreted and expressed, supported by paradigmatic metaphors, techniques, and technologies and potentially embodied in social institutions" (p. 34).

Discourse can inspire change in social practice and can challenge the nature of hegemonic gender structures. My work illuminates cases where discourses and institutional practices awkwardly intersect. There are tensions and blind spots in navigating the complex terrain of gender and computing in organizational contexts. I reveal insights through the analysis the tensions, contradictions, and dilemmas of gender and tech, and also the harbingers of social change that suggest prospects for a new era of women in computing.

Chapter Line Up

This dissertation has the following structure. Chapter 2, reviews the theoretical influences that provided foundational pillars for my thinking, specifically theories of discourse, social change, structuration, and feminist organizational theory. Chapter 3 presents my methodology for this research, which was a multi-method approach that included critical discourse analysis, participant observation, qualitative interview method, and text analysis. Chapter 4 provides a brief history of women in computing that provides the necessary background to set the historical context for the dissertation. This chapter reviews four stages - the early history of women in computing, the mid 20th century status of women in programming, the emergence of the Web, and the contemporary status of women in tech. Chapter 5, introduces the notion of a "forum of discourse" that features the observational lens of ABI's Grace Hopper Celebration and NCWIT's Summit. I used these events to access the discourses of women and

computing and to observe institutional perspectives (corporate and academia), as well as the work in practice for addressing diversity.   Chapter 6 and 7 introduce dominant contemporary themes in diversity discourse – *unconscious bias* and *male allies*. After providing background and definitions, these two chapters provide case analyses of "discursive moments of crisis" where high profile male leaders of a major technology companies publicly advocated for gender diversity and tensions were provoked around issues of gender bias and power.   I examine how highly visible moments of discourse can not only raise awareness of underlying issues but can also play a significant role in the process of positive social change.   Chapter 8 discusses a contemporary shift in the focus of diversity intervention from a numbers-centric paradigm to interventions focused on culture and identity. Key themes include the limits of counting women as a way to deal with diversity, the use of better and different data, and how organizations can approach the more difficult work of social change. Chapter 9 synthesizes the analysis with a review of key moments of discourse, limitations of this study, and avenues for future work.

Since the underrepresentation of women in computing is a social issue of concern when considered in the context of the Internet and the Web, it also provokes essential questions about the impact of new technologies on society. When women are not well represented at key stages of design and development of software that pervades our lives, they are not a part of creating the technology-enabled world of today and the future.

CHAPTER 2
Theoretical Influences

The research of this dissertation was undertaken with an interdisciplinary stance that invoked critical theory, discourse analysis, qualitative methods, and a historical perspective. This chapter will review the groundwork of the foundational theories that influenced my thinking on issues of gender and computing. When read in conjunction with the next two chapters, it reveals my overall approach, with Chapter 3 describing my research methodology, and Chapter 4 reviewing the literature regarding the history of women in computing, an understanding of which is essential for a contemporary analysis of women in the computing and the tech sector.

My review of theory is organized into four sections: (1) I begin with theories of *discourse and power*, starting with Michel Foucault (1970, 1972, 1978) and transitioning to Judith Butler (1999; 2010), who brings gender and identity into the analysis. (2) Next, I transition to the topic of *discourse and social change* with Norman Fairclough's discourse theory (Fairclough, 1992, 2002, 2005) informing the relationships between discourse and social practice[4]. (3) In order to understand gendered discourse in the tech sector, I then review social theory that informs the "constitution of society" (A. Giddens & Dallmayr, 1982) and, thereby, supports the analysis of gender in institutional contexts. Anthony Giddens' theory of structuration (1984b) is a grand theory that considers the mutually reinforcing forces of *structure* (i.e., institutions, systems, laws, policies) and

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[4] Fairclough's theory also lays the ground for discussion in Chapter 3 of Critical Discourse Analysis (CDA) as a method.

agency (i.e., individuals, actors, agents), making it useful foundation for studying issues of gender within institutional contexts.   (4) Finally, I engage feminist perspectives on gender and institutions, especially theories of occupational segregation that inform the *gendering of the computer programmer*. In consideration of the interconnections of institutions, actors, and technologies, I look to the field of Science and Technology Studies (STS) and bring forth Judy Wajcman (2000, 2004), who provided a feminist perspective to the key theories about the social construction of technology and socio-technical systems.

Theories of Discourse and Power

Michel Foucault and Judith Butler provide philosophical grounding for thinking about discourse and power. As such, I used them as theoretical touch points throughout my research and key themes of their theories will be invoked in later analytical chapters. Foucault and Butler provide a type of critical theory that probes the less visible sources of power. The theory also enables the *imagining of new possibilities* through the exposure of and resistance to the hegemonic forces of gendered categorization and computing identities.

An essential tension theorized by Foucault was that discourse is both a force that represents knowledge, as well as a force that can repress it. Indeed, Foucault (1978) argued, "… it is in discourse that power and knowledge are joined together" (pp. 100–101). Inherent in his theory of discourse is an understanding of hegemonic power, specifically how power is constituted and reproduced, as well as the recognition that it can be resisted, including the possibility of even overthrowing it.

"Discourse transmits and produces power; it reinforces it, but it also undermines and exposes it, renders it fragile and makes it possible to thwart it" (p. 101).

Grounding with a theory of power becomes essential when grappling with the underrepresentation of women in computing, and more broadly when examining the invisibility of women's voices in both history and contemporary tech workplace. Foucault (1970) theorized power as residing in discourse by means of the discursive practices (i.e., rules, systems, and procedures) of the "order of discourse", which is a conceptual terrain that regulates what is deemed discursively permissible, and even knowable. In other words, the power of discourse is the control of what can be said, which also legitimizes what can, and cannot, be *thought,* ultimately controlling knowledge itself. In this, Foucault (1978) presented an essential tension - that discourse is both *"an instrument and an effect of power"* (p. 101).

For Foucault, the ability of discourse to silence and repress knowledge happens through "systems of exclusion" (e.g., rules and procedures) that serve to control, constrain and delimit discourse. These systems rest upon an "institutional support" that is continuously reinforced by social practices and educational processes including "the system of books, publishing, libraries; learned societies in the past, and laboratories now" (1970, p. 55). Foucault offers a theory of a total discourse that encompasses what was "already-said," that which was "not-said," and even what was "never said." While the following quote from Foucault (1972) takes some time to digest, it is essential to his argument about how power is exercised through the repression of discourse and the subtle acts of silencing.

... all manifest discourse is secretly based on an 'already-said'; and that this 'already-said' is not merely a phrase that has already been spoken, or a text that has already been written, but a 'never-said', an incorporeal discourse, a voice as silent as a breath, a writing that is merely the hollow of its own mark. It is supposed therefore that everything that is formulated in discourse was already articulated in that semi-silence that precedes it, which continues to run obstinately beneath it, but which it covers and silences. The manifest discourse, therefore, is really no more than the repressive presence of what it does not say; and this 'not-said' is a hollow that undermines from within all that is said" (pp. 27–28).

Above, we see that Foucault made an important distinction between "manifest discourse" and "incorporeal discourse." His notion of manifest discourse can be understood as the acts of discourse that we normally think of (i.e., what was said or written). Yet, Foucault argued that these discursive acts, by nature, cover up much of what is potentially said, not said, or never said, and this is the power of *silencing*. If we embrace Foucault's view that discourse is the totality of knowledge, then the "hollow of its own mark" represents the selective power of repression. This hollow is that which is not said, which is essential to understanding Foucault's concern about the relationship between knowledge and power. If discourse is something that supports hegemonic forces, it is also something that can motivate resistance that counters the dominant discourse. This is essential to social movements that are addressing the issues such as gender bias, sexual harassment, and the underrepresentation of women in computing.

As an instrument of repressive power, discourses both create and reinforce masculinized domains of knowledge. In the domain of computing, it is the "hollow" of discourse that rendered invisible the many women in the history of computing; it is also a void that continues to silence many women in contemporary computing cultures in the tech sector. As an effect of power, the discourses of computing have been produced and

reinforced in computing cultures dominated by men, continuously inscribing symbolic

associations of masculinity on both computers, software, and practitioners, and re-

inscribing it again and again. The discourses of the Web era carry with them the history

that preceded it. They are modern discourses where males dominate the roles of design,

creation and leadership in tech workplace. Foucault would suggest these are all part of a

total discourse produced through the "order of discourse" but that is, fortunately, *not*

static. In other words, Foucault's theory does not foreclose on the potential for resistance

and the emergence of discourses that counter the accepted norms and regulatory rules.

Discourses also have the power to control acceptability of notions of identity, which can

include everything from gender identity, to social identity, to occupational identity, even

down to the identity of the programmer. To develop this idea further, I will now move to

a feminist view of discourse, gender, and power that is grounded in a Foucaultian

perspective.

The regulatory hegemony of gender identity

Judith Butler (1999; 2010) argued that gendered behaviors are regulated by forces

that make certain things knowable and other things essentially *unintelligible*, either

because there are no available words, or because hegemonic structures repress their

articulation. Influenced by Foucault, Butler observed that juridical systems of power

actually produce the subjects they represent. In Butler's (1999) words, "[t]he subjects

regulated by such structures are, by virtue of being subjected to them, formed, defined,

and reproduced in accordance with the requirements of those structures" (pp. 2–3).

Butlers asks,

"...to what extent is identity a normative ideal rather than a descriptive feature of experience? And how do the regulatory practices that govern gender also govern cultural notions of intelligible identity?" (p. 23)

Butler analyzed cases that problematized gender identity by observing how traditional notions of man and woman are subverted in identities of gay/lesbian/bisexual/transgendered (LGBT) people, as well as by ambiguously-gendered individuals. Regarding the binaries of masculine and feminine, Butler (1999) illuminated the political and cultural genealogy of gender ontology with an understanding that the masculine/feminine binary is discursively produced and becomes naturalized within cultures through hegemonic forces (p. 45).

Butler speaks to the intelligibility of gender as a form of identity. This understanding informs notions of sexuality and gender identity that permeate through different social contexts where notions of masculine/feminine become endemic to particular roles enacted and performed in institutional contexts. Taking this one step further, Butler's fundamental notion of intelligibility can be applied when considering gendered identities in the domain of *computing* and particular notions of masculinity. This is where I connect Butler's to my thinking about how the role of the computer programmer, an identity that has been peculiarly gendered in both historical and contemporary institutional contexts. From its conception, the programmer has been symbolically gendered through rules and "regulatory practices" that reformulate it in different manifestations, from the earliest female coders, to the tech entrepreneurs and male "brogrammers" of Silicon Valley. Chapter 4 specifically addresses the gendering of the computing industry and roles drawing on the works of two key scholars, Nathan Ensmenger (2010a, 2010b, 2015) and Janet Abbate (Abbate, 2003, 2010a, 2010b),

among others. In many ways, the computer programmer of Silicon Valley is a new performance of particular type of masculinity.

The performativity of gender

Butler was concerned with how discourses of gender are produced and reproduced, and, ultimately, how particular notions of gender become hegemonic. She explored the role of discourse and the *performativity* of gender and gendered identities. In asserting that gender can be a performance, Butler (1999) saw the malleability of gender identity.

> *"an effect of a subtle and politically enforced performativity, gender is an 'act,' as it were, that is open to splittings, self-parody, self-criticism, and those hyperbolic exhibitions of 'the natural' that, in their very exaggeration, reveal its fundamentally phantasmatic status" (p. 200).*

For Butler (1999), discourses of gender can control what is seen and what is known to be real and authentic (p. 45).   Butler's assertion that gender can be a performance provided a theoretical basis for me to consider how the gendered identity of the male computer programmer can be considered a discursive performance.   And if gender and identity can be performed, then subversive acts of power are also possible since such gendered identities are not forged in stone by their discursive construction (p. 201). As with Foucault, Butler provides for the possibility for resistance and counter discourses that reveal the possibility of alternatives realities from what is accepted as the dominant norm. This is the prospect of re-constituting discourses of computing and the power that can change the discursive landscape of technology and society.

The history of computing reveals the reverberating power of gender and identity with ambiguities in the performance of many discursive identities of the computer programmer throughout the history. As will be discussed in Chapter 4, Grace Hopper, female pioneer of programming, was thought by some to be a legend in her own time (Micheal Sean Mahoney & Haigh, 2011, pp. 106–107), and she was recognized in 1969 as the "*Man of the Yea*r" in computing by one of the main professional societies of the era.[5] Despite her prominence in the computing industry, this masculine designation was a sign that that any other way of bestowing this honor in computing, at that time, was oddly *unspeakable*, and to some people simply *unthinkable*. While some may dismiss this as a convention of the time, this is exactly the point. As will be discussed in Chapter 4, Hopper was one of the few original programmers on one of the earliest computers in the U.S., and she continued as a significant innovator in the development of programming during the 1950s and 60s. The discursive identity of "man of the year" had more significance that it might appear on the surface, since it reveals how regulatory rules of discourse, then and now, reinforce the association of computing with maleness.

Discourse and coalition politics

Given that discourse also offers the potential for resistance to hegemonic forces, there are also some risks in how the resistance movement is instantiated.   When resisting oppression, we often see the tendency of oppressed groups to stand as a "*unity"* - as in a unity of women (J. Butler, 1999, p. 20). A unity stance has been a common calling point

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[5] In 1969, Hopper received the first "Man of the Year" award from the Data Processing Management Association, currently known as Association of Information Technology Professionals, www.aitp.org/?page=aitphistory. Also see Babbage Institute: http://gallery.lib.umn.edu/exhibits/show/gender-codes/item/3227

for many feminists who argue that a unity of women is a "prerequisite for political action" (J. Butler, 1999, pp. 19–21). But Butler also warned that in "coalition politics," the stance of unity can have unintended consequences that can undermine the intended goals of what was imagined as an ideal of the coalition. Inevitably, a unity will encounter a myriad of variations within the assumed unity grouping, and soon we will discover that perspectives and identities within a coalition can appear and disappear, emerge and evolve. Butler (1999) argued that an assumed unity can undermine its own cause by discursively repressing the variations that exist within (pp. 20–22).

> *"If the regulatory fictions of sex and gender are themselves multiply constructed sites of meaning, then the very multiplicity of their construction holds out the possibility of a disruption of their univocal posturing" (p. 44).*

Butler asks us to consider the risks associated with building and sustaining a political coalition, especially how an assumed "unity" can contribute to, and discursively reinforce, invisibility and powerlessness of those who become the new "others" within the assumed coalition. This suggests that any coalition that is working to improve the status of women in computing must also address the unity in many variations - race, class, ethnicity, and age – and to consider what these intersections of identity and experience means for diversity interventions. Specifically, ABI's Grace Hopper Celebration (GHC) and NCWIT's Summit convene "discourse communities[6]" (Swales, 1990) that align around addressing issues gender bias, power, institutional change, and the reconstruction of social identity in computing. These forums expose the tensions that must be explored and navigated when building and sustaining coalitions for improving

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[6] On discourse communities, see the different ways that is has been defined in the Swales chapter.

opportunities for women in tech. Both ABI and NCWIT are explicit about their role in

coalition building, both in convening women in technology at their major events and in

advocating for change through their specific programs. But, at the same time these

coalitions run the risk of not representing many viewpoints since attendance usually has

some amount of institutional support to cover expenses[7]. These forums are doing the

important work disseminating discourses that can influence the recreation of occupational

identities in computing. They also articulate a vision of change to the institutional

structures and policies of the tech workplace and how to pave pathways that can lead to

more women becoming empowered and rewarded. In Chapter 5, I explore these two

events as "forums of discourse" that bring women in computing together, promote

different affinity groups (e.g., Lean In Circles), and convene domain-specific alliances

(e.g., academic, corporate, non-profit, entrepreneurship).

Discourse, gender, and occupational identity

It is important to consider the gendered occupational identity of the computer

programmer, both historically and in the contemporary tech sector. Lorber (1994)

observed the many dimensions of individual identity when theorizing about gender and

organizations.

> *"At any one time, an individual's identity is a combination of the major ascribed statuses of gender, race, ethnicity, religion, and social class, and the individual's achieved statuses such as education level, occupation or profession, marital status, parenthood, prestige, authority, and wealth" (p. 311).*

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[7] Some have critiqued GHC as not appropriately representing black women, as in the Daily Dot piece entitled "When Diversity is Exclusive" that observed a lack of black women as plenary speakers. https://www.dailydot.com/debug/diversity-exclusive-ghc/

Butler argued that identity is discursively formed, and even performed. This informs a discourse perspective on the forces of power that inscribe gendered identity upon particular roles in the workplace. When considering the identity of the computer programmer as a dominant symbolic figure of Silicon Valley and the tech sector, a theory of discourse and power can ground an analysis that probes the masculine identity of the computer programmer and how the imagery of this occupational role is disseminated and reinforced.

Another feminist theorist, Karen Ashcraft[8] (2013), examined how a specific type of person can become a universal image of who fits a particular occupation. Ashcraft considered the performed, symbolic, and discursive dimensions of occupations, theorizing on occupational identity through a symbolic construct of a *"figurative practitioner"* (K. L. Ashcraft, 2013; K. L. Ashcraft & Ashcraft, 2015; K. L. Ashcraft & Mumby, 2004). In terms of resisting the hegemonic forces that create such symbolic personae, Ashcraft's theory of the "glass slipper[9]" provided an analytical frame.

> *"I theorize the glass slipper—a metaphor that encapsulates how occupations come to appear, by nature, possessed of central, enduring, and distinctive characteristics that make them suited to certain people and implausible for others…. Like similar metaphors in management science, such as the glass ceiling… or glass cliff… the glass slipper exposes systematic forms of advantage and disadvantage, in this case stemming from alignment between occupations and social identities"* (2013, p. 7).

Ashcraft suggested that the only way to disrupt the discursive power of the identity of the figurative practitioner is to break the mold. Essentially, if the durability of

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[8] Karen Ashcraft is an interdisciplinary scholar who works at the intersections and borders of the fields of communication, organizational theory, discourse, and historical perspective.
[9] Ashcraft intended the "glass slipper" as a metaphor that presented an irony for gender issues.

masculinized identities in computing is to be challenged through coalition politics, that task at hand would be to "break the glass slipper" (K. L. Ashcraft, 2016). If we acknowledge this, then the question becomes who will break it and how will it be done? I will invoke Ashcraft again in Chapter 8 with a case study that explores the intersections of discourse and practice and analyzes how breaking gendered identity molds in tech connects to practices and processes of institutional change. Theorizing the path from discourse to social change involves understanding the *relationships* between the different elements of discourse and social practices. Therefore, I now move to explicating the relationship between these elements.

Discourse, Social Practice, and Social Change

Norman Fairclough (Fairclough, 1992, 2002, 2005) theorized the connection of discourse to social practice and, ultimately, the path from discourse to *social change*. Invoking themes from Foucault as an influence[10], Fairclough identified his own theory of discourse as having a sensibility of the *linkage of heterogeneous parts,* essentially separate elements of discourse whose meaning can be understood by focusing on the individual elements, the relationships between the elements, and the tensions produced around them.

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[10] Fairclough explained his connection to Foucault in how he connects of discourse to social practice, saying "'[d]iscourses' in a Foucaultian sense are for me elements of social practices. 'Discourse analysis' correspondingly has a doubly relational character: it analyses relations between discourse and other elements of the social, and it analyses relations between linguistic/semiotic elements of social events and linguistic/semiotic facets of social structures and social practices, including 'discourses'." (Fairclough, 2005)

Like Foucault and Butler, Fairclough (2002) saw that discursive rules can regulate the performance of social identity, including the identities of people who occupy *particular roles*.

> *"The identities of people who operate in positons in a practice are only partly specified by the practice itself. People who differ in social class, in gender, in nationality, in ethnic or cultural membership, and in life experience, produce different 'performances' of a particular position"* (p. 123)

This is significant to the social roles that appear in forthcoming chapters – specifically, women in professional computing roles such a computer programmer, change leaders who are working to transform organizations, and men who align with women as male allies to fight bias and promote opportunity for women. Fairclough's critical discourse analysis is a valuable tool for studying *organizational change,* a requirement for interventions aimed at correcting the underrepresentation of women in computing. On this topic, Fairclough (2005) raised the following types of questions:

> *"... when organizations change, what is it that changes? What makes organizations resilient in the face of change, resistant to change, or open to change? How are external pressures for organizational change internalized in organizations, how may organizational members respond to them, and what outcomes are possible?" (p. 935)*

All of these questions are essential for understanding and addressing issues of the underrepresentation of women in computing. Fairclough viewed "social life as interconnected networks of social practices of diverse sorts (economic, political, cultural)" and he saw elements of discourse in every *social practice* (Fairclough, 2002, pp. 121–122). Theorizing discourse as a whole, the elements of discourse become constituent parts of the whole and meaning comes from how the parts are connected. The

parts are also heterogeneous, consisting of language (text and speech) and visual

language (gesture, body language) and other forms of expression.

Invoking the notion of a "moment" of discourse as an element of the material

social process, Fairclough argued that discursive moments can reveal "*contradictions*"

which can lead to "*dilemmas*" (Fairclough, 1992, 2002). In Chapters 6 and 7, I analyze

moments that reveal unconscious bias and the unintentional consequences of engaging

male allies. As shown in Chapter 8, tensions exist even among committed "kindred

spirits", which is revealed in a case analysis that shows how women were split around

their reaction to "Lean In" as movement for female empowerment and agency.

Fairclough's influence on my work is seen in my analyses that show how discourse is

related to social practice, and also in the illumination of the paths from discourse to social

change (Fairclough, 1992).

Regarding social practice and gender, Fairclough (1992) observed that discourse

can problematize social conventions, as for instance interactions between men and

women in institutional contexts (pp. 96–97). This is only a brief introduction to

Fairclough. I will elaborate further in Chapter 3, which will discuss Fairclough's method

of Critical Discourse Analysis (CDA), which is closely tied to his theory. CDA is

employed as a method throughout this dissertation.

By destabilizing gender and institutional identities, and by surfacing the politics

inherent in their hegemonic construction and maintenance, theories of discourse and

power can provide us the analytical tools necessary to imagine new possibilities by

contesting the limits imposed by gender categories that are discursively enforced. New

subversive acts of power are possible because they are not foreclosed by the discursive

construction of predetermined or fixed identity categories. This can be transferred to our

understanding of gendered occupational identities.

To bring another dimension to the analytical landscape, I next move to

sociological theories about the relationship of the social structures of institutions and the

agency of individuals. Specifically, these theories challenge the notion that the *source* of

power is not in the hands of individuals.

Gender, Agency, and Social Structure

Anthony Giddens brought power back to the individual with development of the

"theory of structuration." While Giddens (A. Giddens & Dallmayr, 1982) recognized the

significance of a Foucaultian analysis of power, he broke with what he saw as Foucault's

notion that "power emanates from the dark and mysterious backdrop of 'history without a

subject'" (p. 121)

> *"…It is precisely to counter such a view that I have developed the tenets of the theory of structuration. Human beings, in the theory of structuration, are always and everywhere regarded as knowledgeable agents, although acting within historically specific bounds of the unacknowledged conditions and unintended consequences of their acts." (pp. 221–222).*

In the theory of structuration, Giddens (1984a) provided a theory of society that

reconciled structuralism with hermeneutics by acknowledging both the role of systems

and institutions, as well the role of the individuals who have agency. Giddens' describes

a dynamic, interactive process where individuals influence the structures of society and,

inversely, structures influence individuals (A. Giddens & Dallmayr, 1982; Anthony

Giddens, 1984a). He defined agency as the capability of doing things, encompassing

both intentional and unintentional acts.   Through the process of "reflexive monitoring" agents are able to cognitively engage with their actions as they create and re-create the continuous flow of social life. (Anthony Giddens, 1984a, pp. 5–9). For Giddens, it is through the collectivity of their actions, that human agents produce and re-produce the structures of society.

Structuration theory asserted the notion of a "duality of structure" where "structural properties of social systems are both the medium and outcome of the practices they recursively organize" (A. Giddens & Dallmayr, 1982, p. 25). This echoes themes from Foucault and Butler, but it attributes a more active role to the human agents who produce and re-produce the structures of society. These structures of social systems, in turn, either influence how humans can engage, or can constrain their future acts of agency. Human agents are able to cognitively engage with their actions as they create and re-create the continuous flow of social life (Anthony Giddens, 1984a, pp. 5–9), including the patterns and rules of social structure (1984a, p. 16).

Human agency

For Giddens (1984a), human beings are omnipresent agents that are simultaneously knowledgeable and constrained by history. Furthermore, human agency encompasses both intentional and unintentional acts.

> *"Human beings, in the theory of structuration, are always and everywhere regarded as knowledgeable agents, although acting within historically specific bounds of the unacknowledged conditions and unintended consequences of their acts" (p. 222)*

The significance of human agents and their possession of resources and skills makes structuration a useful theory for the study of gender and computing in both the academic and professional sectors where both women and men are agents. These agents are acting within institutional contexts that are affected by history, the present, and an array of unknown or unacknowledged conditions. While humans are knowledgeable agents, there also unintended consequences to their actions, and with regard to the larger issue of agency and power over time and space, Giddens (1984a) says,

> *"We should not conceive of the structures of domination built into social institutions as in some way grinding out 'docile bodies' who behave like the automata suggest by objectivist social science. Power within social systems which enjoy some continuity over time and space presumes regularized relations of autonomy and dependence between actors or collectivities in contexts of social interaction." (p. 16).*

For Giddens, this type of reflexivity includes the ability to reflect on one's actions (i.e., "reflexive monitoring"), which is uniquely human and essential to notions of human accountability. In honoring the power of individual consciousness, Giddens distinguished between "discursive consciousness," which is what actors are able to say about their activities, and "practical consciousness," which is "… tacit knowledge that is skillfully employed in the enactment of courses of conduct, but which the actor is not able to formulate discursively." (A. Giddens & Dallmayr, 1982, p. 31). Giddens, himself, did not theorize about gender and power. Nonetheless, he offered the type of theoretical foundation that can benefit the analysis of gender issues such as the underrepresentation of women in computing and in the workplace. In this context, the agency of individual women can collectively influence the social structures and policies of institutions, including things such as diversity policy, hiring practices, and reward systems.

Gender and agency

There have been feminist adaptions of Giddens structuration in other fields of study. Kathy Davis (1991) viewed Giddens' "grand theory" as a useful abstraction that was in need of contextualization within empirical studies and grounded theory. Davis also argued that power is intrinsic to human agency and rejected the notion that social actors are completely governed by social forces (p. 72). Wolffensperger (1991) also brought a feminist perspective to Giddens structuration and introduced the new concept of "engendered structure" to enable the articulation of gender in social systems (p. 89). This systems perspective recognized the organizing principles of "domination, signification, and legitimization" (p. 93) and asked the analyst to look at what is "*present"* and "*absent"* in the structuring of gender relations, with awareness of rules that agents follow and the resources they use and deploy in different domains of practice.

Davis (1991) challenged the traditional "feminist common sense on power" (p. 79) where power is automatically linked to relations of domination and authoritarian forms of coercion and control. She argued that the theory of structuration, "makes it possible to look for power in hitherto unlikely places: in cultural discourses, in the ordinary working of everyday life, in intimate and even friendly relations" (p. 10).

Focusing on agency, Davis (1991) argued that even when resources and skills are asymmetrically distributed due to structural forces, agency is not extinguished. Davis focused on social contexts that reveal the subtle ways that women assert power, even in the face of disadvantage and unequal status. For example, in dynamics of face-to-face communication between male doctors and female patients she observed a "dialectic of

control" that illuminated how the less powerful agents (i.e., female patients) managed resources to assert power over those who have more resources (i.e., doctor). These types of communications problematized the notion that power is absent when resources and skills are asymmetrically distributed due to structural forces. If we accept power as intrinsic to human agency, we can reject the notion that social actors are completely governed by social forces (p. 72). Agency is not extinguished.

With this established, Davis critiqued the "structural determinism" that had inhibited some feminists from theorizing about *female power* and agency and encouraged the development of new feminist theories that grapple the nature of power and become more attentive to the dynamics of agency, negotiation, and consensus building. From an analytical standpoint, Davis (1991) said

> *"It is important to delineate how relations of power are being negotiated; that is, the process by which relations involving domination and subordinations are produced, reproduced and transformed." (p. 80).*

These feminist adaptations of structuration are meaningful for analyzing the agency and the power of women who speak up about bias and harassment in the workplace. They also improve the analytical frame for analyzing the power of women and men whose actions challenge stereotypes and who fight for change in the power relations of the tech sector. Overall, the explicit elevation of gender into discourse theory and structuration theory enables a multi-dimensional perspective for understanding the gendering of the computer programmer and its implications, discussed next.

The Gendering of the Computer Programmer

As discussed earlier, Butler's theory pushes us to consider how gender can be understood as an *effect* of hegemonic regulatory forces. In alignment with this, other feminist scholars have challenged the basic assumptions of gender essentialism and the binary constructs of male/female or masculinity/femininity (J. Butler, 1999; Kimmel, 2000, pp. 113–119; Lorber, 1994; Stone, 2004, p. 137). Those feminists who have theorized about gender, power, and the social structures of the workplace have inevitably landed on the phenomena of gendered occupations and occupational segregation.

The gendering of occupations

Judith Lorber (1994) viewed gender as more than a status assigned to an individual; instead, she argued that gender is best understood as a social process that assigns and reproduces individual gender statuses. She argued that gender is a *first-class structure*, meaning that gender is not an auxiliary dimension of other social structures, but instead it is an underlying structure (i.e., a building block) of the structures of society (pp. 30–32). She also claimed that *gendered personalities* are the result of social expectations about how members of different gender statuses should feel and behave, and that *gendered ideology* reinforces and justifies gender statuses (pp. 30–32). As previously mentioned, Ashcraft (2013) theorized the notion of a "figurative practitioner"; how a specific type of person can become a universal image of who fits a particular occupation. For the study of women and computing, there are three significant questions about these gendered occupational identities - how such associations arise, how they circulate, and how durable they are.

Historically, occupations have tended to be vertically segmented along gendered lines and women have been overrepresented in lower-wage tiers (Acker, 1990a; Lorber, 1994). Many scholars have argued that discriminatory attitudes in the workplace have conspired to keep women highly concentrated in the lower end of the primary labor market, typically as clerical workers, or in the secondary labor market as service and blue-collar workers (Fox & Hesse-Biber, 1984; Freedman, 2002, pp. 157–163; Kimmel, 2000, pp. 259–264; Young, 1990). Gender segregation has been a persistent pattern that we can observe. It reinforces gendered identities in jobs and enables this gender identity to be reproduced again, and again. A modern manifestation of occupational segregation is seen in the gendered division of jobs of Silicon Valley and the tech sector, where men dominate professional software design and development, while women are found in a preponderance of positions related to customer support and the marketing of technology. Even operating outside the formal structures of the organizations of tech, a significant number of women have occupied "pink ghettos" and have suffered the disadvantages of independent work that requires a significant amount of uncompensated digital labor (Duffy & Pruchniewska, 2017).

When studying the identity of the computing professional, it is important to look at the history of computing and to focus on the organizational processes that led to its gendering. These processes can be expressed as discourses, invoking images and symbols that express gendered divisions, and even endorse such things as linguistic style, gesture, and dress that are continually enacted by individuals and disseminated by the media. These processes also construct social behaviors along gendered lines and, as Acker (1990b) argued, in aggregate these processes are components of an organizational

logic that produces the gendered components of identity (pp. 144–147). All of this

contributes to the gendering of the professions of computing, resulting in individuals,

groups, and organizations that are building technology based on the visions and designs

inspired from a partial perspective of needs, opportunity, and risk. But this does not

acknowledge the full complexity since there are many variations that exist within gender.

More than gender … intersectionality

Many feminists have problematized the category of "woman", observing how

gender identity co-exists with other social dimensions of personhood including race,

ethnicity, social class, and age. As Butler (1999) said,

> *"…because gender is not always constituted coherently or consistently in different historical contexts, and because gender intersects with racial, class, ethnic, sexual, and regional modalities of discursively constituted identities. As a result, it becomes impossible to separate out 'gender' from the political and cultural intersections in which it is invariably produced and maintained." (pp. 4–6).*

In this argument, Butler offered a philosophical explanation for what other theorists and

social scientists have approached through the lens of 'intersectionality" (Crenshaw,

1989), a term that originated in black feminist critical theory to recognize of how gender,

race, and other dimensions of identity intersect in the both the expression and experience

of bias (Collins, 1991; bell Hooks, 1984). Thus, for example, when considering gender

bias as a force in the underrepresentation of women in computing, it should be

recognized that African American women can be navigating multiple dimensions of bias

– gender, racial, class-based bias. As Lorber (1994) observed,

> *"At any one time, an individual's identity is a combination of the major ascribed statuses of gender, race, ethnicity, religion, and social class, and the individual's*

achieved statuses such as education level, occupation or profession, marital status, parenthood, prestige, authority, and wealth" (p. 31).

From an occupational perspective, intersectionality acknowledges the double, or multiple, challenges faced by individuals who are structurally positioned in a workplace sector, such as Silicon Valley, that is dominated by white men. Feminist organizational studies, has also invoked intersectionality theory to understand in-gender variations within the specific domain of information technology (Kvasny, Trauth, & Morgan, 2009, p. 114; Trauth, 2006, 2012). At the same time, bringing intersectionality theory to diversity programs has been challenging in practice (Ahrens, 2017).

Intersectionality theory when applied to the computing workplace can also surface other types of variations and professional styles within the category of women. These variations can be significant, especially the ways different women socially identify when they embrace male-dominated professions. Differences in professional and discursive style among different types of women can impact the ease or difficulty they have navigating the cultures of the computing workplace. Some variations to consider involve essentialist notions that do not accommodate some women's preferred styles of interaction that may be more similar to the males with whom they work (Adam, Howcroft, & Richardson, 2004; Trauth, 2002). At the same time, some women may find it natural to "lean in" while others find it difficult or even risky. To the extent that social action is built and sustained by coalitions of individuals and groups working to address the underrepresentation of women in computing as a social issue of concern, it becomes necessary to both recognize and accommodate such differences within coalitions when paving the path to social change.

The gendering of the computing occupations, such as the computer programmer, is a key area of focus within coalitions focused on women in computing. The significance of this type of change to occupational identities and gender representation, will transitively impact what is materially created by people in these occupations – the technologies themselves that can be understood as the outputs of gendered development processes. The relationship between actors/agents, institutions, and material artifacts is the last area of theory to be explored.

The gendering of the technology

Any analysis about the gendering of the occupations of Silicon Valley and tech sector would be incomplete without consideration of the gendering of the technologies that are produced. This has significant implications for society. To shine a light on this, I considered scholars that address the questions about whether technologies act as a force of their own or are they socially determined. From the perspectives of the field of Science and Technology Studies (STS), Judy Wajcman (Cockburn, 1999; Wajcman 2000, 2004) recognized what was at stake in the underrepresentation of women in technology and computing, arguing

> *"... women are chronically under-represented in precisely the jobs that are key to the creation and design of technical systems in the new economy. Increasingly, these technical systems comprise the world we inhabit." (Wajcman, 2004, p. 31).*

The field of STS had already developed theoretical responses the to the position known as "technological determinism," arguing that technologies and technological artifacts, themselves, do not have a pre-defined impact on society. Hughes (1987, 1994) was a pillar for STS with his analysis of *socio-technical systems*, which recognized

multiple forces are woven together in a "seamless web" during the development and evolution of a large technological system. These, forces included the technological, political, economic, social, and the natural. As argued in the body of scholarship known as the Social Construction of Technological (SCOT), technology is what society determines it to be (Bijker, Hughes, & Pinch, 1987). Essentially, this means that technology is not only designed by social actors, but social actors interpret, deploy, and use technology in ways that determine its meaning. In terms of how a technology evolves, social constructivists believe there is an "interpretive flexibility" around a technology, rather than fixed meanings and pre-defined uses (Kline & Pinch, 1999). Accordingly, social groups may disagree on the appropriate meaning and use of a technology, and therefore must negotiate. From this, a state of "closure" is reached when all relevant social groups agree upon a solution.

Other STS scholars brought the materiality of technological artifacts directly into the analysis. Latour (1992) set the stage for a discussion of how humans and non-humans can be analyzed in a symmetrical manner and argued that both are actors that have the capability of exchanging their properties (p. 160). The implication here is that human and non-human actors are put on the same analytical plane; neither holds all the power. Scholars of this perspective assert that "… the first principle of the new sociology of science and technology: that what we like to call 'the social' is materially heterogeneous" (Callon & Law, 1997, p. 168). As Law (2011) argued, "[we] need a way of working in which we are able to think simultaneously about three things that we normally tend to keep in separate boxes. We need to find a way of thinking about the social, the technological, and the natural, all together." (p. 4). Actor-Network Theory (ANT)

evolved to assert that all elements and forces are parts of a "heterogeneous network" and all components should be treated as equals, including people, technical artifacts, processes, nature, institutions, governments, economics, politics.

Feminist scholars noted that these perspectives were overdue for a compelling feminist voice. This happened when Judy Wajcman (Cockburn, 1999; Wajcman 2000, 2004) rang the alarm bell about the omission of gender in the analysis of the social construction of technology and heterogeneous networks. Wajcman's critique observed that the primary analytical methods of STS depended on the analysis of "relevant social groups" (i.e., SCOT) and "heterogeneous networks" (i.e., ANT) and in both theoretical frames, women were *not empirically visible* for analysis. While women could make an appearance in analyses of "interpretive flexibility" and the uses of the technology, when it came to the *design and development* of the technologies, women were largely invisible.

The significance of the invisibility of women in technology cannot be understated. To address this, Wajcman proposed a powerful convergence of theory at the intersections of the sociology of technology and feminist technology studies. Especially when considering the history of women in computing, and the peak and decline of women computer science since the 1980s, we can see how Wajcman (2000) "nailed" the issue of gender in STS

> *"So what is it about social studies of technology that has made it hard for us to think about gender issues? Several problems are involved.... To begin with the marginalization of gender in both SCOT and ANT constructivist studies of technology is indicative of a general problem with their methodology. This is related to the conception of power deployed by theorists in this genre. Using a conventional notion of technology, these writers were concerned to identify and study the social groups or networks that actively seek to influence the form and*

direction of technological design. Their focus on observable conflict led to a common assumption that gender interests were not being mobilized. What many have overlooked is the fact that the exclusion of some groups, while not empirically discernible, may nevertheless have an impact upon the processes of technological development." (p. 452)

In her feminist critique of STS, Wajcman (2000) specifically argued that women were not empirically visible for analysis because members of "relevant social groups" tended to be men who had the power to design technology and to negotiate the development and deployment of the technologies.   Additionally, actors and group members were usually empirically identified as those actors that participated in the negotiations or controversies around a specific technology. Since historically women were typically absent from these contexts, "there was a tendency to overlook the need for a gender analysis of the technology" (p. 451). As to the effects of the structural absence of women, Wajcman argued,

"While the effects of structural exclusion on technological development are not easy to analyse, they should not be overlooked…. Few women feature among the principal actors in technological design, as the sexual division of labour has excluded them from entering science, engineering and management." (p. 452)

Regarding previous feminist analyses of technology, Wajcman (2004) challenged certain early strands of feminist theory that she thought exhibited a "naive technological determinism" (p. 33), framing technology as oppressive to women, or viewing women as the victims of patriarchal technology (pp. 13–15). Wajcman challenged these perspectives as "over-determined" analyses that translated the technology itself into a malevolent force that was bad, exploitative and damaging (p. 6).

Wajcman's contribution to STS is essential for considering the underrepresentation of women in contemporary computing cultures. In bringing the

analytical dimension of gender into ANT, Wajcman opened new paths for analyzing

issues of power, and especially for *unravelling the flows of power* in the heterogeneous

network.   Leadership and power are significant issues in the study of women and

computing, given that Silicon Valley and the tech sector operating as heterogeneous

networks of companies with male leadership. Leadership is often attributed to a type of

presence, often leaders who are valued for their commanding style or a type of charisma,

such as Steve Jobs of Apple Inc. (Isaacson, 2014). But extensions to the ANT framework

can also permit a more distributed notion of leadership that moves beyond the "great

man" assumption. Fairhurst and Cooran (2009) engaged and adapted ANT when

exploring the limitation of this singular actor view of leadership, providing instead a

multidimensional perspective of leadership viewed through the lens of "presence" and

"absence." When approaching ANT from this perspective of ANT, they invoked the

discursive notion of "rhetorical presence" arguing for the inclusion of *narration* and

discourse in ANT's heterogeneous networks. These adaptions to ANT, they argued,

"enable analysts to unravel complex networks associated with attribution of leadership"

(p. 470). By understanding what is absent and present in the discourse that is part of the

network, we can get a difference view of the forces of power and where leadership of

different forms exist (p. 470). Bazerman (1999) also introduced the similar notion of

"symbolic heterogeneous engineering" (p. 335) in his analysis of Edison and the

development of the electric light. While not officially considered of the ANT tradition,

Bazerman was in alignment with STS sensibilities in his attentiveness to the interplay of

technical, social, and economic forces. Bazerman's contribution was analyzing such

networks with a discourse perspective, bringing the symbolic dimension of

"communicative events" that can be seen to unfold in networks of actors, institutions and artifacts (pp. 334–335).

Conclusion

Overall, theories of discourse, gender, organizations, and socio-technical systems grounded my thinking for navigating and investigating issues of gender and the underrepresentation of women in computing. Foucault provided foundational theory of discourse, knowledge, and power. Butler brought a feminist perspective to a Foucaultian theory of discourse and power. Fairclough theorized the relationship of discourse and social change through the mutually reinforcing nature of discourse and social practice. Giddens theorized the mutually reinforcing and recursive nature of institutional structure and individual agency. Ashcraft developed a theory of how gender plays into occupational identity and the symbolic notion of who "fits" an particular occupation. Wajcman brought new feminist perspectives to the analysis of the social construction of technology arguing that an analysis of technology should not be developed exclusively from a masculine paradigm. Lorber and other feminists provided theory on gender and social structures of the workplace that explain the phenomena of gendered occupations and occupational segregation. Black feminist theorists including Crenshaw, Collins, and Hooks recognized of how gender, race, and other dimensions of identity intersect in the both the expression and experience of bias.

The persistent underrepresentation of women in computer science and programming cultures is not a problem with a simple answer. Using the theoretical influences reviewed in this chapter, my goal was to avoid taking reductionist views of

both the problem and the solutions. To identify tractable paths towards social change, I

embraced perspectives of discourse and culture that could help bring forth new insights

issues of gender and technology for the benefit of society at large. As described in the

next chapter on methodology, I embraced a multi-disciplinary approach to my research

on interventions that are addressing the underrepresentation of women in the

contemporary tech sector

CHAPTER 3
Methodology

"Changing discourse practices contribute to change in knowledge (including beliefs and common sense), social relations, and social identities; and one needs a conception of discourse and a method of analysis which attends to the interplay of these three." *(Fairclough, 1992, p. 8)*

Introduction

For Fairclough (1992), Critical Discourse Analysis is both a theory and a method for discourse analysis. As a method, it addressed a key challenge for my research, which was to operationalize my use of critical theories of discourse and power (pp. 49-59), especially those of Foucault and others with a Foucaultian influence[11]. In Chapter 2, I discussed my theoretical framing in terms of a multi-force framework that brought the elements of discourse and social practice into analytical view, as well as the forces of structure and agency, while recognizing *gender* at the nexus of all. Fairclough's CDA focuses on the relationships of elements of discourse and social practice, which I interpret as a type of semiotic network overlay upon the actors, institutions, and technologies of a socio-technical system.[12]

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[11] During period 2012-2014, I developed a breadth of knowledge on theories of discourse within the context of the "Discourse and Technology" reading group[11] at Cornell's Department of Communication. With interests in both history and contemporary issues on women in computing, the topic of gender and power became a primary concern and motivated a deeper reading of the theories of Foucault and Butler.

[12] This view is both evocative of STS perspectives of Hughes' "seamless web" and ANT, but with a symbolic dimension as in Bazerman (1999) who brought a discursive view to such networks Bazerman (1999) also put a discursive lens on a socio-technical system with the notion of "symbolic heterogeneous engineering" (pp. 334-335). In *The Language of Edison's Light*, this analytical construct acknowledged the interplay of multiple forces – technical, social, economic – but Bazerman placed the lens directly on communicative events and how they operate and unfold in a discursive system. He illuminated how Edison chose a path that gave him long-term recognition, even though he was not accepted by the scientific community.

"We can see social life as interconnected networks of social practices and diverse sorts (economic, political, cultural, and so on). And every practice has semiotic elements. The motivation for focusing on social practices is that it allows one to combine the perspective of structure and the perspective of action - a practice is on the one hand a relatively permanent way of acting socially which is defined by its position within a structured network of practices, and a domain of social action and interaction which both reproduces structures and has the potential to transform them. " (Fairclough, 2002, p. 122)

In arguing for the usefulness of Critical Discourse Analysis (CDA) as a method for *social science researchers*, Fairclough said that a set of "minimal conditions" were needed (Fairclough, 1992, pp. 8-9). First, the method would need to provide for multi-dimensional analysis so that relationships between discourse and social change could be identified and evaluated. Second, the method would need to provide for multifunctional analysis of language. Third, the method should be able to could serve in historical analysis, and fourth, it would need to be a critical method. As described in the next section, Fairclough's CDA is a five-stage methodological framework that begins with identifying a social problem of concern. From here, it moves through several empirical and analytical stages, including the selection of discourse samples, and concludes with a critical analysis. Below, Table 1 summarizes the five stages of Fairclough's CDA framework and how my empirical research was conducted with influences from each stage (Fairclough, 2002, pp. 125-127).

Table 1. Fairclough's CDA Framework

	Framework Stages	**Significance for My Research**
1	Focus on a social problem of concern that has a semiotic aspect to it.	What do public texts and discourse artifacts reveal about the definition of the problem? Consider different subject positions and ask the question of "a problem for whom?" and defined by whom?

		How can I operationalize a critical discourse analysis in the Foucaultian tradition (i.e., power, hegemony) that includes "texts" and semiotic elements situated amid active social processes?
2	Identify obstacles to the problem being tackled through analysis if the network of practices, the relationships of elements, and discourse/semiosis itself	Acknowledged the relationships of elements of discourse and social practice; it can also accommodate analysis of the forces of structure and agency. Compatible with a network perspective on a socio-technical systems problem, enabling an ANT-like model with a discursive overlay.
3	Consider whether the social order in a sense "needs" the problem	Helped me focus on justifications, tensions, crises, and contradictions among different institutional and subject positions. Use of a counterintuitive but useful analytical probe for CDA with the concept of "needing" a problem.
4	Identify possible ways past the problem	This puts the focus on interventions by the institutions and actors in the women and computing terrain. Critical analysis can focus on possible solutions and the re-constitution of discourses.
5	Reflect critically on the analysis	Analysis of tensions, contradiction, and dilemma that can reveal signs of struggle and resistance. Focus on moments of discursive crisis can reveal disorder and reordering, which can illuminate both the problem and the solutions. Helped reveal fertile areas for future research and analysis.

Mixed methods approach and triangulation

My use of the methodological framework of CDA accommodated multiple forms

of data collections and analysis. Denzin (2012) proposed a way of conceptualizing mixed

methods research that is based in interpretive and critical methodologies. As a researcher,

I was particularly interested in Denzin's methodological concept of the "bricoleur."[13]

Denzin's notions of the "interpretive bricoleur" and the "critical bricoleur" (p. 85) offered

the most appropriate descriptions of the bricolage metaphor for the methodological

orientation of my dissertation research. As Denzin asserted,

> *"The product of the interpretive bricoleur's labor is a complex, quiltlike bricolage, a reflexive collage or montage, a set of fluid, interconnected images and representations. This interpretive structure is like a quilt, a performance text, a sequence of representations connecting the parts to the whole. " (p. 85)[14]*

> *"Critical bricoleurs stress the dialectical and hermeneutic nature of interdisciplinary inquiry, knowing that the boundaries between traditional disciplines no longer hold." (p. 85)*

With these approaches, a process of *triangulation* (Denzin and Lincoln, 2011; Creswell,

2011; Rothbauer, 2008) becomes an important way to integrate findings that originate

different sources and texts, or to compare different accountings of the discourses and

practices that surrounded the social problem of the underrepresentation of women in

computing. There were many sources of information that I engaged during the years of

this research and this facilitated the use of triangulation to cross-check that what I had

observed held consistent from different vantage points. I could compare different

understandings of the key analytical themes that arose, such as unconscious bias and

"male allies" that may be differently understood from different subject positions.

Institutional paradigms on gender and diversity may vary and this may be seen through

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[13] Denzin identified several categories, including the "methodological bricoleur" who engages with many types of methods such as interview and introspection, and the "theoretical bricoleur" who is knowledgeable in many interpretive paradigms such as feminism, cultural studies, and constructivism (p. 85).

[14] Denzin also noted that "interpretative bricoleur" will approach research as an interactive process that must be attentive to the context of the people being studied (such as their gender, social class, race, and ethnicity).

comparison of the discourse artifacts of the private and public sectors, and the press.

In terms of my overall research process, a multi-method approach can be seen in the activities that I engaged in during key phases of my research.

a. I engaged deeply with texts and discourse artifacts. I systematically examined public texts that including websites, reports, filings, promotional material, articles, press accounts, and social media. I also systematically analyzed multimedia artifacts of public discourses including audio of public interviews and Livestream videos of public presentations and speeches.

b. I engaged in participant observation of key events focused on women and computing. My two primary case sites were ABI's GHC and NCWIT's Summit that provided access to the active discourses and deliberations that were focusing on issues and interventions. During participant observation at these events, I attended plenary sessions, presentations, workshops and discussion sessions focused on understanding the issues and those mounting interventions to address the underrepresentation of women in computing.

c. I conducted informal interviews during events to get perspectives from individuals from different constituency groups who represented different subject positions. As research sites, ABI and NCWIT gave me access to the network of other organizations for which the not-for-profits serve as a both a connector and hub of activity.

d. I conducted formal interviews with the leadership of ABI and NCWIT. Semi-structured, deep interviews with the leadership of these organizations enabled me to probe beyond what was expressed in public documents, texts and discourses. They also provided insights about the different subject positions (industry, academia, government, press) that were actively engaged on the issues.

From an analytical perspective, I could observe particular moments of discursive struggle and the deliberation that followed from the perspective of different types of institutional paradigms (corporations, universities, not-for-profits) and from individual subject positions (e.g., corporate CEO, employees, not-for-profit leaders, political activists). From an observational perspective, using participant observation, I was able to directly experience organizations engaged in the practice of constituting, re-constituting,

and disseminating discourses of gender and computing. By conducting informal interviews during the events I attended, I was also able to gain insights from individual about their perspectives on gender bias and the intervention that were underway. Through formal semi-structure interviews with the leadership of ABI and NCWIT I was able to probe beyond what was said in public texts and public discourse, and then to critically surface and analyze what was unspoken and what issues were relatively hidden. Also, by engaging through the lens of ABI and NCWIT, I was able gain behind-the-scenes views on how corporations were working with the not-for-profit sector to address issues of gender bias and in mounting interventions to improve the state of underrepresentation of women.

The benefit of engaging with all of these facets of evidence was the ability to do analytical cross-checks on what I had examined and observed and, thereby, support the veracity of my critical analysis. When doing this type of social inquiry, there is value in a multi-case approach due to the ability to compare and contrast (Ragin, C. & Becker, H., 1992). For example, I found that the examination of public texts could be juxtaposed with (and compared to) the content of my formal interviews with the NCWIT and ABI leadership. Also, the public documents on websites that describe a tech sector company's commitment to diversity and inclusion could be interrogated alongside specific moments of discourse by CEOs (such as statements by CEOs at GHC or the NCWIT Summit). Taken as a whole, the full corpus of texts, recordings of public events, and transcripts of interviews were thematically integrated in later stages of CDA analytical to identify ambiguity, disorder, and contraction to help support a critical analysis.

In terms of the limitations of what my particular constellation of texts, observations, and interviews provided, I note several things. First, there are many significant players in the WIT ecosystem, notably the leadership of Lean In and other grassroots coding organizations whose views were not directly engaged. My data indirectly engaged with the perspectives of leadership of these organizations since they engage with ABI and NCWIT. Through their collaborative relationships they have with ABI and NCWIT, I was able gain access to the views on synergies and tensions among the players in the WIT ecosystem. In terms gaining access to the specific perspectives of major corporations of Silicon Valley and the tech sector, I relied on the texts that were publicly available, which tend to present an optimistic view that promotes a positive corporate image/brand. This is balanced with the public texts that critique Silicon Valley's lack of diversity (especially what appeared in the press and social media during the years of my research). Since I did not engage in formal interviews with corporate leaders and senior employees of these companies, my data are filtered from the perspective of how they interact with leaders of ABI and NCWIT. However, due to their engagement at GHC and the Summit, these companies are, by definition, either already interested in or committed to diversity and improving opportunity for women. This optimistic view of the tech sector's commitment to diversity view was balanced with the insights I gained through interviews with the leaders and staff of ABI and NCWIT, which were informed by their deep work with companies. As hubs, advisors, consultants, conveners, and partners with hundreds of major companies, ABI and NCWIT leaders have a good sense of the pulse of the corporate sector.

There are many considerations about the ways that "case studies" have been defined (Ragin, C. C., & Becker, 1992; Ragin and Rubinson, 2009). As Ragin and Rubinson observed, "[t]here is a crucial distinction between the *unit of analysis* and the *unit of observation*" [my emphasis]. Unfortunately, social researchers often use the term 'case' to refer to both… … a single case study may involve many observations" [15]. (Ragin & Rubinson, 2009, pp. 20-21).

When I refer to ABI and NCWIT as providing an observational lens for my research, I do not mean that they, themselves, are case studies or units of observation. Instead, they provided me access to many other distinct *units of observation* (e.g., plenary sessions, workshops, meetings, etc.) that illuminated the social problem of concern (underrepresentation of women) and the interventions being mounted to address it. From here, as the researcher, it was my task to review these units of observation and select those that would be subject to further critical analysis. Using the CDA approach, I selected particular "moments of discourse" for deeper critical analysis, which essentially promoted these moments to *units of analysis*. As units of analysis, these moments might be thought of as "mini cases" that were components of larger "meta" cases, such as: the case of unconscious bias in the workplace; or the case of male allies in support of women in tech; or the case of Silicon Valley releasing diversity numbers. Each of these larger cases have a complex network of elements of discourse and practices, within the broader context of institutions that impose forces of structure, and individuals taking action and asserting agency.

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[15] Ragin and Rubinson also noted that "today it is fashionable to refer to such research as 'triangulated' or 'multi-method' (p. 21).

Next, I will review Fairclough's notion of moments of discourse and practice and introduce the five steps of Fairclough's CDA. A separate section for each stage of the CDA framework will explain how my research was influenced by CDA.

Using Critical Discourse Analysis as Method

A key construct that I adopted from Fairclough is the notion of a moment of discourse. From a methodological perspective, Fairclough's CDA enables analysis of discourse as moments which are composed of elements of discourse and social practice (Fairclough, 1992, p. 122), especially when placing analytical attention on the relationships among the elements and the boundaries between them.

> *Discourse is one 'moment' among several that comprise social processes, events and practices, the others being power, beliefs/values/desires, institutions/rituals, material practices and social relations (Harvey,1996). All human activity is made up of these moments, involving representation through discourse, the playing out of power relations, the possession or giving up of beliefs or values, the building of institutions, the transformation and movement of materials and the engagement in social relations with others. Dialectically, each moment internalizes the others in the flow of human activity–they are different but not discrete." (Fairclough and Thomas, 2004, p. 4)*

Moments of discourse and social practice

In viewing discourse as a moment among many related moments in the social process, Fairclough offered an approach that is based on an understanding of elements of discourse (i.e., as language, texts, semiosis) and elements of practice that are related to each other in the constitution of "moments" of a broader social process. If a moment of social process is made up of multi-dimensional and inter-related set of moments of

discourse and social practice,[16] and we accept that an "order of discourse" is a totality of discourse in the Foucaultian sense (i.e., encompassing the totality ideas, assumptions, practices), we can also accept that there can be multiple and overlapping discourses. Examples of overlapping discourses include discourses of gender equality, discourses of computing, and discourses of women in tech. From a CDA perspective, then, there can be many moments within such discourses, and these can overlap or intersect with each other. Such moments of discourse can also be recursive, as was seen in foundational theories of discourse (especially evident in Foucault and Butler)[17]. Such moments of discourse and social practice are co-constitutive. When considering how this happens (i.e., the social process) we can also bring into view the mutually reinforcing forces of institutions (structure) and individual actions (agency).

From a methodological perspective, the notion of the moment fits within Fairclough's CDA that encourages analysis around the *relationships and boundaries of elements* of discourse and practice, which can be fertile zones for the analysis of social change. Fairclough suggested that the boundaries between elements may be "lines of tension" (Fairclough, 1992, pp. 68-69). From this standpoint, he encouraged analysis at

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[16] Also see Mumby (2004) on use of Fairclough, specifically around the notion of a moments of domination and resistance (pp. 6, 10)

[17] Since recursion is often a non-intuitive concept, having ways of describing the phenomenon is useful:
  Recursion: when the invoking the rules of discourse can actually change the discourse
  Recursion: when rules are both medium and the outcome
  Recursion: when the means of production becomes the outcome of production
  Recursion: when the process of repetition introduces change in the process itself
  Recursion: when a system is reproduced through functions that produce the system

the boundaries of "settings and practices" suggesting that different institutional contexts could be fertile ground for analysis. Similarly, he suggested looking from the standpoint of different subject positions and different communities of practice and "different social circumstances."

My use of CDA is most evident in the moments that I selected for analysis, particularly those covered in Chapters 6-8. In selecting moments that have significance for social change, I followed Fairclough's advice on detecting a "moment of crisis" (Fairclough, 1992, p. 230).

> *"One selection strategy which has much to recommend it is to focus on what I earlier called 'cruces' and 'moments of crisis'. These are moments in the discourse where there is evidence that things are going wrong: a misunderstanding which requires participants to 'repair' a communicative problem, for example through asking for or offering repetitions, or through one participant correcting another; exceptional disfluencies (hesitations, repetitions) in the production of a text; silences; sudden shifts of style" (Fairclough,1992, p. 230)*

My CDA Adaptation: Discursive Moments of Crisis

I have adapted Fairclough's notion of a "moments of crisis" to my research as a *Discursive Moments of Crisis (DMC)* which are sequences of **crisis → disorder → reorder**. This particular pattern of related moments is a sign of disruption and recovery that can be seen through elements of discourse and practices that exist amid the forces of structure and agency, and that are illuminated by issues of gender. A *DMC* is comprised of multiple overlapping constituent moments, supported by moments of gendered discourses and interconnected with moments of social practices in computing workplaces. DMCs can be representations of a gendered storm that is brewing in contemporary workplace cultures. DMCs can also be moments of discourse and practice

that serve as interventions for navigating the storm, such as moments of reconciliation, moments that articulate end enforce a diversity policy, or moments when individual speaking up when observing an instance of gender bias. Some DMCs may be candidates for further critical analysis especially when tensions and contradiction can be located in network of related elements of texts and social practice.

Fairclough's CDA framework was appropriately motivated for what I set out to do, which was to identify the problem of the underrepresentation of women in computing, and then focus on what was being done to correct it. Motivating CDA for the social sciences, Fairclough argued,

> *" CDA is a form of critical social science, which is envisaged as social science geared to illuminating the problems which people are confronted with by particular forms of social life, and to contributing resources which people may be able to draw upon in tackling and overcoming these problems" (Fairclough, 2001, p. 125)*

To begin engaging with the CDA framework, I began with a deeper understanding of the nature of the problem that the existing research that had been done on it. I engaged with the substantial literature that was already available about gender bias, identity, power, gender and technology, and reasons for the underrepresentation of women in computing. Standing on the shoulders of other researchers on theories about the causes of the problem, I established my primary research focus on the *interventions* that were being mounted to address these issues to achieve a state of diversity in the tech sector in the future.

Detecting tensions, contradictions, and dilemmas

From a methodological perspective, the notion of the Discursive Moments of Crisis fits within Fairclough's CDA, which encourages analysis that can reveal tensions, contradictions, and "dilemmas" (Fairclough, 1992, pp. 96-97; Billig and Condor, 1988). Fairclough encouraged analysis of the *relationships and boundaries of elements* of discourse and practice, which can be fertile zones for further critical analysis. He suggested that these boundaries between the elements may reveal "lines of tension" (Fairclough, 1992, pp. 68-69). Specifically, different institutional contexts can be fertile ground for analysis around the boundaries of "settings and practices." Similarly, different subject positions and different communities of practice can reveal "different social circumstances." Overall, Fairclough observed that "under different social circumstances, the same boundaries might become a focus of contestation and struggle, and the subject positions and discursive practices associated with them might be experienced as contradictory" (p. 69).

Fairclough acknowledged that the elements of the "orders of discourse" are heterogeneous and of different types. He also recognized that different disciplines have different understandings of the major categories of these types (i.e., examples are "discourse." "genre," "style," "register"). In light of this, and to promote interdisciplinary use of CDA, he encouraged the researcher to avoid taking an overly rigid stance of the meaning of these terms since this could distract from the appreciation of the complexity of discourse and, accordingly. He said we have to resort to the use of a vaguer term of "discourse type" (Fairclough, 1992, p. 124-125). However, when using Fairclough's framework for my research, the notion of 'genre' was still important

because it is essential to his method of linking elements of discourse to social practice, and especially the understanding of how they are related to each other.

> *"I shall use the term 'genre' for a relatively stable set of conventions that is associated with, and partially enacts, a socially ratified type of activity, such as informal chat, buying good in a shop, a job interview, a television documentary, a poem, or a scientific article. A genre implies not only a particular text type, but also particular processes of producing, distributing and consuming texts. For example, not only are newspaper articles and poems typically quite different sorts of text, but they are also produced in quite different ways (e.g., one is a collective product, one an individual product), have quite different sorts of distribution, and are consumed quite differently – the later including quite different protocols for reading and interpreting them."* (p. 126)

Having established this as the social problem of concern, I used the CDA framework to guide my research process. The next five sections describe the specific activities I engaged in at each stage and the timeline for my work can be found in Appendix C.

CDA Stage 1 – Social Problem of Concern

In framing my research with the CDA framework, my first task was to review the terrain and to establish an entry point into what was a vast institutional and extra-institutional terrain of discourse and practice around the social problem. I began with the broad problem domain of diversity in STEM and the analytical lens for interventions of national law and policy. Figure 4 depicts the scoping of this problem domain and the lens for analysis of interventions. I then began to narrow these two dimensions, as seen in the increasingly lower parts of the two triangles. The diversity problem was refined to computing – software – diversity – workplace. The intervention lens landed on not-for-profits that focused on women in computing.
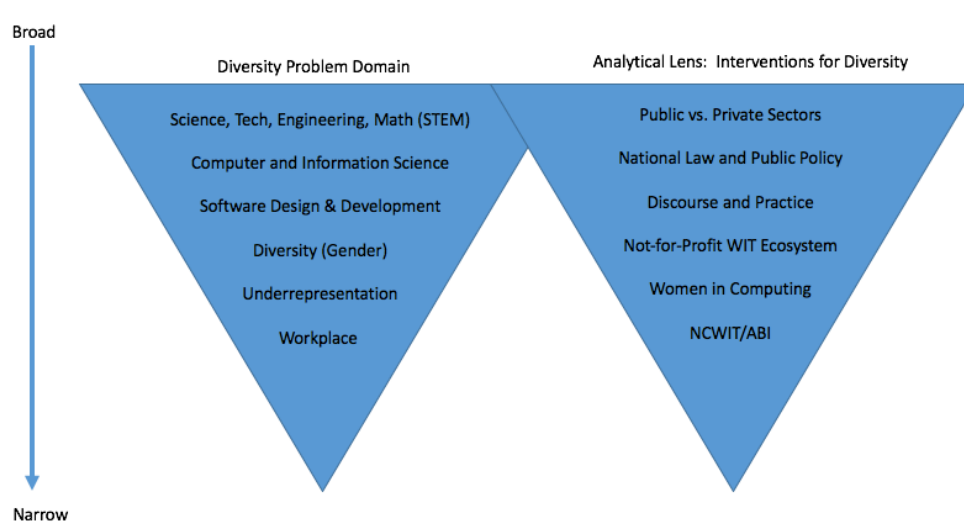
Figure 4. Narrowing the Problem Domain and Selecting the Lens for Analysis

As discussed in Chapter 1, the problem of concern can be briefly restated here: despite decades of advancements for women in STEM, the proportion of women in computing was declining even during the very time that the Web was emerging and tech startups were creating new technologies that entered our work and personal lives in significant ways.   This is a social problem *of concern* for many reasons. First, most women were not discursively visible for the achievements they already had made and they were not getting the new opportunities the tech sector had to offer. More broadly, there were economic and social implications of how these new technologies were being designed, built, and deployed and the gender disparity in tech was not widely appreciated, discussed, and acted upon. Given that the design and creation was being done predominantly by white males, the most powerful sector of the contemporary economy had a radical imbalance – a lack of gender and racial diversity. The unfortunate truth is that this state of affairs had been going on for decades and most efforts for correcting it had not brought the state of women in computing anywhere near to parity.

In terms of selecting an analytical lens, I identified ABI and NCWIT as organizations whose missions were directly addressing the social problem of concern that I defined for my research. Their focus was on *interventions* to address the underrepresentation of women and working with other organization to paths for resolution of this problem. These two not-for-profits focused broadly on issues of women in technology, with a particular concern being the issues of bias, inequity, and obstacles faced by women in computing. Their missions were about interventions to combat such problems through educating, advocating, building coalitions, and inspiring social change, and, overall, mounting interventions in the technology sector that are motivated by the public good. For all of these reasons, I selected ABI and NCWIT as my analytical lens for the social problem of concern.

ABI and NCWIT were the two particular organizations within the WIT ecosystem that stood out due to their being well-established and well-connected to many other organizations. ABI and NCWIT were like hubs connected to many other organizations, including companies in Silicon Valley, the tech broader sector, universities, governments, and others organizations in the WIT ecosystem. In particular, the nature of these connections were: the organizations that were members, sponsors, or partners of the not-for-profit organizations; the organizations that regularly sent employees and students to the major events of ABI and NCWIT; the organizations that worked with ABI and NCWIT on issues of policy and advocacy for social change. Also, the executive leaders of both of these organizations were on the Boards of Directors of ABI and NCWIT as 501(c)3 not-for-profit organizations. For all of these reasons, ABI and NCWIT offered fertile ground for my observations by providing exposure many different types of organizations that were engaged in issues of women and computing in tech sector. The individuals who were representing these organizations at key events also offered a breadth of perspectives and subject positions. This breadth was necessary for interpreting the discourses of

gender and computing, understanding the different institutional paradigms on the problems and solutions, and identifying opportunities for further discussion and later interviews.

Starting at this early stage, and continuing throughout my research, I selected and analyzed "texts" as elements of discourse, including public and government documents; organization websites and web archives; news, blogs, and public media; transcripts of public sessions and plenaries (both text, audio, and video); and social media used by the communities of practice.   This was the beginning point for Stage 2 where the analysis turned to identifying obstacles to addressing the social problem of concern.

Stage 2 and 3 – Identify Obstacles to Addressing the Problem

Using CDA, I selected discourse artifacts that I considered in terms of their relationships to each other, but also in terms of their relationships to the macro forces in my multi-force framework (i.e., discourse, practice, structure, agency, with gender throughout). My purpose was to not only focus on selected texts as discourse samples, but to do so in context of the broader qualitative and critical analysis that asks questions from the vantage point of all of these forces. The identification and analysis of obstacles led to my focusing on themes that were revealing particular Discursive Moments of Crisis. Several key themes surfaced during my analysis of 2014-2016 - *unconscious bias*, *male allies*, *diversity data*, and *culture change*.

In adopting Fairclough's analytical perspective of an "order of discourse," I was especially attentive to CDA's focus on how relationships among the elements of discourse and practice could draw attention to the "particular social ordering of relationships amongst different ways of making meaning." As Fairclough noted,

> *"[a]n order of discourse is a social structuring of semiotic difference - a particular social ordering of relationships amongst different ways of making meaning, that is different discourses and genres. One aspect of this ordering is*

dominance: some ways of making meaning are dominant or mainstream in a particular order of discourse; others are marginal, or oppositional, or 'alternative.... [Difference may become hegemonic, become part of the legitimizing common sense which sustains relations of domination, but hegemony will always be contested to a greater or lesser extent, in hegemonic struggle" (Fairclough, 2002, p. 124)

What makes the social problem not easily resolved?

An important part of the CDA framework is identifying obstacles to addressing the social problem of concern. Fairclough asked, "what is it about the way social life is structured and organized that makes this a problem that is resistant to easy resolution?" (Fairclough, 2002, p. 125). While some obstacles are overt, many others are subtle and these are the ones that are important to surface. In Stage 3 of his framework, Fairclough posed an interesting question: "does the social order… in a sense 'need' the problem?" (p. 126). This question of needing the problem, on the surface, is counterintuitive since, by definition, a social problem of concern would seem to be a problem that is not wanted, and thus not needed. This brings up the different subject positions and how they understand the problem. If the social problem of the underrepresentation of women were discursively framed a bit differently - as in "we have a pipeline problem" - then things might look different to some. This alternative framing would have us ask if some actors "need" the dry pipeline. When taken from this standpoint, Silicon Valley startups and competitive high-tech companies had an upstream supply problem. As discussed in Chapter 1, the dry pipeline argument was the type of problem Silicon Valley entrepreneurs could "need" since they could deflect responsibility for organizational practices and sexist cultures that were common obstacles for women in tech. This type of use of CDA involved analyzing discourse elements for signs of tension and

contradiction, or what Fairclough also referred to as "dilemmas" (Fairclough, 1992, p. 96-97).

Next, I discuss the process of selecting and examining texts that I will refer to as *discourse artifacts*. Some of these discourse artifacts have direct relationships to each other, and all of them have indirect relationships to one or more element of discourse and practice related to the social problem of concern.

Selection and Analysis of Discourse Artifacts

There were many public sources that served as fertile ground for the discovery of discourse artifacts. These artifacts are elements of discourse and consist of written texts, numeric data, visual images, spoken and recorded language, and multi-media ensembles. In selecting discourse artifacts for further analysis, I observed the state of permanence of the artifacts and whether they were concrete instances of the discourse that the artifact represented. Some discourse artifacts were part of a permanent record ("PR"), others in a state of relative stability ("RS"), while still others were dynamic and in an evolving state ("DE"). These states are prefixed below for each of the types of artifacts I examined.

- **PR**: Government Documents of 501(c)3 organizations

- **PR**: EEOC-1 Reports of corporations

- **PR**: NCWIT's Male Advocates and Allies Report

- **PR**: Impact Reports of ABI and NCWIT

- **PR**: Web archives - ABI and NCWIT website snapshots via Wayback Machine

- **PR**: Press accounts of gender and tech in Silicon Valley

- **RS**: ABI and NCWIT websites - selected web pages (2015-present)

- **RS**: Corporate websites - diversity and inclusion web pages and infographics

- **RS**: Resource Collections (e.g., NCWIT Research-based[18]; Lean In's Educational[19])

- **RS**: Impact Reports (e.g., Annual; ABI Top Companies; NCWIT Patent Study)

- **RS**: Selected Blogs (organizations; individual commentators)

- **DE**: Online communities and Email groups (e.g., ABI Systers; Lean In Circles)

- **DE**: Social media posts on Twitter and in blogs

One of the significant aspects of these states of permanence for my research was knowing the degree to which a text would continue to be available. Regarding the permanent documents ("PR" type), I could count on these being available from a custodial institution. If this wasn't assured I created a personal screenshot of it. The government documents for the 501(c)3 organizations are required to be made publicly available by law and for most established not-for-profits these documents are available via GuideStar[20], which is the dominant service for reporting on not-for-profit organizations. Websites are classified as "RS" since they are relatively stable, even though some pages will have dynamic context. Also, since entire websites or specific pages can be removed by the organization that publishes them, I relied on the Internet Archive's Wayback Machine[21] to access snapshots of the pages as web history. Other artifacts are by nature dynamic and evolving ("DE" state) such as those that I included from Twitter and blogs. While some will view tweets as ephemeral, Twitter continues to make tweets available via the

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[18] NCWIT's Research-based Resources, https://www.ncwit.org/resources
[19] Lean In's Educational Resources and Videos, https://leanin.org/education
[20] Guidestar is the dominant service and database for not-for-profit reporting. Basic profiles and reports can be accessed for free and premium services are available for more extensive information. For my research, I subscribed to GuideStar Premium. See: http://www.guidestar.org)
[21] Internet Archive Wayback Machine, http://archive.org/web/

Web and also introduced Twitter Search to ease the pain of scrolling backward through time. Nevertheless, for Twitter texts, I made the decision to copy the text of all tweets for particular hashtags for a particular period of time to ensure their persistence for my research. For blog posts, I printed blog pages to PDF documents. My copies of these texts were saved on my computer and backed up for later analysis. Regarding the issue of privacy and the ethics of quote Tweets of individuals, I would use the text of the tweet without the name of the individual. Regarding storing copies of the Tweets, I maintained a document in password protected storage with the just the tweet text and the URL that links to the original tweet on Twitter.com.[22] Some texts I considered relatively stable, meaning that they were published on the Web by trusted institutions, but there was always a chance that they could by revoked or taken down. I considered the documents from the NCWIT Resources collections to be this way, and for both my analysis of the texts and ensuring a permanent copy, I downloaded all Resources relevant to the themes of my analysis.

Public documents and reports

Another example of stable texts are the documents filed in compliance with United States Code 501(c) of the Internal Revenue Service (IRS), which defines a "public charity" as a not-for-profit organization that is primarily publicly funded and engages in activities aimed at "relief of the under-privileged," "advancement of education or science," "eliminating prejudice and discrimination" and "defending human and civil rights secured by law"[23] (IRS, 2014). From a researcher perspective, the public documents filed by 501(c)3 organization to the IRS are valuable texts that state the mission and purpose of an organization, along with other statements about achievements and impact. As part of my initial scan of the terrain, I obtained copies of

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[22] Example Twitter URL link is https://twitter.com/concernedfems/status/520023816769388547
[23] IRS https://www.irs.gov/charities-non-profits/charitable-organizations/exempt-purposes-internal-revenue-code-section-501c3

these documents for each not-for-profit organization in the WIT ecosystem. I examined the statements of purpose that motivate the activities and the programs of each organization (see Appendix 3.1).[24] The mission and purpose statements of both NCWIT and ABI strongly reflect visions of a world where women are fully represented in the design and development of software and computing technologies that are increasingly woven into modern life. Each organization had a different refinement of this greater purpose, with specific programs focused on organizational change and others on individual empowerment. The mission statements of organizations tend to be relatively stable over time, and this was seen in the statements of purpose of the not-for-profit organizations. For a more dynamic view of the organization and the discourses for strategies of fulfilling the mission, I examined organizational websites as texts.

There are many other types of public documents that are available, including the annual impact reports of organizations, diversity data reports (e.g., EEO-1), and resources such as research reports and best practice guides. There are a substantial number of articles from mainstream press and magazines that cover the issues of gender bias, and the lack of diversity in Silicon Valley and the tech sector. For example, I drew extensively on the press coverage of Microsoft CEO Satya Nadella's appearance at GHC14 in my analysis of the event. Other examples of public documents are extensive collections provided by NCWIT and Lean In that address key issues that are relevant to my research, especially articulations of the social problems and the interventions for addressing the underrepresentation of women in computing. For example, I selected particular NCWIT Resources as discourse artifacts for my analysis since they were texts covering relevant of themes including unconscious bias, gender bias, the effect of diversity on business performance, male allies and advocates, and how companies can attract and

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[24] All of the organizations in the WIT ecosystem are legally public charities, with the exception of Lean In, which is a private foundation founded and primarily funded by Sheryl Sandberg, COO of Facebook[24].

retain women. Web-based manifestations of Resources can be downloaded from the NCWIT

website and many Resources[25] are also available in physical printed form (e.g., brochures,

booklets, printed cards, etc.) on request or at the annual NCWIT Summit, where they are

promoted and showcased for those who may want to later order large quantities for distribution at

other events.

Websites and Web archives

Organizational websites and web archives can be approaches as discourse artifacts. I

extensively examined the websites of not-for-profits and corporations in the tech sector,

especially those companies that released diversity data in 2014 and evolved their public diversity

and inclusion web presence. All of these websites are elements of the discourse of women in

computing, and reveal much about high resonance issues of women in tech. The ABI and

NCWIT webpages are public articulations of how the problem is being understood and the nature

of the interventions being mounted. Corporate websites are also instructive since they reveal the

public face of a company and are they are publicly responding to the changing tide of the

environment of tech. The discourses of data were also apparent on the websites of many Silicon

Valley and tech companies, and especially those who publicly released diversity data in 2014.

Websites of other organizations in the wider Web provide good sources of discourse counter to

those of dominant organizations.

While organization websites that are relatively stable (i.e., RS category), the *content* of

these websites can change over time, which provides a more dynamic view of the strategic

discourses of organizations in both in the private and public sectors. The Web-based discourse

that an organization publishes reveals much about the stated values of the organization and its

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[25] NCWIT Resources, http://www.ncwit.org/resources

leadership, and this can change over time. From a methodological standpoint, I was interested in the relationship between the stable legal discourses of the organization (e.g., corporate mission statement, IRS Form 990) and the dynamic nature of the organizational discourse, especially as the evolved their strategies on gender issues, diversity, culture and social change.

Blogs, Online Community Forums, and Social Media

Many other discourse artifacts are expressions by individuals at notable periods of time surrounding particular moments of discourse. I also captured artifacts of bloggers who were active and commenting about GHC during the periods of time of my analysis. One example was a blog that featured commentary and a transcript of GHC14 male allies panel. This was significant because the Livestream video of the panel was one of the few plenaries that was not available on the GHC website.[26] Another blog was the source of the Ally Bingo game and the activist intervention during the GHC14 male ally panel. I was able to download a copy of a completed Ally Bingo card as an artifact of discourse after the blogger made herself known as the instigator of the game and made a copy of the card available on the blog[27].

Some artifacts may only be available for a limited period of time. Others may appear to be somewhat ephemeral, for example Twitter posts. Such texts can still available from third party agents who mass-download a corpus of tweets. But such copies are not archived in the formal institutional sense (i.e., what archivists and librarians as stewards consider the archive to be). For example, for Twitter to become part of the long-term historical record, its content must be taken under stewardship of an actor or institution whose mission is the preservation of knowledge. The U.S. Library of Congress tried to make this happen by downloading the Twitter corpus as public

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[26] Male Allies transcript, http://juliepagano.com/blog/2014/12/02/male-allies-panel-transcript/
[27] Ally Bingo card, https://hypatia.ca/2015/09/23/bingo-and-beyond/

record, but policy questions of privacy and managing at scale remain and as of 2017 LoC is no

longer archiving every Tweet, but is doing so for selected and thematic collections of tweets. [28]

Tweets were essential artifacts of discourses in support of my analysis of the Discursive

Moments of Crisis related to unconscious bias and male allies discussed in Chapters 6 and 7.   I

was able to take advantage of the current Twitter Search[29] and create my own pseudo "archive"

of Tweets for further analysis, including,

- Tweets by individuals about specific days of GHC (#GHC14 and #GHC15)
- Tweets of the Union of Concerned Feminists in 2014-2015 (@concernedfems)
- Tweets related to GHC Allies Bingo in 2014-2015 (#ghcmanwatch)

The apparent semi-permanence of these Twitter postings was overcome by retrieving the tweets

through the Twitter Search platform services. From there, stable URLs can also be obtained.

Stage 4: Identify Ways Past the Social Problem of Concern

Both ABI and NCWIT are organizations that convene many types of organizations at

their annual events that I refer to as *forums of discourse* (discussed in detail in Chapter 5). For

ABI, the forum is its flagship event, the Grace Hopper Celebration of Women in Computing

(GHC). For NCWIT, it is the Summit, which is the annual meeting of members and

representatives of NCWIT alliances. Both of these forums provided the lens I needed to observe

the network of institutions and individuals across the tech sector. These forums were attended by

leaders and employees from companies, faculty, researchers, students from universities and

colleges, employees in government organizations, leaders of other not-for-profit organizations,

program officers of funding agencies, and members of the media and press.   Both ABI and

NCWIT had established their legitimacy in a cross-institutional terrain by engaging with

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[28] Status of Twitter archive at Library of Congress, https://www.npr.org/sections/thetwo-way/2017/12/26/573609499/library-of-congress-will-no-longer-archive-every-tweet
[29] Twitter search: http://www.idownloadblog.com/2014/11/19/twitter-archive-search/

individuals who were corporate leaders, policy makers, academics, other not-for-profits, government organizations, funding agencies. As not-for-profit organizations, they provide one of the few contexts where all representatives of all these types of organizations come together to share information, to deliberate on the issues, and to enact processes for social and institutional change. My two primary sites for participant observation are described next.

Virtual Observation - 2014 GHC and the NCWIT Summit

Early in my research I examined the websites of ABI and NCWIT and realized that many of the materials of their major events (GHC and the Summit) were available online (via Livestream video recordings and supplemental materials). I decided to conduct a "virtual observation" of these events in 2014 by watching all of the videos and examining all of the social media surrounding the events, with the plan of attending in person the next year. My strategy was to examine all of the 2014 events that were available via LiveStream video recordings and the supplemental materials online. In addition to enabling me to start identifying themes and discourses that were currently active, my observation of the 2014 events would also help me prepare for on-site *participant observation* in 2015.

I was already familiar with the GHC event since I had previously attended in 2009 when it was held in Tucson, Arizona. At that time, I was invited to be part of a panel on open source software with other female leaders of technology-based not-for-profit organizations[30]. My prior experience as a woman in tech, plus my having attended GHC in the past, helped me prepare for attending GHC with a new research purpose in 2015.   While I expected to see how the discourses

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[30] At this time in 2009, I was Executive Director of Fedora Commons Inc. the not-for-profit I founded based on the vision of open source software the Fedora Digital Repository, which began with my research and development of the software known as the Flexible Extensible Digital Object Repository (i.e., Fedora). The organization evolved into DuraSpace supporting a suite of open source projects.

of women and computing had changed since my attending in GHC09, I didn't expect GHC, itself, to have changed as radically as it did in 2014 and 2015, most notably the size of the event.

My first exposure to the NCWIT Summit was in 2014 when I "virtually" attended by taking advantage of the Livestream videos made available on the NCWIT website[31]. Since the Summit is a member-oriented meeting, for this year I had access to only the public information about the 2014 Summit and NCWIT Alliances that included major plenary sessions and documents that were available. My goal was to obtain an invitation to attend the 2015 Summit in person as a full participant observer and have direct exposure to the discourse and practice of the NCWIT member community. NCWIT was also described as an "organization of organizations" that is concerned with convening and catalyzing communities that have an interest in improving opportunities for women in technology. To secure an invitation, I reached out to the CEO of NCWIT, Lucy Sanders, to introduce myself and my research. Sanders granted me a guest invitation and connected me to staff to register for the Summit. She also introduced me to one of the NCWIT research scientists who endorsed me as an institutional representative of Cornell University which made me a member of the NCWIT Academic Alliance. After receiving my formal invitation, I registered for the 2015 Summit that was to be held in Hilton Head, NC and indicated that I would attend the full Summit and the annual meeting of the Academic Assembly.

On Site Participant Observation

My preparation for participant observation included developing a plan of action – a schedule of thematic sessions to attend, the events I would participate in, and a preliminary list of people to connect with for formal or informal interviews. I attended all of the major plenary sessions and sessions tracks that would give me exposure to the discourses and the practices of

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[31] Summit materials are archived at: http://www.ncwit.org/summit/archive/242).

both the corporate participants and the academic researchers. I also attended sessions that we geared towards empowering women and providing advice to organizations about how to have successful interventions (e.g., for example introducing unconscious bias training, releasing a company's diversity numbers, and mentoring women).

2015 Grace Hopper Celebration

The Grace Hopper Celebration (GHC) was a primary site of participant observation since it is the largest event that addresses women in computing, convening a national and international audience. Founded by ABI, the event was well-attended by employees of the private sector, public sector, and universities. There is representation from major tech companies that serve as partners and sponsors of ABI. In addition to the GHC event, the ABI organization offers many other programs, as well as a rich online presence with information resources, newsletters, blogs, and social media for community building that can be engaged with throughout the year.

I submitted a proposal to GHC15 in the data science technology track about my work on an NSF-funded cyberinfrastructure project so that I could attend the event as both a full participant at the conference, while also being there as a doctoral researcher and observer to analyze the event. My proposal to present to the session track was accepted and I registered to attend the full GHC15.

In October 2015, I attended GHC15 in Houston, Texas. This was a multi-day event held in a huge convention center to accommodate the almost 12,000 attendees. Being both a participant and an observer provided a full emersion in the most well-known and well attended event for women in computing. As a participant observer, I was able to give a presentation of my technical work which led to discussions with other women doing similar or related technical work (i.e., the topic area was publishing and preserving research data in open repositories). Overall, as

an observer, my plan included attending strategically selected sessions, conducting informal interviews with other attendees, observing the "Expo" and career fair, and letting serendipity prevail during the free time between my intentional and planned observations. In addition to attending all of the main plenaries, I was able to attend smaller interactive workshops which allowed me to spend time with corporate leaders and diversity and inclusion directors. During the unstructured time, I interacted with many women in technology, including women who were leaders in tech, women who were developers and engineers, and women who were students. These women were of many age groups and from different ethnic and racial backgrounds, including several from other countries. This embedded process enabled me to spontaneously conduct informal interview or arrange for later interviews. GHC15 also gave exposure to work of other WIT not-for-profit organizations that partnered with ABI, including Lean In which had a standing room only session at GHC with a long line of women waiting outside hoping seats would open up.

2015 NCWIT Summit

NCWIT was my other primary site for participant observation. In contrast to GHC, the NCWIT Summit research is a smaller member-based event. The Summit is focused on convening the "change leaders" of organizations, and from that standpoint it is not open to the public and there are no students attending or presenting their work. This is a smaller event of approximately 500-600 attendees. The Summit provided a national perspective on the state of women and computing – appropriate to its name as the *National Center for Women in Information Technology* (i.e., NCWIT) which was funded by the NSF. As a established 501(c)(3) non-profit organization, NCWIT identifies itself as a community of more than 575 universities, companies, non-profits, and government organizations. The annual NCWIT Summit convenes institutional representatives from its four major alliances – Academic Alliance, Workplace

Alliances, Entrepreneurial Alliance[32], and K-12 Alliance. NCWIT had already cultivated

relationships with major corporations and universities that were among member institutions of the

NCWIT Workforce Alliance. In May 2015, I attended the NCWIT Summit in person at a

conference hotel in Hilton Head, NC. The NCWIT Summit is a place of discussion, deliberation,

strategy, planning of action. It was a multi-day event so there were ample opportunities for

networking and informal discussions. I was able to spend time with academics studying issues of

gender and diversity, corporate leaders and diversity and inclusion directors, and representative

from NSF and other government agencies. I also was able to meet leaders of NCWIT and other

WIT not-for-profit organizations, which enabled me to arrange for later in-depth interviews.

Informal interviews

I also conducted informal interviews during participant observation at 2015 GHC, the

2015 Summit, and the NCWIT strategy meetings in Boulder, CO. For these interviews, I either

sought out specific individuals that I wished to converse with at the event, or I approached a

person spontaneously after a session that we both participated in.   These informal interviews

provided a variety of viewpoints from representatives of several different groups - corporate

employees, university professors, human resources professionals, and students. I introduced

myself and revealed that I was conducting research on key interventions for improving the

representation of women in computing. I asked the interviewee about his or her role and why

they were attending the event. I then asked if I could ask a few questions for my research. I

posed one of two types of questions from my interview script depending on their context.

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[32] The NCWIT Entrepreneurial Alliances is focus on issues of a company's early stages when innovation is critical, executive teams form, and core values are established. See:
https://www.ncwit.org/alliances/ea
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The type of first question I asked informal interviewees was focused on the *woman in tech* perspective, as in "what is the biggest obstacle that women face in the computer tech industry?" The other was focused on the *corporate perspective*, as in "what is the most significant challenge that *a company* in the computer tech industry faces regarding issues of gender?" I also used probes such as what is the most stubborn or frustrating challenge, or the biggest prospect or opportunity. Overall, I conducted over 30 of these types of informal interviews, each lasting approximately of 15 minutes. In most cases I posed a second question that was relevant to their particular work context. Either during, or immediately after each discussion, I wrote up notes about the encounter in my hand-written journal for later analysis. I reviewed all of these notes and selected a subset to transcribe for use in later analysis. For example, some of the informal discussions after plenary sessions expressed subtle viewpoints about key themes of interest and revealed tension that I expected to be useful later in my analysis.

NCWIT Strategy Meetings

At the end of the 2015 Summit, I received an invitation from the NCWIT CEO to observe the next NCWIT strategy meeting and to meet with other NCWIT staff to further inform my research. This summer observations took place in July and August 2015 at the NCWIT headquarters in Boulder, Colorado. The strategy meeting was the annual gathering where all NCWIT leadership and staff attend. As an "all-hands" type of meeting of approximately 50 people, the entire NCWIT team engaged in facilitated strategy sessions to discuss program development, prioritization, future goals, and impact of programs. This was a strategy meeting, which gave me the opportunity to observe the deliberations of the NCWIT leadership. These could inform my research on the discourse and practice of the social process of interventions for women in computing. They also provided me with an insider view of the past year of work convening a "change leader network" of organizations that are working to address issues and improve opportunities for women in tech. My summer Boulder visit also provided the

opportunity to meet with members of the NCWIT staff and conduct informal interviews. From

these informal interviews, I was able to schedule formal in-depth interviews with the NCWIT

leadership.

Formal Interviews with ABI and NCWIT Leadership

Overall, my formal interviews with the not-for-profit leadership were ways to unpack the

details of what it means to lead an organization with a public mission directly focused on women

in tech. These interviews were also provided insight into the perspectives and activities of

corporations in the tech sector, since ABI and NCWIT leaders could serve as valuable surrogates

for the corporate leaders they worked with. The interviews included the founders of the

organizations who also became the organization's first CEOs and were still leading the

organizations during the years of my study. They also included the executives and senior leaders

who were responsible for enacting the mission and developing the programs of the not-for-profit

organizations. All of these leaders and staff members were engaged in builders of relationships

with other institutions, especially corporations and universities.

As not-for-profit organizations, ABI and NCWIT were structurally positioned as *hubs*

that connect many other types of organizations, which makes them valuable resources for getting

at some of the backstory that is not available in public texts and documents. Specifically, formal

interviews with ABI and NCWIT leaders and staff provided valuable information about the

companies who partnered with them or were in alliance with them (e.g., the companies that were

ABI Partners[33] or members of NCWIT Alliances[34]). In the interviews, I probed for insights about

how different companies articulate the problems of women in computing, why they pursued

certain types of solutions, and the value they saw in public/private partnerships such as

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[33] ABI Partners, https://anitab.org/partner-with-us/our-partners/
[34] NCWIT Alliances, https://www.ncwit.org/alliances

collaborations with ABI, NCWIT, and others in the WIT not-for-profit sector. My interviews also probed issues such as: who are key leaders in the corporate sector that are working with them? How do these companies *define the problem* of gender and tech and what are they actually doing to address it? Why are these companies motivated to work with ABI or NCWIT? In terms of the work of ABI and NCWIT, I asked questions about what they forecast for the future in terms of progress for women in tech, and what the unique impact of the not-for-profit sector is and how this can translate into action when working with companies. While the knowledge about corporations was reported second hand by the not-for-profit leaders, they present a perspective from their position of trusted partners and advisors to companies in the corporate sector.

During the interviews, I probed to understand the perspectives of corporate leaders that partnered with the not-for-profit sector. While ABI and NCWIT work for the public good, they also must also regularly navigate issues with an understanding of how companies were addressing them, which means helping companies navigate the tension between business performance and social justice. ABI and NCWIT knew they had to advise companies on how to achieve both of these. While all of the companies have performance-based and profit-based models, they benefit from having trusted intermediaries that can connect the processes and practices of the private sector with the social problems of concerns of diversity and the underrepresentation women and computing. Of fundamental interest during these interviews were the frames of how the problem was being defined, how interventions were addressing the problem, and how success and impact were defined when mounting these interventions. I sought the leaders' perspectives on these issues and how it was framed by those from different subject positions. My general interview style was semi-structured interviews and guided conversations (Weiss, 1994; Kvale and Brinkmann, 2009) which provided for a naturalistic style. Prior to the interviews, I offered a preparation package to the interviewees that included an IRB summary, an IRB approved consent script, and a summary of the interview guide. I indicated that the interviewees would not be

identified by name but that quotes would be used about their organization - its strategy, goals, and challenges, as well as quotes that resonated regarding issues of gender bias and the under-representation of women in computing. I indicated that if I were to quote them by name, I would provide them with a copy of that segment of text before any publication.[35]

The interview process

During the period of time from July 2015 through May 2016, I conducted fifteen in-depth, semi-structured interviews with the leadership of both ABI and NCWIT. The interviewees included the CEOs of both organizations; executive-level leaders (VPs and Board), program directors, senior researchers, evaluation and communication staff, and consultants. My initial challenge was gaining access to the executive leadership. I decided to approach from the top-down (instead of bottom-up) with the intention of getting the broader vision and strategic perspective of the not-for-profit founders. My means of achieving this was to identify the closest links in my social and professional network that might connect me to the executive level of ABI and NCWIT. I had success through two of my academic network connections, two women who are academic computer scientists that were able to provide me with introductions to the CEOs of ABI and NCWIT. Both CEOs then offered me introductions to the other leaders in their organizations. For interview requests that did not have a direct introduction, I introduced my myself via email and described the purpose of my research and the multiple hats that I was wearing – a doctoral candidate in Communication and a former information science researcher and not-for-profit founder, myself, focused on technologies and open source software for Web-era digital libraries.

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[35] I plan to provide copies of the full dissertation document to particular interviewees. This will serve as a member check prior to publication that will reveal if my informants think there are any misinterpretations of what they had said in interviews and whether their organizations have been fairly represented.

I generally followed an interview guide that had a set of questions in six topic areas: (1) organization history and mission, (2) the role of the not-for-profit organization, (3) the problem and solutions for women in computing, (4) communication and discourse, (5) organizational structure and individual agency and (6) determining impact. The full interview guide is found in Appendix 3.2. Since my goal was to conduct the interviews in a semi-structured conversational format, I kept the interview guide next to me for quick reference. I was able to weave the different questions from six general topic categories into the conversation as we talked. I ensured that I covered at least two of the questions in each topic category by the time the interview ended. When possible, I arranged in-person interviews, but most of the interviews were conducted by phone. Each interview lasted about 1 hour, I asked each interviewee for permission to record our conversation and they granted permission verbally on the recording once I started it. This was process was done using the oral consent narrative found in Appendix 3.1. After each interview, the audio files were downloaded from my voice recorder on to my secure computer. The files were assigned a unique number to identify them and they were kept it in a secure storage location. All interviews were transcribed using a professional transcription service. Each audio file was uploaded using a secure Web connection to the service and when the transcripts were complete, I downloaded them from the service to my local computer. The transcript files were named with the numeric identifier and stored on password protected storage.

The interviews began with a warm up question about the mission and history of the not-for-profit and the particular role of the interviewee. From there it moved into a discussion about the programs they offered to institutions and individual women to address issues of women in tech. Then, the conversation moved to nature of the specific issues, challenges and opportunities faced by women in the computing, especially at companies in the tech sector. Since many of the interviewees were passionate about their work, I asked individual leaders how not-for-profits were making a difference. I asked questions that would provide insight how they interacted with

corporation, as well as how these companies viewed the nature of the problems of gender and

tech, and how the not-for-profit organization was helping. Many of the interviewees also had

personal backgrounds in computer science or engineering, in addition to being leaders in the not-

for-profit sector, so I asked them to reflect on what they had observed over the past few decades

in terms of the tech culture, perceptions about women in computing, and the identity of the

computer programmer. Several questions attempted to probe on issues of structure vs. agency,

such as whether more women just needed to learn how to code or "lean in", or whether change to

organizations structures, policies, and cultures of companies are the path to successful

intervention. Many questions were used to solicit discussion that revealed elements of the

discourse of gender and computing, such as how the work of your organization influences

perceptions about women in computing or influences the way women and men think and talk

about gender?

Using Tools for Qualitative Research

In the early stage of my research, I evaluated two tools that would help in organizing and

analyzing qualitative data - ATLAS.ti[36] and NVivo[37]. I chose ATLAS.ti due to its flexibility and

network orientation, especially being able to treat codes as members of sets of "code groups" and

as a network of related concepts. Also, ATLAS.ti was well-designed for storing, managing and

coding both documents texts and multi-media audio and video. I created an initial version of a

codebook during the early stage of my research that was a preliminary review/scan of the WIT

environment. This evolved to become the basis for further coding of interview transcripts and

discourse artifacts later. There were several perspectives from which I was coding, so I created

different high-level code groups, each intended to serve a different analytical purpose. For

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[36] ATLAS.ti for Qualitative and Mixed Methods Data Analysis, http://ATLASti.com/
[37] NVivo, https://www.qsrinternational.com/nvivo/home

example, I create a code group "CDA:" that I used to code selected segments of text that I interpreted as signs of tension, dilemma or contradiction, following the principles of Fairclough's CDA. Examples of codes this group included "cda:dilemma" and "tension:unintended-consequences." In terms of thematically coding the interviews for what interviewees said about women and computing, I created group codes (e.g., "themes:" and "data") for concepts that were emerging in the responses to interview questions. These group containing codes such as "theme:culture change", "theme:unconscious-bias", and "data:diversity metrics,". As I proceeded through the process of doing interviews and coding, I added new groups and codes and merged similar concepts as I observed patterns emerging. In terms of how the ATLAS.ti tool helped in my decisions about selecting "moments of crisis" for further CDA analysis, I looked at how code-groups intersected, for example the "cda:dilemma" code was my interpretation of text segments that showed signs of tension or contraction, and when such text segment frequently intersected with thematic codes such as "theme:male-allies," I saw this as something that was a candidate for further CDA analysis.

During the process of coding I was methodologically influenced by axial coding and selective coding strategies (Corbin & Strauss, 2008; Corbin, J., & Strauss, A., 2012. pp. 159–194). Corbin and Strauss's work offered a refinement of a grounded theory approach with regard to analyzing data in the form of the transcripts of the interviews (Corbin and Strauss, 2012; 1990; Glaser & Strauss, 1967). While I started off with a flat codebook, it was possible to evolve structure over time, with either hierarchical structure or network structure in the relationships of the codes. I also added special codes to flag particulars of interest for the not-for-profit organizations (in code groups as "ABI:", "NCWIT:"), and created utility codes such as "quotable:" for my practical use. I was able to filter these code groups out of analyses for which they didn't apply or were not useful. Overall, the ATLAS.ti tool proved to be extremely adaptable in terms of reorganizing the knowledge coding as more codes were found to be

necessary, and merging codes together as redundancies became apparent. Essentially the tool

supported an inductive knowledge modeling paradigm as significant terms and patterns were

discovered in the texts. The ability to relate concepts to each other was also very attractive, with

the ability to define the nature of such relationships such as whether one code is a part of another.

The ATLAS.ti application provided a number of useful tools, including the "code cruncher" that

provides code frequencies and the "code co-occurrence table". If a picture speaks a thousand

words, I would say that ATLAS.ti "word clouds" were a useful research tool that enabled me to

view the "big picture" that emerged during my analysis of interview transcripts and related texts.

Figure 5 displays a word cloud that was dynamically generated based on the current state of the

entire coding in the text corpus after merging all of the ATLAS.ti projects I created.
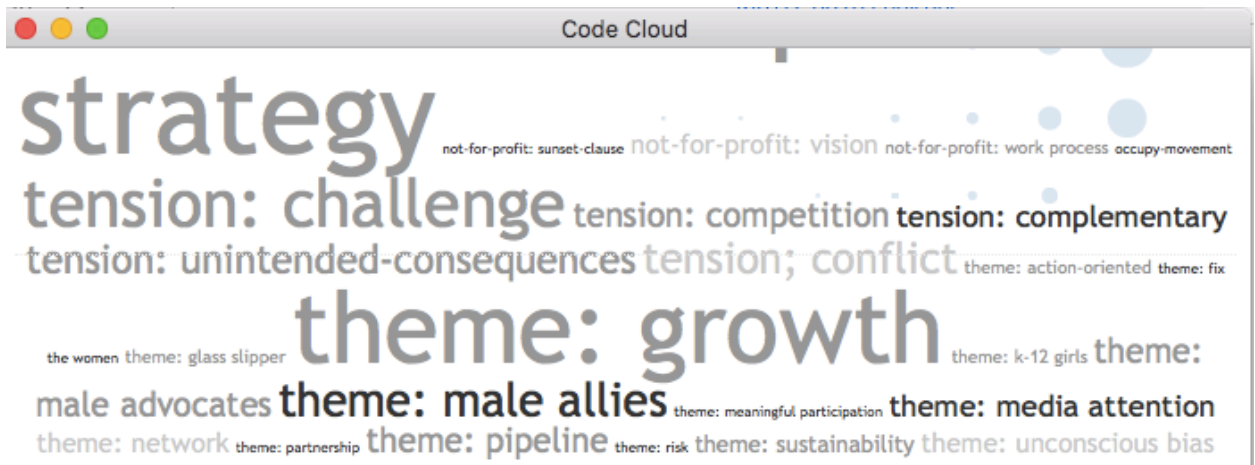
Figure 5. Filtered word cloud for ABI interview (ATLAS.ti)

The figure shows many different code groups, both the utility groups, the cda-related groups, and

the thematic groups. The word size indicates the relative frequency of that a code appeared in the

corpus documents, and for this reason I would subset the different analyses into separate

ATLAS.ti projects. For example, the figure shows a word cloud of corpus of all code groups for

only the ABI interview transcripts, shows a combination of thematic codes that focus on what the

interviewees actually said about women and computing and utility code groups (e.g., "not-for-

profit:strategy) that talk about how the not-for-profit organizations work to fulfill their mission.

These word clouds are *active*, meaning that if the researcher clicks on a term in the cloud, she is linked directly to all segments of texts that were coded with this term. During my process, the word clouds were useful for standing back to see the big themes that were emerging. There are different ways of dealing with using ATLAS.ti and, overall, the flexibility of tool for filtering, establishing code groups, and linking typed relationships of codes are among the major benefit I found in using the tool. From a research process and analytical standpoint this tool enabled flexible and free movement through the texts as a "knowledge base" from which I could explore and juxtapose specific samples during the process of discourse analysis.

Personal Methodological Reflections

In pursuing this dissertation research, I was challenged to look outside my personal experience as a woman in computing since the 1980s, an information science researcher, open source software developer, and leader of a tech-oriented not-for-profit. In many ways, I entered computing at an opportune time, at the peak of the curve in the 1980s when women were coming out of degree programs and entering the workplace at higher percentages than we see today. That has meant for me that my formative years in computing helped build a confidence and a positive identity that I took with me through many different stages of my career. By the time I was working on open source projects, even though I was typically the only woman on the team, I was often baffled, asking "where are the women?" My positive experiences over multiple decades in industry, academia, and the not-for-profit sector had obscured the reality of the difficulties that many women had, especially in modern Silicon Valley and startups. For this reason, before I began this research, I was more oriented to taking the type of stance articulate by Lean In. I wanted to encourage more women more women "get in the game" of tech and to assert themselves as leaders. This research challenged me to see the limitations of this type of stance

and to realize the complexities of the institutional contexts and the realities of gender bias experienced by many women in many professional contexts.

Overall as a systems builder, I was also influenced by theories of socio-technical systems orientation as found in STS. To bring this in alignment with a communication perspective, I saw the opportunity to bring discourse as elements into these systems. Fairclough's theory and method accommodated a style of thinking that was natural for me. Also, the source of my attraction to critical theory is not surprising when we consider that I was a philosophy minor in college, and have continued reading such texts since that time. I then had the opportunity to reignite that interest in the context of my PhD studies. In justifying my use of a mixed method approach of CDA combined with critical analysis and qualitative social science methods, I argue that the complexity of the problem deserved a rich and deep social and cultural analysis. Having been a builder of software and systems for decades, one of my motivating goals in pursuing this dissertation research was to turn the lens from being a system builder to examining the social implications of what is built and by whom it is built.

Given my background and proclivities vis-à-vis my research domain, I nevertheless aimed to fulfill the hallmarks of high quality qualitative research. Tracy (2010) sought to identify best practices for qualitative research of different methodological orientations, and speaking to broadly to the "big tent" of all who embraced such methods of inquiry she argued,

> *"...high quality qualitative methodological research is marked by (a) worthy topic, (b) rich rigor, (c) sincerity, (d) credibility, (e) resonance, (f) significant contribution, (g) ethics, and (h) meaningful coherence.* (p. 840)

From a theoretical standpoint, I approached my research with an acknowledgement of complexity with the multi-force framework described in Chapter 2. I staged my research in a way that demanded "rich rigor" by integrating multiple perspectives, exploring the terrain to be in

a position to select moments for deeper exploration, then being able to back away from these moments and discuss their significance in the broader terrain again. My use of not-for-profit organizations as a frame for observation is consistent with my intention to approach the issues of gender and computing from an ethical stance. Conveniently, using them as an observational lens, they provided a view into the terrain from which I could select discourse samples for further critical analysis. These selected samples were analyzed as the Discursive Moments of Crisis featured in the core chapters. They illuminated some of the key issues of affecting women in computing - unconscious bias. the prospect and dilemma of male allies, and the tensions a number-centric vs. culture-centric posture in making interventions for diversity. Overall, my intention was to provide coherence to understanding the complexity of the problem and current state of affairs, illuminating the challenges and prospects of positive social change.

One of the significant aspects of these moments is what they can tell us about the *prospects for social change*. The selected and analyzed Discursive Moments of Crisis were underlying tensions and ambiguities that had not been fully articulated and not fully resolved. These moments were exemplary of dimensions of the social problem that are not easily spoken, and thus not easily resolved. They also raise awareness of discourses that are both visible and hidden, and are in a continuous process of being constituted and re-constituted. By focusing on Discursive Moments of Crisis, I revealed complexity and tension that can contribute by illuminating obstacles and opportunities in the bumpy path to resolution, social justice, and organizational change.

> *"… discourse analysis can make a significant contribution to researching*
> *organizational change, and addressing such general concerns as the following:*
> *when organizations change, what is it that changes? What makes organizations*
> *resilient in the face of change, resistant to change, or open to change? How are*
> *external pressures for organizational change internalized in organizations, how*

may organizational members respond to them, and what outcomes are possible?"
(Fairclough, 2005, Peripheral Vision p. 935)

My analytical focus on interventions for addressing the underrepresentation of women in the workplace brought the issue of organizational change to the forefront.   The topic of the underrepresentation of women in computing is a worthy topic, as demonstrated throughout this dissertation, and this analysis occurs at an especially relevant time when software, the Web, and the myriad of computer-enabled technologies have profound implication for personal lives, societies, and the material worlds in which we live.

CHAPTER 4
A Short History of Women in Computing

To set the stage for the analysis in the remainder of this dissertation, in this chapter I provide a brief overview of the history of women in computing. A historical perspective enables us to consider the nature of gender and power relations in the evolution of computing technology and practice. This can help us interpret events in the present and future.   This history begins with Ada Lovelace, who is credited by historians as creating the first algorithm for a general-purpose computing machine. In 1843, Lovelace published the logic for computing Bernoulli numbers for Charles Babbages's historical machine, the Analytical Engine. Lovelace's work was arguably the first act of programming, from which she was able to envision the broader potential of programming for other purposes (Fuegi & Francis, 2003; Hammerman & Russell, 2015). Lovelace is often referred to just as "Ada" as seen in the examples of the Ada programming language[38] and the "Ada Project" that provides online resources about women in computing[39].

In highlighting "Ada", I remain mindful of Foucault's (1978) perspective on discourse and knowledge, stating that history is an ever-receding point and locating original moments of discourse will never be achieved. Even if we consider Ada, at the beginning of this history, I observe that the history of computing has marked women as

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[38] The programming language was named "Ada" to recognized Lovelace's historic role in programming in what has been recognized as the first example of the process of computer programming. See the Ada Community Clearinghouse http://www.adaic.org/
[39] The Ada Project provides resources on women in computing (https://www.women.cs.cmu.edu/ada/Resources/Women/)

absent, meaning that they are not discursively visible in many contexts. With discourses of computing that are dominated by symbols and narratives of innovation, women's achievements were always present, but have been discursively devalued, reminding us how elusive a full accounting of the history of women in computing can be.

On Machines and Masculinity

The allure of machines would continue to increase in the twentieth century, when technological sophistication became a trope designed to authenticate male authority in American society and to corroborate the inherent superiority of the Western world (Oldenziel, 1999, p. 31).

Ruth Oldenziel made this observation in her analysis of gender and machines in America during the industrialization during the period 1870 – 1945. In 1946, Just after the endpoint of this industrial period, a new type of machine was announced to the public –the first electronic computer, known as the ENIAC. A joint venture driven by the military and academia, the ENIAC "shop floor" at the University of Pennsylvania was clean and streamlined, and the labor required to operate the computing machines was cognitive in nature. This stood in contrast to existing bastions of male identity - the grime and soot of the steel mill, the machine tools of the factory, and the heavy equipment of the civil engineering site (Oldenziel, 1999, p. 999). Nevertheless, a gendered ideology of work was re-inscribed at the dawn of the new information age, with men being associated with the design of computers and women served as assistants to men by "operating" the computers.

Paul Edwards (2003) provided an insightful analysis of this gendered history through the lens of the "soft/hard" dichotomy. Edwards explained that gendered identities are rooted in an epistemological standard of thought in Western society that is

rationalistic and positivistic. He noted that "[t]his standard – rationality as a dispassionate, context-independent, logic-oriented discourse fundamentally separated from its object – has historically provided a kind of master trope for the construction of gender, politics, and science" (p 238). He also offered a deep analysis of the cultural implications of the entanglement of military culture with science and engineering cultures before, during, and after the development of the first computers (1990, 2003). Edwards triangulated an argument that military and computer "microworlds" have much in common, especially their male orientation. He reflected on the epistemological and cultural forces that form the origins of an ideology of gender that aligns softness with femininity (e.g., easy, smooth; agreeable, responsive, not strong, submissive) and hardness with masculinity (e.g., requiring effort, harsh, persistence, severe, dispassionate, sternly realistic) (2003). In the area of computing, the analogy is materialized in the form of computer *soft*ware and computer *hard*ware, where these objects are seen, respectively, as soft and hard, as are the intellectual processes of creating them.

Communication scholars have observed patterns from the past, such as male exclusivity in other communication technology cultures, that show similar patterns to contemporary computer programming cultures. Douglas (1999) observed that cultural factors set forth new trajectories of innovation in radio technology in which tinkering men of early radio culture created the equivalent of a secret society that did not include women (p. 99). Dunbar Hester (2008) argued that the long history of radio tinkering can be understood as a "site of masculine identity construction" where men of a "Geek Group" met weekly to solve problems on the technology side of FM radio advocacy. In contemporary computing, we see "hacking" groups and open source software

communities emerge that are male-dominated and feed a particular narrative and imagery of the computer programmer.

Nathan Ensmenger offers a historical perspective that informs our understanding the social and gendered history of computing programming and how programming became masculinized. Ensmenger (2010a; 2015) argued, it was not until later in the 1950s and 1960s that the "computer boys" took over and the association of masculine discourse and male personality traits became deeply associated with both programming and technical expertise in computing. Ensmenger engaged history as a mechanism to inform the dynamics of contemporary issues. He revealed the history of women in computing, while also examining the dynamics of gender and the role of masculinity in computing identities. He also brings an STS perspective by viewing computer programming as a socio-technical system that "blurs the boundaries between the technological and organizational, and typically creates a process fraught with conflict, negotiation, disputes of professional authority, and the conflation of social, political, and technological agendas" Ensmenger, 2010b, p. 8).

Janet Abbate (2012) used the historical method to explore professional identities and gender roles in computing from the beginning of digital computing era through to the present. She asserted that "computing is a particularly good arena for examining the intersections of gender and technology" since "masculinity and femininity were part of a cultural vocabulary that was used to define what a computer was and who was best qualified to use one" (p. 4). Abbate's goal was to unseat assumptions that the practice of computing is gender-neutral by showing how history reveals a legacy of unequal power

relations, despite women's significant presence and contribution to the field.   As part of her research, Abbate produced an extensive corpus of oral histories of notable women in computing[40].

The representation women in computer programming did increase and peak in the 1980s. It then declined in the early 1990s. Since then a revised image of the computing practitioner discursively emerged - the male nerd/geek, which emerged in the public conscious though masculinized imagery of male "hackers" and "brogrammers[4142]" (Hicks, 2013; MacMillan. Douglas, 2012; J. M. Reagle, 2006; Tufekci, 2014; J. C. Williams, 2014). I will review all of these stages, starting with the prehistory of computer programming.

Human computers

The history of computer programming is foreshadowed by the history of the women who were the original computing laborers before the first electronic computers even existed.   These women were the "human computers" who began in the 19th century doing calculations for astronomical science that supported classification of stars via light spectrum analysis (Ceruzzi, 1991, p. 240; Grier, 2005).   This practice continued through World War I producing mathematical tables for calculating ballistics trajectories. David Grier's work *When Computers Were Human* (2005) is an essential foundation for understanding this early history of women in computing and the continued cultural and

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[40] The Abbate oral histories can be found at http://ethw.org/Oral-History:Women_in_Computing
[41] https://www.bloomberg.com/news/articles/2012-03-01/the-rise-of-the-brogrammer
[42] https://medium.com/message/no-nate-brogrammers-may-not-be-macho-but-thats-not-all-there-is-to-it-2f1fe84c5c9b

identity issues that reverberated for decades and influenced programming cultures in industry and academia.

Later, in the 1940s, "human computers" were employed by the military to work on complex calculations to solve problems, such as the creation of ballistics firing tables used to predict the trajectory of a bullet under different conditions. The human computers worked in a common computer room with an active manager, using standard methods for computing and result checking, maintaining regular hours, and receiving guidance from an oversight board. These basic work patterns endured and were replicated throughout the United States and internationally in computing offices supporting land surveying, weather analysis, agricultural production analysis, and ballistics analysis. (Grier, 2005, pp. 49–54).

We see a similar hidden history at NASA where African American women were recruited as human computers and subsequently contributed significantly to the success for the space program (Shetterly, 2016).   These predecessors of computer programmers were women who performed invisible labor that became lost in history until contemporary scholars and historians reclaimed them.

First Female "Coders" of the 1940s

The casting of human computers as laborers was re-inscribed in the next generation of computing work on the ENIAC, which was the first fully electronic computer in the United States. A group of six women, selected from the top ranks of the human computers, were instrumental to paving the way forward to having the ENIAC perform wartime mathematical calculations. These six women were initially cast as non-

professionals at a time when the word "computer programmer" did yet exist[43] (Ensmenger, 2010a, 2010b, Light, 1999, 2003).   Running a program on the ENIAC required manual configuration of wires, switches and plugs, meaning that the machine had to be set up to run a particular problem each time. The initial team of women had to master this work with only machine diagrams, experimentation, and an ambiguous path of training; work that required a significant amount of creativity and ingenuity. Nevertheless, in a manner similar to the depiction of the female workers who were already employed by the military, early computer designers portrayed these female coders as laborers who followed a routine process that involved transcribing instructions for the computer. In contrast to the contributions of the women, these instructions were depicted as the fruits of the intellectual work of male leaders (Ceruzzi, 1991; Grier, 2005; Light, 1999).

Jennifer Light (1999, 2003) addressed the invisibility of these women in a division of labor that devalued female operators while heralding males as the inventors and engineers of a revolutionary computing machine. Light uncovered specific accounts of the ENIAC women's experience that problematized assumed gender boundaries, notably how the women mastered the design of the hardware circuitry of the ENIAC while setting up problems to run on the computer (1999, p. 470). She argued that sex-typing produced a gap between what was prescribed for women vs. what they actually did. Ensmenger (2003) also observed how a gendered notion of the division of labor even made its way into the first textbook on computing published in the U.S. that

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[43] The term "programmer" emerged in the 1950s.

"outlined a clear division of labor in computing that clearly distinguished between the 'head-work' of the (male) scientist… and the 'hand-work' of the (largely female) coder" (p. 123).

Haigh et al. (2016) validated the complexity of the work of the ENIAC women noting that "…coming up with a suitable plug board configuration for a particular task was far from trivial, requiring an appreciation of the various sensors and counters built into the machine being configured and a creative sense of how its capabilities could be used in conjunction with those other machines to automate steps in a particular process" (p. 75). In addition to the coders of the ENIAC, he (2010c) also highlighted the "wiremen" and assemblers of ENIAC who were also mostly women (pp. 61–62) . Haigh identified the wiremen as blue-collar workers who were essential to building the ENIAC but who are not celebrated in history.

Haigh et. al also problematized the relative differences in status among the women who worked on the ENIAC (T. Haigh, Priestley, & Rope, 2016). Their analysis focused on the disputed claims about who was actually responsible for the training of the female operators of the ENIAC. They interpreted archive materials that suggest that there were "tensions" between the female operators and the trainers, several of whom were the wives of the ENIAC leaders. Haigh (2010c) suggests that the women who were senior and the trainers "wielded additional influence through their marital alliances" (p. 78). However, according to Light (2003), it is unclear whether these women became 'visible' because their husbands' visibility accorded them extra attention, because these

men somehow facilitated their wives' careers, or became the women themselves campaigned for recognition" (p. 304).

Amid flawed assumptions that framed "coding" as a form of routine labor, the ENIAC women navigated problems that were not resolved, in practice, by the diagrams of the machine. Operating the ENIAC required a range of skills that included, mathematical knowledge, machine knowledge, complex problem-solving skills, and creativity. Unanticipated challenges exposed the ambiguities in the roles of the engineers and the women who were the first coders. While having low status at the time, these women were later recognized as predecessors of what later became known as computer programming.

Grace Hopper – a luminary begins her work

Contemporaneous with the ENIAC, work on a computer known as the Harvard Mark 1 presented a different view of the first female computer programmer. Grace Hopper was one of the two original programmers on the Mark 1 and emerged to play a leading role in its progress in the 1940s (Abbate, 2012; Beyer, 2009; Ensmenger, 2010a, 2010b; Micheal Sean Mahoney & Haigh, 2011; Misa, 2010a; Sandy Payette, 2014; K. B. Williams, 2004). Grace Hopper is one of the most well-known pioneers of early programming and remained influential throughout her lifelong career in the military and the commercial computing industry. As Mahoney (2011) observed,

> "...men soon took over, and leading women became the exception in an increasingly masculine field. Hopper remained highly visible until her death in 1992. Indeed 'Amazing Grace' achieved something akin to canonization in her own lifetime" (p. 169).

Hopper was among the first cohort of women to receive a PhD in mathematics from Yale University in 1934 and went on to become a professor of mathematics at Vassar College (Beyer, 2009; Sandy Payette, 2014; K. B. Williams, 2004, p. 99). As a mathematician with a career in academia, Hopper's entry into computer programming actually began with her decision to serve her country during WWII. In 1943 at the age of 37, she made the bold decision to leave the ranks of academia to join the military. Characteristic of her fierce determination, Hopper overcame the age limit by successfully petitioning to be admitted to the US Naval Reserves where she graduated first in her class of women at the Navy Midshipman's School. As a Naval officer, Hopper was assigned to the Mark 1 programming team, which was actually a military "crew"[44] operating at Harvard's Cruft Laboratory. Officers Grace Hopper and Richard Bloch served as the first two programmers under Howard Aiken, the original designer of the Mark 1 computer and commander of the project[45]. This was the beginning of Hopper's long and influential career in computing.

Figure 6 Grace Hopper of the Mark 1 Crew

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[44] The Mark 1 "Crew", http://sites.harvard.edu/~chsi/markone/crew.html
[45] While designed by Aiken, the Mark 1 computer was built by IBM and shipped to Harvard.

At a time when the computer as a *machine* was still front and center, Hopper was presented with the formidable challenge of making the machine solve mathematical problems with no precedent for what it meant to program a computer. Hopper emerged as a key force in the Mark 1 team, gaining Aiken's trust and asserting significant leadership behind the scenes in the project. As Beyer (2009) appropriately noted,

> *"Howard Aiken and the engineers at IBM had turned a Harvard graduate student's ideas for an automated computing machine into a physical reality. It was now up to Grace Hopper and Richard Bloch to communicate with the hulking machine and make it do their bidding"* (p. 43).

After gaining the respect of colleagues and recognition for her work on Mark 1, Hopper joined the Eckert-Mauchly Computer Corporation to be part of the intense startup environment to develop the first commercially viable electronic computer - the UNIVAC[46]. This spawned a period of innovation in programming for Hopper. It was on UNIVAC that Hopper invented many of the foundational building blocks of human-oriented computer languages. She had the early insight that computer programming languages should be human-oriented. In Hopper's own published work from the 1950s we see her developing the first human-readable "pseudo-code," the concept of subroutines, and a compiler for the computer (Hopper, 1953, 1955, 1958, 1988).

Hopper was also the major force behind the development of the COBOL[47] programming language, and she is often referred to as the "mother of COBOL (MacNeil, 2017). COBOL was heavily influenced by Hopper's FLOW-MATIC language that she designed as a programming language with English-like syntax. COBOL was developed

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[46] UNIVAC became a division of Remington Rand corporation in the early 1950s.
[47] The COBOL acronym is the "common business-oriented language"

by a committee and Hopper was the senior technical advisor to a team that also included

four other women who had previously worked with Hopper - Jean Sammet, Betty

Holberton, Nora Taylor and Mary Hawes (Beyer, 2009, p. 296). This notable number of

women working to develop COBOL as a standard language is significant given that

COBOL became the dominant language during a period of masculinization of the identity

of the computer programmer in the 1960s. As a legacy "3rd generation language,"

COBOL is still in widespread use today in business and finance systems that run on

mainframe computers.

By the 1960s, Hopper was especially prominent in industry as evidenced by her

being named the first Computer Science "Man of the Year" in 1969 by the Data

Processing Management Association[48], a key professional society. Despite this, it is also

notable that in 1968, neither Hopper nor any other technical woman was in attendance at

the first NATO conference on software engineering. This was a watershed gathering of

academics and practitioners addressing an impending "software crisis" (Glass, 1998;

Thomas Haigh, 2010a, 2010b) due to a recognized shortage of programming expertise.

Grace Hopper was still active in the 1970's, 80s, and into the early 90s. As Rear

Admiral, Grace Hopper retired from the military in 1986 as the oldest active officer in the

Navy. She continued to work as a consultant and speaker for Digital Equipment

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[48] The award was renamed the Distinguished Information Sciences Award in 1980 by the
DPMA's successor organization the Association of Information Technology Professionals
(AITP). See AITP newsletter at: http://www.aitp.org/resource/resmgr/old_nanosecond/ns-
winter2001.pdf

Corporation until the year of her death in 1992 at the age of 86 (Beyer, 2009, p. 324).

But this final phase of Hopper's contribution happens to be the very timeframe when the

percentage of women in computer science and software was beginning to decline, a

subject I address later in this chapter. In later years, Hopper began to write about

possible futures of computing, and foresaw possible futures where computers would have

an impact on large-scale problems such as population growth and the environment. In

many of her later writings she discussed the advent of mini-computers and networks of

computers to help solve large-scale problems (Hopper, 1976). Presciently, Hopper

(1976) said:

> *"...there is a challenge, a challenge to bring down the myth of the monolithic, all-powerful computer and replace it with a more-powerful but more manageable system of multiple computers. A world concerned with population, food supplies, ecology, will need a multiplicity of facts and relationships to meet the requirements for better management in the future (p. 8).*

Hopper realized early in her career that the future of computing would be

dependent on the development of human-oriented computer languages that could

democratize the means of controlling the computing machine. In her seminal article

"The Education of a Computer," Hopper (1952) revealed her vision of how advances in

computer programming could not only enable the mathematician to return to the work of

doing math (p. 244), but could also bring about a future where programming could be put

in the hands of the many. Hopper understood that the computer's potential extended

beyond its original scientific application that was driven by military wartime needs.

Prescient during the foundational years of computer science, Hopper maintained her

visionary posture in a set of essays written later in her career that discussed the future and

technology (Hopper, 1976a, 1976b).

Programmers, Professionalization and Masculinity (1950s - 1970s)

Despite the core role of women in early computing and the prominence of women such as Grace Hopper, the identity of the programmer was increasingly associated with masculinity. Nathan Ensmenger (2010b) examined the question of how this identity developed.

> *"... as computer programmers constructed a professional identity for themselves during the crucial decades of the 1950s and 1960s, they also constructed a gender identity." Masculinity was just one of the many resources that [men] drew on to distance their profession from its low-status origins in clerical data processing" (pp. 239–240).*

Ensmenger (2010a) argued that professionalization and the "politics of technical expertise" were a crucial aspect of the masculinization of programming and that these efforts played to women's disadvantage. He noted that the 1960s was a period when approximately twice as many men as women received a college degree. Contemporaneously computing professional societies initiated more stringent requirements for membership. For example, the Association of Computing Machinery (ACM) instituted the requirement of a 4-year degree for full membership (Ensmenger, 2010a). Ensmenger (2010a, 2015) also observed that professionalization in the corporate sector emphasized management experience, which disadvantaged women at a time when most women were not being promoted into managerial roles. Bias and cultural stereotypes framed leadership and management as an essentially masculine way of being. In addition to professionalization, there were rivalries between corporate and academic computer science as seen in discourses that revealed gendered tensions between the theory and practice of computer programming (Sandy Payette, 2014).

Companies that were hiring in the computing industry during the 1960s began to use programming aptitude tests as a supposedly objective way to identify talent. While, in theory, these tests should have been an equalizing force, where women who scored highly would be hired, in practice, the tests were biased in favor of men by selecting for knowledge that would only be achieved through certain areas of academic study and for personality traits that were typical of a certain type of male. (Abbate, 2012; Ensmenger, 2010a, 2010b). Abbate observed that while aptitude tests were designed with the intention of identifying individuals who would be good programmers, companies viewed college degrees as a proxy for intelligence. Given the unequal structure of opportunity, women came up proportionally underrepresented in attainment of bachelor's degrees in fields related to computing (Abbate, 2012, p. 11). Overall, addressing the means that companies pursued to find good programmers, Abbate (2012) argued, "[n]one of these strategies measured programming competence directly, and all were heavily laden with gendered assumptions" (p. 41). Ensmenger (2010a) argued that strategies and politics of professional development would make programming "one of the most stereotypical male professions, inhospitable to women" (p. 2).

Haigh (2010c) argued that an important part of maintaining masculine identity was *autonomy,* which is expressed through exerting power over those below, and acting in the name of those above. Haigh attributed this to male status anxiety (2010c, p. 55) that was rooted in a sense of vulnerability about losing advantages already attained. Male status anxiety influenced the sex-typing of jobs when men attempted to keep women out of management positions to maintain the masculine identity of higher-level jobs. (pp. 57–58). Misa (2010b) observed how gender specific employment patterns were clearly

evident when women "operators" had access to only the lowest level jobs. He noted, "[t]heir standard weekly salaries were lower and they were effectively closed off from the higher reaches of this occupation, where there would soon be significant (male) advancement into the ranks of computer programmers" (p. 194) .

In summary, as programming developed over the decades of the 1960s and 1970s, hierarchies developed in the profession with women disproportionally represented in lower status and lower paying jobs. "A hierarchy developed within the software professions, as the more broadly educated "systems analysts" attempted to distinguish themselves from the narrowly technical "coders" and keypunch operators. The programmers sat somewhere in between these two extremes" (Ensmenger & Aspray, 2003, p. 11). The job of computer programming, itself, split into multiple job categories at different levels of status and expertise. At the high end were systems analysts and lead programmers, while at the lowest end were the coders and operators who were disproportionally women. However, despite this period of masculinization, in the 1980s the presence of women in programming began to emerge again, both in academic computer science degree programs and in computing jobs in the workplace. But this was short lived.

A Peak and a Precipitous Decline (women in 1980s to the present)

The National Science Foundation (NSF) published data on academic degrees earned in science and engineering for a 40 year time period spanning from 1966 to 2006 (National Science Foundation (NSF), 2008). As Figure 7 shows, the percentage of bachelor's degrees in computer science awarded to women was growing from the start of

this period until when it peaked in 1986. After 1986, the percentage declined and has not

recovered today.

CS Bachelor's Degrees Granted
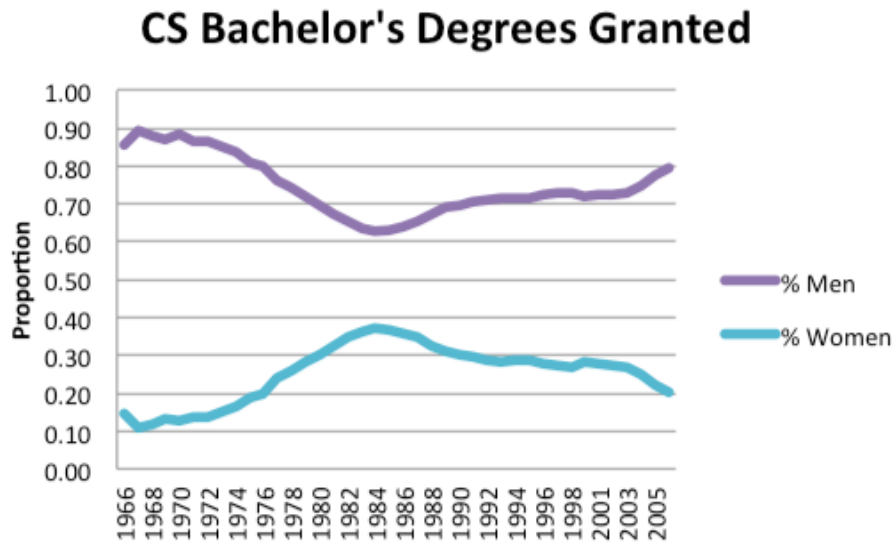
Figure 7: NSF Data on Computer Science Degrees 1966-2006

If we examine the NSF data more closely, we can see that while the absolute

number of women attaining computer science bachelor's degrees continued to increase

after 1986, the proportion of women dropped from 37% in 1984 to 25% in 2004. The

more recent Taulbee survey (i.e, 2011-2012), another source of information on

enrollment and completion of degrees programs in computer science and computer

engineering, reports good news that, overall, PhD production in computer science was the

highest ever, and undergraduate enrollment grew for the 5th straight year.   However,

while the data in recent years show a modest increase in the proportion of degrees

granted to women at the masters and doctoral levels in computer science, the early

pipeline is drying up as the percentage of women granted bachelor's degrees in computer

science has steadily declined for over twenty years. Paralleling the academic end of the

pipeline, data show that the participation of women in the computing workforce also peaked in the 1980s, thereafter declining even during times when the computing technical job market was growing.

Why is the proportion of women sinking under variable conditions in the technology sector, especially whether there is an economic boom or bust? One theory about the decline is that issues of social identity influence whether women embrace computing. Multiple studies have shown that stereotypes of computer science majors and computer programmers as white male "geeks and hackers" tend to alienate many girls and women early in the educational process, which later affects employment opportunity downstream in the pipeline (Abbate, 2010b, p. 215; Hayes, 2010b; Margolis & Fisher, 2002).

One of the most significant and highly cited studies on gender in computer science is Margolis and Fischer's study of pre-college and college experiences of female students at Carnegie Mellon University (CMU) (Fisher & Margolis, 2002; Margolis & Fisher, 2002). Margolis and Fischer observed cultural dynamics that begin early in childhood, such as parents more frequently buying their boys a home computer, and teachers not interfering when boys take control over school computers. For these boys,

> *"… love of computing comes early, and becomes part of their identity and the stories they tell about themselves. They describe a magnetic attraction between themselves and the computer, with the computer becoming an object of fascination and allure" (Margolis, Fisher, and Miller, 2000, p. 7).*

This contributed to boys establishing a positive masculine self-image in computing, which often came at the expense of girls not being welcomed.

Many scholars have argued that when girls are discouraged from gaining foundational experiences in computing and are not enrolling in advanced computer science classes, there are implications later for whether and how they proceed in computing at the college level (L. J. Barker, Snow, Garvin-Doxas, & Weston, 2006; Cohoon & Aspray, 2006; Goode, Estrella, & Margolis, 2006; Hill, Corbett, & St. Rose, 2010). In addition to their background research on younger girls, Margolis and Fisher proceeded to study a cohort of female computer science students at CMU and observed significant differences in how women and men experienced their entry into the major. After studying the experiences of the CMU women, the Margolis and Fischer (2000, pp. 129–147) worked with the computer science department to intervene by focusing on curriculum and admissions policy. The CMU intervention yielded significant results. The proportion of women entering the undergraduate program went from 7 percent in 1995 to 42 percent in 2000 after changes were instituted. These percentages were significantly above the national average and roughly double the rate for comparable university programs. Similar policies and climate interventions have been adopted by other institutions, with the notable example of Harvey Mudd University that was able to triple its representation of women to 40%, the highest in all U.S. co-ed institutions (Bix, 2013, p. kindle loc 6335).

Moving from the academic to the career phase, we can see the persistence of these cultural dynamics. Research on adults in the computing workplace reveals the strength and durability of masculine and feminine identities in computing into adulthood (Abbate, 2012; Paul N Edwards, 1990; Ensmenger, 2010b; Faulkner, 2000). Hayes (2010a) suggested, "stereotypes of computer scientists may have begun to turn women away in

disproportionate numbers as those stereotypes began to take hold in the public consciousness, starting in the mid-1980s and continuing through the current day" (p. 26). Ensmenger (2010b) observed, "The association of masculine personality characteristics with inherent programming ability helped create an occupational culture in which female programmers were seen as exceptional or marginal. Only by behaving less 'female' could they be perceived as being acceptable" (p. 129).

Media accounts also produce and reinforce images of gender and computers that can exert a powerful influence on how we understand the reality of the tech sector. Media traces of the discourses of gender and computing, now and throughout history, can provide hints that suggest what is and is not valued at different points in time. Media can contribute to gender bias by making women invisible, making negative stereotypes of women discursively visible, and making positive views of men highly visible. An early historical example is seen in Figure 8. This photo was cropped for re-use in a U.S. Army advertisement[49] that was run in *Popular Science* in 1946, essentially focusing on the man in the foreground and removing the women from the frame, the result being a media account that replayed the metaphor of man and machine.

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[49] US Army Advertisement appearing in 1946 issue of Popular Science magazine. Available at: http://blog.modernmechanix.com/mags/PopularScience/10-1946/how_high_is_army.jpg
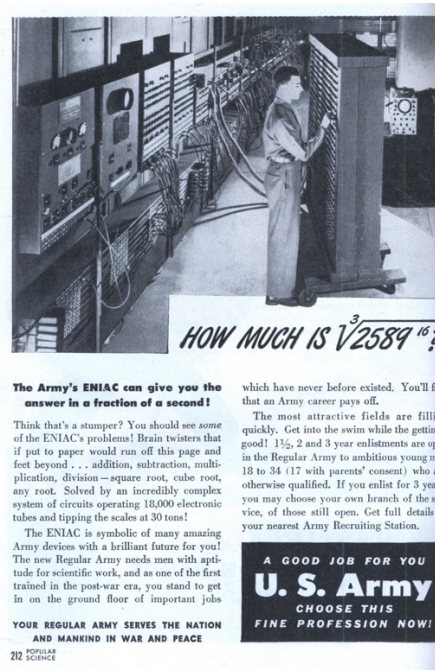
Figure 8 : ENIAC advertisement – where are the women?

There is also a tendency to suppress discourse and imagery of males who fit the
female stereotypes around use of computers (Corneliussen, 2010, p. 169). These
dynamics promote discourses about *who fits* with computing and the tech world, which
often aligns with common stereotypes of people in computer science (Cheryan, Plaut,
Handron, & Hudson, 2013). Even the portrayal of women in computer advertisements of
the 1960s and 1970s invoked sexist imagery, which has continued today as seen in the
example of the sexist ads of the tech company GoDaddy. Gender stereotypes of both
men and women in computing are replayed on television series such as *Silicon Valley,*[50]
the *Big Bang Theory*[51], and *Revenge of the Nerds.*[52] While Silicon Valley is rather
humorous, it does not help in promoting a positive media portrayal of Silicon Valley for

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[50] Silicon Valley on HBO, https://www.hbo.com/silicon-valley
[51] The Big Bang Theory, https://www.imdb.com/title/tt0898266/
[52] Revenge of the Nerds, https://www.imdb.com/title/tt0088000/

women in computing. As will be discussed in the next chapter, ABI, NCWIT, and others

WIT ecosystem are counterforces to such portrayals of tech and through interventions

that promote positive images of women in computing.

Conclusion

From the historical perspective, it took over fifty years from the birth of the first

commercial computers for scholars to begin to reclaim the history of the women of the

ENIAC and other female pioneers, including the formidable Grace Hopper. Only

recently has the topic of women in computing become a subject taken up by popular

historians (Isaacson, 2014; Shetterly, 2016). As Mahoney argued, we might better think

in terms of the plural "*histories*" of computing which enables the historian to focus on

different "communities of computing" or communities of practice (Mahoney, 2011, pp.

59-69).   Scholars such as Ensmenger, Abbate, Beyer, Ensmenger, Grier, Haigh, Light,

Mahoney, Misa, and others have identified and illuminated the roles and contributions of

women in computing, as well as the paradoxes, opportunities, and barriers women

encountered throughout the history of programming and software. A notable replaying

of the theme of masculinity and machines actually emerged in more recent computing

cultures, for example the design of hardware that led to the development of the

microcomputer and the technological innovations of the free and open source software

movements that had a significant impact on the emergence of Web infrastructure.

Meanwhile, the media has perpetuated gender stereotypes in computing, which continues

today with popular images of the "geek," the "computer nerd," and the "hacker."

The issue of voice is one reason that oral histories of computing are valuable resources. As previously mentioned, Yost and Abbate have made initial contributions to fill this gap using oral histories of women who worked in computing starting in the 1960s and 1970s and subsequently started their own companies. As continues to be true today, Yost's observation that the history of female entrepreneurs in computing is "unchartered territory" holds true, and he attributed this to the trajectories of both business history and feminist scholarship that did not take up this topic (Yost, p. 230). Given the large number of women who navigated different roles throughout decades of software, few scholarly works have probed the lived experiences of those women, and there are ample opportunities to fill these gaps in the history of women in software.

While there is an emerging body of literature that documents women's underrepresentation in computing, there has been less that has considered the nature of the women who reside behind the statistical trend lines. Who are the women that entered computing? Who are the women that do not enter? What is different about them? What were their attitudes and experiences? Are there men who experience similar things? Are there other entry routes to computer programming besides a computer science degree? What stereotypes are in play and how are they reinforced or resisted?   In closing, I cite Mahoney (2008) who suggested that scholars of the history of computing ask questions that engage gender and examine the experiences of diverse participants in the processes and theories of developing software.

> *"Hence, the history of computing, especially of software, should strive to preserve human agency by structuring its narratives around people facing choices and making decisions instead of around impersonal forces pushing people in a predetermined direction. Both the choices and the decisions are constrained by*

the limits and possibilities of the state of the art at the time, and the state of the art embodies its history to that point." (Michael S Mahoney, 2008, p. 10)

CHAPTER 5
Forums of Discourse: GHC and NCWIT Summit

ABI and NCWIT offer an array of programs to support their missions of

advancing the state of women in computing and technology. While all of their programs

are important, each organization has a flagship that I categorize as a *forum of discourse*.

For ABI, the forum is the *Grace Hopper Celebration on Women in Computing (GHC)*, a

conference and event that has become the "largest gathering of women in computing" in

the world (Anita Borg Institute, 2016a; Anita Borg Institute & ACM, 2015)[53]. For

NCWIT, the forum is the *NCWIT Summit*, "the world's largest, annual convening of

change leaders focused on addressing underrepresentation in computing through

research-based approaches." (Summit Announcement, email, June 21, 2017)[54].

This chapter sets the stage for the next three chapters that are empirical cases from

my research. These cases focus on the relationship of discourse to practice and social

change to improve workplace conditions for women in computing in the tech sector.

Chapter 6 examines a moment of discourse that surfaced hidden gender bias of a well-

known male CEO speaking at GHC, and the widespread media attention that followed.

Chapter 7 looks more deeply at complexities of engaging male allies, who are those men

participating in the work of cultural and organizational change to support women in the

workplace. Chapter 8 examines shifting the focus from data-centric interventions to

issues of culture. All three chapters focus on public moments of discourse that are

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[53] Grace Hopper Celebration website: https://ghc.anitab.org/
[54] NCWIT Summit webpage: https://www.ncwit.org/summit/2018-ncwit-summit-women-and-it

instructive for understanding the significance the relationship of discourse to practice and the process of social change.

I consider GHC and the Summit to be *forums of discourse* that each serve as a lens into the broader domain of women and computing. In framing them this way, I invoke Edwards's " (1996) expansive definition of discourse.

> *"In the larger sense…, discourse goes beyond speech acts to refer to the entire field of signifying or meaningful practices: those social interactions – material, institutional, and linguistic – through which reality is interpreted and constructed for us and with which human knowledge is produced and reproduced"* (p. 34).

Both GHC and the NCWIT Summit are sites where assumptions of the past and present about gender and computing are examined, interpreted, and re-constructed. As forums, GHC and the Summit engage the social and technical dimensions of women and computing – social relationships, languages and texts, institutional practices, identities, and material artifacts. They provide contexts for community dialog, deliberation and the construction of alternative discourses. Borrowing from Foucault, these forums can shine the light on knowledge that is suppressed, such as the forgotten history of women in computing. In addition, they can surface contemporary voices and images of computing that represent both hegemony and struggle in tech. These forums bring visibility to the "continuous micropolitical struggles"[55] (P. N. Edwards, 1996) of women in computing whose identities and concerns are eclipsed by dominant white male cultures of tech and Silicon Valley.

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[55] I used this term from Edwards who was influenced by Foucault's notion of competition among discourses motivated by power relations (1996, pp. 37–38).

The next two sections provide highlights from my participant observation of GHC and the NCWIT Summit to set context for the analyses of later chapters.

Grace Hopper Celebration of Women in Computing

The Grace Hopper Celebration (GHC) of women in computing was established in 1994 when Anita Borg and Telle Whitney convened their first meeting of women in technology and computing. Reflecting on the founding story, Whitney said,

> *"Anita founded Systers in 1988, which was an online community where women who worked in technology or computing could actually come together and share stores and get support. Then in 1994, we held the first Grace Hopper Celebration of Women and Computing conference. After founding Systers, [Anita] had been very involved with some of the work in Washington about creating venues for women in technology…. We [Anita and I] had this idea that we could celebrate the achievements of women and that's how the Grace Hopper Celebration was founded…. [A]t the first Grace Hopper celebration had about 500 women and it was very exciting and it was very inspiring."*

Since its founding, GHC has grown to the point of sold-out audiences of increasing size. As a forum of discourse and an event, it is known for many things. It is the event that honors Rear Admiral Grace Hopper, arguably the most well-recognized female pioneer in the history of computing. At the same time, GHC is a technology conference that is produced in collaboration with the Association of Computing Machinery (ACM), the main academic and scholarly society for computer science[56]. As a founding partner of GHC (Patterson & CACM staff, 2006), ACM is engaged in promoting women in computing, especially through the its Council on Women in Computing (ACM-W).

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[56] ACM, https://www.acm.org/

The atmosphere of GHC

GHC is also a women-in-computing festival, valued by many for its feminist unity stance for women in tech. In its early years, GHC grew from the initial meeting of 500 women to a small conference held in a reasonably-sized conference hotel. It convened women who were excited to have an event that was focused exclusively on women in computing and that provided a sense of community. The conference grew significantly in size, reaching 7830 attendees at 2014 conference, then jumping to approximately 12,000 attendees at GHC 2015, followed by 15,000 at GHC 2016, and peaking at 18,000 at GHC 2017 (see Appendix I). From its modest beginnings, GHC evolved into a highly-produced event; its attendees had become participants in a giant, high-energy international tech festival, reminding everyone that, indeed, GHC was not just a "celebration," not just a conference, but a significant event that was even gaining mainstream media attention. Reflecting on the atmosphere of GHC and how it became the "actual and symbolic flagship" for women in computing, Fran Berman, Chair of the ABI Board (and internationally prominent computer scientist) shared this thought with me: "[t]he environment, as you know, at Grace Hopper is like women in tech Nirvana." (private communication, 2016). To give an appreciation of Berman's Nirvana perspective, Figure 9 provides a visual of the international critical mass of women in computing that is typical of GHC today.
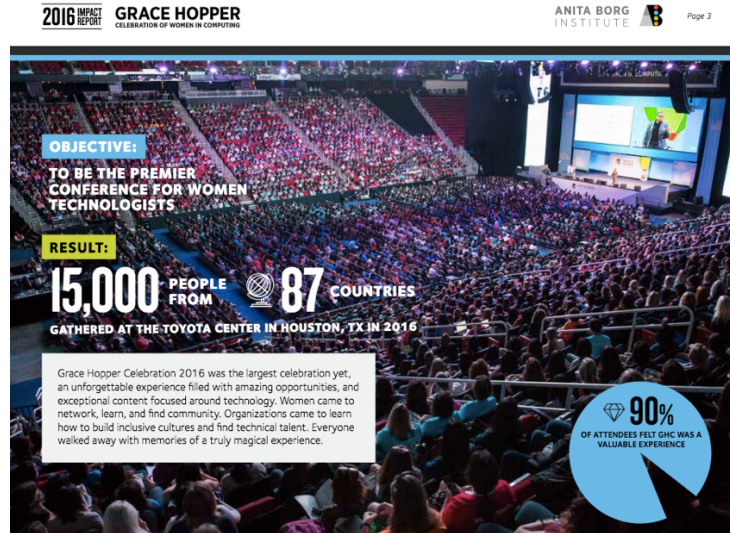
Figure 9. GHC 2015 International audience in main convention hall[57]

Having attended GHC both before and after its period of transformative growth, I witnessed how the atmosphere of the venue and program had changed. In 2009, when I was a panelist on one of the first GHC sessions on women in open source[58], GHC was a notably smaller technology conference in a reasonably sized conference hotel. The 2009 audience was excited to have an event that was focused exclusively on women in computing with a strong sense of community.   As an observer of GHC 2014 and a participant-observer[59] in 2015, it was clear that GHC had become a huge event with a notable international reach and high-profile speakers.   As CEO Telle Whitney remarked about the increase in the size of GHC, "… in the last few years we've experienced significant growth… phenomenal growth." Indeed, since 2014, GHC has been held in cavernous conference centers with the main hall powered up with huge screens and high-

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[57] Source of photo: *(Anita Borg Institute, 2016a)*
[58] GHC 2009, http://ghcbloggers.blogspot.com/2009/10/technical-track-open-source-community.html.
[59] I presented a paper on SEAD, research data infrastructure project funded by NSF.

energy rock and hip-hop music. At GHC14, I observed a vibe that event planners generated even before the opening plenary sessions began. Motivational messages were projecting on the big screen, amid an audio background of stadium-style stamping and clapping that ended with an intense rock electric guitar riff. Among the messages I saw projected on the big screen were themes of collective agency such as "*this is how change is made*," and "*we are making history*."   In terms of casting an overall vision, the screen informed, "*we are creating a future where people imagine and build technology that mirrors the people and societies they build it for*."

The technical program of GHC

While the GHC conference is open to all, it has attracted mostly women and its plenary speakers have been historically female technology leaders and influential academics. Over time, the program has evolved to include plenary sessions featuring high-profile speakers from industry, government, and academia. Recent examples include: Melinda Gates (GHC17); Ginny Rometty, CEO IBM (GHC16); Sheryl Sandberg, COO Facebook (GHC15), Satya Nadella, CEO Microsoft (GHC2014), Shafi Goldwasser, ACM Turing Award Winner[60] and MIT Professor (GHC14), and GHC favorite Megan Smith, U.S. Chief Technology Officer (GHC16, GHC15, GHC13, GHC09[61]). As a technical conference, the GHC event evolved to host hundreds of juried papers in parallel session tracks, covering topics that include data science, cloud computing, HCI, security, software engineering, open source, mobile technology and the

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[60] https://amturing.acm.org/award_winners/goldwasser_8627889.cfm
[61] Megan Smith also spoke at GHC09 when she was Vice President, New Business Development, Google, and General Manager, Google.org

Internet of Things. Consistent with its theme of celebration, GHC always had social events, community meet-ups, networking opportunities. It has always been devoted to mentoring, and over time has offered more leadership workshops and student labs. A notable feature of GHC that emerged is a large "Expo" where companies can advertise, and students can submit resumes to engage with recruiters. Interestingly, I encountered many academically oriented members of the GHC community who have been critical of the Expo, claiming that GHC has become a big recruiting event for industry rather than a community-oriented technology event.

Given my experience in open source, and the notably low percentage of women in open source development communities, I was attentive to how this was addressed by GHC over time. Since 2009, when I attended the first open source panel event at GHC, the conference program evolved to include an Open Source Day. In 2015, this was promoted as an event where women can "…spend the day coding for humanitarian causes in a dynamic, collaborative environment." [62,63] The humanitarian "Code-A-Thon," did not evoke the stereotypical images of a "hackathon" associated with a predominantly with male programmer culture. Instead, GHC Open Source Day had all female coders focused on projects that support international aid groups such as Microsoft Disaster Response[64] and the Peace Corps. with open source projects that included applications for data collection in the field, tracking progress (e.g., Malaria prevention), and enabling

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[62] GHC Open Source Day, https://ghc.anitab.org/conference-overview/open-source-day-2015/
[63] http://www.openhealthnews.com/hotnews/grace-hopper-open-source-day-2015-turning-point-open-health-and-humanitarian-open-source-pro
[64] https://www.microsoft.com/en-us/research/blog/ghc-open-source-code-a-thon-to-benefit-humanitarian-relief-2/

communication among women in Haiti, Africa (e.g., Women's P2P Network)[65]. As such, the GHC hackathon contributes to a discourse of social good, and counters narratives such as hackers promoting nefarious or frivolous activity (Brunton, 2013), or the privileging of the aesthetic beauty of code over the downstream effects of code on society (Coleman & Golub, 2008; Leach, Nafus, & Krieger, 2009).

Media Coverage of GHC

In February 2015, a new Vice President and General Manager of the Grace Hopper Celebration came on board to advise the ABI Board of Trustees about navigating the significant growth that GHC had experienced. The new VP, Mona Sabet[66], came to ABI with a background in business strategy in Silicon Valley and a focus on the issue of the *growth as strategy*.   She articulated to the ABI Board a value proposition of the growth of GHC, invoking examples of other big events in tech such as South by Southwest Interactive (SXSW)[67] that attracts around 40,000 people, as well as Oracle World[68] and DreamForce[69]. In my interview with her, she said

> *"[T]he one thing that size does for you is it brings the attention of the media and the media is what drives perception in our world and perception become reality in our world. It's sad, but it's true…. and when you start looking at the mainstream media covering 15,000 women whose lives defy the male stereotype, right? That's when you start changing the perceptions of society."*

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[65] Open Source Day, see: https://ghc.anitab.org/news/grace-hopper-celebration-open-source-day-learn-contribute-collaborate/)
[66] Mona was at ABI from Feb 2015 to May 2016. Her title during that time was: Vice President & General Manager Grace Hopper Celebration at Anita Borg Institute for Women & Technology
[67] SXSW, https://www.sxsw.com/
[68] Oracle Open World, https://www.oracle.com/openworld/index.html
[69] DreamForce, https://www.salesforce.com/dreamforce/

Mainstream media attention is a powerful force of influence that can change perceptions in society. As the new VP, Sabet argued for the value of GHC growth and that media was key to changing perceptions and, thus, was an essential ingredient for ABI's strategy for enabling culture change. Sabet argued to the Board that the mainstream media is not interested in small-sized events, and for GHC to have a wider reach it must continue to move out of the realm of niche media, noting "there is definitely niche media, but they are talking to the people that have already been converted."

Considering GHC as a forum of discourse, the growth of the event had already begun to attract media attention. Important messages about the state of women in computing had already reached beyond the corporate executives who directly engage with ABI; beyond the students who attended and were inspired at GHC; and beyond the companies whose employees attended GHC. But, especially in 2014, the discourses of GHC had begun to move outside of the conference hall and extending the reach of ABI's messages about phenomenon such as culture change, unconscious bias, and male allies. As will be discussed in the following chapters, messages that originated at GHC had already reached major media outlets including mainstream news channels (e.g, CNN, BBC, Fox, PBS Newshour), US national press (e.g., New York Time, Washington Post, USA Today), and other mainstream magazines (e.g., Forbes, New Yorker, Time).

NCWIT Summit: "Evidence-based" Forum of Discourse

The NCWIT Summit is a forum of discourse that offers "*exhilarating days of change-leading conversation*[70]" that include the NCWIT leadership and members of NCWIT Alliances. Lucy Sanders, CEO of NCWIT, stated to me in a 2015 interview:

> *"… we convene, we equip, we unite a change leader network of over 650 organizations and we work to increase participation of girls and women in computing."*

The membership of NCWIT is grouped into Alliances, including the Workforce Alliance, the Academic Alliance, the K-12 Alliance and the Entrepreneurial Alliance. Alliance members and invited guests form a network, and the Summit serves as a forum for dialog, deliberation, and the development of strategies for taking discourse into action. This is all done with the goal of fulfilling NCWIT's stated not-for-profit mission to "*ensure that women are fully represented* in the influential world of *information technology and computing*" (Internal Revenue Service, 2015).

Essentially, the Summit convenes and empowers "change leaders," defined as those individuals that are positioned as leaders in organizations and can make decisions. These leaders are also referred to as "change agents," who are essentially all those who can assert influence to make institutional change a reality.   Both of these roles can be understood through what Sturm (2006) referred to as *organizational catalysts*, those individuals who are "information entrepreneurs and bridge builders at pivot points that can leverage change" (p. 250).

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[70] Text from the NCWIT Summit Announcement email, June 21, 2017

A forum for transforming discourse into action

The work of NCWIT reaches beyond the Summit through a network effect, with NCWIT positioned at the center of a network of organizations working to disseminate *actionable knowledge* on issues that affect the underrepresentation of women in computing. Thus, the key goals of the Summit are to move discourses into action and align organizations in this work to improve conditions for women in computing, which requires influencing structural change in the institutions that educate and employ those women. One NCWIT leader described the evolution of the NCWIT Summit as follows.

> *"Early on, we were like, 'we need women in technology.' That was a big part of the message. Then it was 'we need research on women in technology.' Now it's 'we need to act on the research on women in technology.'"*

The NCWIT team produces a full program for the Summit, with plenary speakers, discussion sessions, and interactive workshops on topics of interests in the workplace. One goal is the enable attendees to "learn from the experts" through exposure to scholarly research in the disciplines of social psychology, communication, sociology and organizational studies. Notable speakers have included Brian Nosek on unconscious bias, Micheal Kimmel on gender and masculinity, Joan Williams on institutional solutions for bias[71], and Karen Ashcraft on gender and occupational identity. Other themes have included systemic and structural change in organizations the role of men as "male allies" in combating bias and strategies for women navigating careers in computing and tech.

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[71] Williams plenary, https://www.ncwit.org/video/2015-ncwit-summit-%E2%80%93-plenary-iii-hacking-bias-joan-c-williams

The NCWIT team regularly reviews the state of the relevant research and scholarship and takes seriously the responsibility for recommending action that is "evidence-based."   The team is heavily invested in making sure that the Summit program is backed by research and that they are, as stated in a personal interview "not communicating any inaccurate or non-research-based messages". As the NCWIT CEO Lucy Sanders said at the opening of the 2015 Summit, "When you step out as a change leader, you do so based on the best possible evidence."   Some members of the NCWIT leadership team are passionate about the importance of research and evidence, as can be seen in this interview comment about the difference between evidence and "anecdote."

> *"... It makes us crazy that these young women, or all women, are going into professions where people are feeding them anecdotes about how to succeed in tech.   Anecdotes.... anecdotes!   Dangerous, stereo-type producing and sustaining anecdotes We hate that. Hate it."*

The term "evidence-based" is invoked frequently by NCWIT leadership when making reference to the Summit.   In my interviews, all of the NCWIT leaders argued that evidence-based approaches are essential for understanding unconscious bias, improving opportunities for women, motivating male allies, enacting new policies to improve diversity, and for mounting successful interventions for women in computing. For NCWIT leaders "evidence-based" means that the advice they communicate to its members is grounded in research, typically social science research. NCWIT has its own team of research scientists and works closely with its Social Science Advisory Board of academics who help support its evidence-based strategy.

The NCWIT research team confirmed that they spent a significant amount of effort and time considering what is "evidence-based" and what is not. As one research

scientist said to me, "we have, internally, all kinds of conversations on what is research-based and what it is not, because it's an important differentiator for us." Use of the term "evidence-based" can help legitimize NCWIT's work to audiences that value data and quantitative research methods. But at the same time, NCWIT qualitative research provides findings about why "stories" matter.

For the NCWIT team, "evidence-based" also means translating scholarly research to make it consumable and actionable to different audiences. Such translations can be viewed as derivatives of academic research outputs and, as such, they are new resources in their own right. In terms of the process of producing these *NCWIT Resources*, the research team starts by reviewing and selecting items from a relevant corpus of existing scholarly publications, as well as the reports from NCWIT's own research studies. The team also consults with the Social Science Advisory Board[72], which is made up predominantly of university faculty. The next steps involve the actual creation and publication of a "text" that can be used by practitioners (i.e., put into action) for solving particular problems in the workplace or for taking steps to open up new opportunities for women in tech.

Discourse Artifacts – "Evidence-based" Resources

In addition to the dialog that occurs at the Summit, NCWIT "Resources" are particular constructions and disseminations of knowledge that can be understood as

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[72] SSAB, https://www.ncwit.org/alliances/ssab

discourse artifacts. Thus, NCWIT Resources are *mediated* constructions[73] [74] of

knowledge, especially about bias, diversity, and the mechanisms for individual and

organizational change. NCWIT Resources are disseminated at the Summit, and they are

also available to the public, thus extending the reach of NCWIT's not-for-profit

interventions.

NCWIT Resources are different types of texts that are distributed in different

ways and targeted at different audiences. In this sense they are what Fairclough (1992)

called *genres* of discourse where "…a genre implies not only a particular text type, but

also particular processes for producing, distributing, and consuming texts" (p. 126)

Examples of genres of Resources produced by NCWIT include: (1) brochures that distill

research into lists such as "Top 10 Ways" and "Tips", (2) educational packages such as

"Toolkits" and "Programs In-a-Box", (3) reference materials such as "Statistics and

Reports," and practitioner guides for conversation such as "Talking Points." Figure 10

shows the covers of typical genres of NCWIT resources that are distributed at the Summit

and available on the NCWIT website.

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[73] "…genres correspond closely to types of social practice, and the system of genres which obtains in a particular society at a particular time determines which combinations and configurations the other types [of elements of discourses] occur in (Fairclough, 1992, pp. 125–128).

[74] I was influenced by Foucault's discourse theory and using Fairclough's CDA to approach NCWIT Resources as discourse artifacts.

Figure 10. Example covers of NCWIT resources (source:
https://www.ncwit.org/resources)

The first example is a brochure of "Top 10 Ways" that managers can work on

retaining and advancing mid-career women. The second is an educational toolkit for

engaging male allies and advocates, the third is a critical listening guide that for "a sign

that the discussion is headed in a direction that is not research-based" and the fourth is a

guide for discussion on how to take action when bias happens. In producing these types

of resources, NCWIT reviews, selects, and translates scholarly research on key topics

about gender and computing, gender bias, and the theory and practice of diversity

interventions. Through this process, it re-frames and interprets evidence as actionable

knowledge, essentially re-producing discourses of computing in material form as

discourse artifacts. NCWIT "evidence-based resources" are texts that are available in

document form at the Summit and in electronic form on the NCWIT website.

Shaping Knowledge is Power

Once we consider NCWIT Summit as a forum of discourse and NCWIT

Resources as discourse artifacts, we can understand the role of NCWIT as one of power;

power to select, translate, annotate, or possibly even suppress certain knowledge.

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It is appropriate to contemplate the nature of this power from the perspective of theory of discourse. In *Archeology of Knowledge*, Foucault (1972) tells us that the archive, itself, is a system of statements, essentially a representation of a discourse, both of what has been said in the past, but also influencing what can be said in the present and the future.

> *"The archive is first the law of what can be said, the system that governs the appearance of statements as unique events. But the archive is also that which determine that all these things said do not accumulate endlessly in amorphous mass, nor are they inscribed in an unbroken linearity…; but they are composed together in accordance with multiple relations, maintained and blurred in accordance with specific regularities" (p. 145).*

NCWIT's collections of resources have become an online archive of evidence relevant to addressing the underrepresentation of women in computing.   As argued by Schwartz and Cook (2002) "[a]rchives – as records - wield power over the shape and direction of historical scholarship, collective memory, and national identity, over how we know ourselves as individuals, groups, and societies" (p. 2).   If archives are sites of power then those responsible for the curation of archives exercise significant power in society. In essence, archives are social constructions and "… the choice of what to record and the decision over what to preserve, and thereby privilege, occur within socially constructed, but now naturalized frameworks that determine the significance of what becomes archives" (p. 3).

While not considering themselves archivists, members of the NCWIT research team are aware of their role in shaping knowledge. In my interviews, it was revealed to me that the team debated about this process, with one side feeling ambivalence about "dumbing down" the research from a scholarly perspective, the other side feeling that the

research needed to be presented in a streamlined manner that elevated the essence and made it actionable. In the end, the prevailing viewpoint of the NCWIT research team was that translations were necessary to get important messages out to practitioner communities in the way that they could consume it.   An NCWIT leader connected the Summit and Resources to its public mission this way:

> *"Our mission is to be their personal trainer.   They have called us the Consumer Reports of gender and tech... the NPR of gender and tech… the open source of gender and tech – because we don't monetize access to information.   All of our resources are free and on our website."*

and also,

> *"We take that information and we turn it into…into a form that looks like it belongs in a corporate environment, in an academic environment, in a social media environment, in a startup environment, right? We want those to be consumable pieces of information. I sometimes kind of refer to us as the sort of TED of gender equity."*

Conclusion

If we consider the GHC and the Summit as forums of discourse, we can observe that there is power in the hands of not-for-profit organizations, and that type of power is the dissemination of knowledge for the public good. The Grace Hopper Celebration as a forum of discourse for women in computing began in 1994 as a gathering of 500 women grew to have an international reach and has become a significant conference of over 18,000 attendees. It evolved into the "go to" place for individual women in computing to convene and showcase their work. Originally GHC was a way for female technologists to come together as a community. Today it is a convention-center event with major speakers from industry, academia and government, a full-program of peer reviewed papers (notably with ACM as co-producer), networking, mentoring and leadership

programs, and an Expo where corporations can recruit women. The critical mass at GHC showcases the identities and achievements of a large international group of women in computing fields that have become a key component of changing attitudes and perceptions in society, which have negatively affected women in computing. I described that GHC has attained grown enough to garner significant mainstream media attention, which can influence perceptions about who will play important roles in creating the new computing technologies of the future. This media attention has served to extend the discourses of women and computing outside of the on-site GHC conference itself.

NCWIT Summit is a community-oriented face-to-face experience that enables leaders and "change agents" of organizations to engage in discussions about the research on gender and the workplace. As a forum that encourages deliberation and strategy, The Summit disseminates new discourses and best practices can be taken away to influence organizational and culture change. As material collections of knowledge, NCWIT Resources are "evidence-based" artifacts of discourse that become tools for organizations to use when solving problems of diversity and creating career opportunities for women in tech. I argued that as creator and curator of collections of knowledge resources, NCWIT asserts power in the framing of the discourse of women and computing and in the dissemination of knowledge.

CHAPTER 6
Unconscious Bias and the Power of a Moment

As discussed in the previous chapter, *Grace Hopper Celebration on Women in Computing (GHC)* is a forum of discourse that is simultaneously an event with high-profile plenary speakers from industry, academia, and government; a multi-track technical conference, a celebratory event; and the flagship program of ABI billed as the "largest international gathering of women in computing in the world." While GHC attracts mostly women, and its speakers have been predominantly women in tech, the GHC program organizers did something new in 2014 – they created sessions that explicitly engaged men who were identified as "male allies" in the cause of improving opportunities for women in computing. This chapter explores a moment of discourse at GHC 2014 that brought mainstream media attention to the issue of gender bias in the form of "unconscious bias". This occurred due to the unexpected display of unconscious bias by a highly visible CEO who, in fact, was a male ally for women in computing.

I focus on the plenary session at GHC 2014 that featured Satya Nadella the CEO of Microsoft. The host of the plenary was Maria Klawe, president of Harvey Mudd College, a member of the Microsoft Board of Directors, and a computer scientist. The format of the plenary was notable; it was not a speech, but instead in was framed as a "conversation" where Klawe set the agenda and posed questions to Nadella that were pre-submitted by audience members. What was otherwise anticipated to be an inspiring event that featured a male CEO of a major tech company talking about opportunities for women, turned into a dilemma when Nadella responded to one of the last questions posed

to him regarding his advice to women about their discomfort in asking for a pay raise. Nadella's response, which I will describe in full later in this chapter, advocated a non-assertive approach that Nadella connected to the metaphor of "good Karma". I will explore this moment of discourse and the aftermath in social media and the press when Nadella's statement ignited public discussions on bias and equity issues that women confront in the tech workplace.

Taking the position that both discourse and social practice are key drivers of social change, my goal in this chapter is to focus on the discursive dimensions of the Nadella incident. I analyze the Nadella plenary at GHC14 as a discourse sample that consists of the video transcript of the Nadella/Klawe conversation as the primary text and the reactions to it in news and social media as related texts. My analysis was influenced by Norman Fairclough's analytical framework of Critical Discourse Analysis (CDA) and his theory of discourse as a constituent part of social practice. To lay the ground work for this analysis, I will first define two terms that are fundamental to understanding the analysis in this chapter – "unconscious bias" and "male ally."

Definitions: Unconscious Bias and Male Ally

Over the past several years, the term "unconscious bias" has become dominant in workplace discussions about diversity and many Silicon Valley companies now offer unconscious bias training programs. Since the 1990s, social psychologists have identified the phenomena described as "implicit bias" or "hidden bias" by demonstrating that despite their intentions, and outside of their own awareness, a person's unconscious perceptions of a social group influences their judgments about the abilities, strengths,

weaknesses, and character traits of individuals of that group (M. Banaji & Greenwald, 2013). Foundational work by Greenwald and Banaji (1995) raised awareness of the dissociation of conscious and unconscious mechanisms of bias and opened up new paths for thinking about how *implicit bias* could influence judgment and social behavior[75].

> *"The signature of implicit cognition is that traces of past experience affect some performance, even though the influential earlier experience is not remembered in the usual sense—that is, it is unavailable to self-report or introspection" (1995, pp. 4–5).*

Even with the best of intentions, both men and women can exhibit unconscious gender bias (p. 15). Overall, the body of work on implicit bias provides insight on how bias can operate even when people hold egalitarian beliefs (M. R. Banaji & Greenwald, 1995; Mahzarin Banaji, Hardin, & Rothman, 1993)[76]. A National Academies (2006) report, which reviewed research from the fields of psychology and social psychology on bias and barriers that women and minority groups encounter in science and engineering, concluded that underlying mechanisms of implicit cognition are at work in perpetuating these biases.

> *"... most discriminatory behavior takes the form of implicit bias and results from gender schemas, the largely unexamined sets of ideas people hold concerning gender roles" (p. 135).*

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[75] Greenwald and Banaji (1995) offered the following template for implicit cognition: "An implicit **C** is the introspectively unidentified (or inaccurately identified) trace of past experience that mediates **R**. In this template, **C** is the label for a construct (such as attitude), and **R** names the category of responses (such as object- evaluative judgments) assumed to be influenced by that construct." (p. 5)

[76] The researchers who conducted seminal studies on implicit bias also invented an instrument knows as the Implicit Association Test (IAT) to measure implicit bias (Anthony G Greenwald, Banaji, & Nosek, 2015). See Project Implicit, http://projectimplicit.net/index.html.

The terms *"male ally" and "male advocate"* also emerged as elements of discourse in practitioner communities that are working to promote gender diversity in the workplace.   The leaders of both ABI and NCWIT agree that engaging men is a critical part of establishing gender equity and ensuring that culture change is sustainable.   Taking a critical look at the history of diversity programs in the workplace, another non-profit organization, Catalyst, posed the question "why have so many programs missed the mark?" The answer, they argue, is that most programs have not directly engaged men in a meaningful way.

> *"Regrettably, in their exclusive focus on women, rather than engaging men, many companies have unwittingly alienated them, inadvertently jeopardizing the success of their gender initiatives. Without the avid support of men, who are arguably the most powerful stakeholder group in most large corporations, significant progress toward ending gender disparities is unlikely." (Prime & Moss-Racusin, 2009, p. 2).*

Not-for-profit organizations, especially NCWIT and ABI, have published guides about the *qualifying* practices for being a male ally. These practices include mentoring and sponsoring women, advocating for fairness, speaking up when bias is observed, helping to amplify women's voices, and not allowing them to be interrupted ("Male Advocates and Allies : Promoting Gender Diversity in Technology Workplaces," 2016)[77]. Broadly, we can understand male allies and advocates as men who are in allegiance with women in working for gender equality. More specifically, the male advocate is a male ally who actively engages in the best practices that promote gender equity and women's

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[77] NCWIT Allies and Advocates Toolkit, https://www.ncwit.org/resources/male-allies-and-advocates-helping-create-inclusive-highly-productive-technology-workplac-1 ;

interests in the workplace (Catherine Ashcraft et al., 2013).   This topic will be taken up in more detail in Chapter 7.

The Nadella plenary of 2014 was the first event to explicitly engage a male ally in a public conversation at the largest gathering of women in computing in the world. In motivating the male allies program as a key part of ABI's overall strategy, CEO Telle Whitney argued, "[i]t is critical for organizations to effectively engage both their female and male leaders—many of whom are well-intended, and help them understand how to create these changes in their own cultures."[78]

Discourse and Social Change

To understand moments of discourse (such as the incident that is the subject of this chapter) in relation to cultural and social change, Fairclough (1992) argued for a "double focus" on the orders of discourse and discursive practices or discursive events. This requires close analytical attention to how "processes of re-articulations" (p. 96) affect orders of discourse and thereby influence social change.   Providing CDA as a method for operationalizing a Foucault-influenced perspective of discourse, Fairclough (2005) argued,

> *"… 'Discourses' in a Foucaultian sense are for me elements of social practices.
> 'Discourse analysis' correspondingly has a doubly relational character: it
> analyses relations between discourse and other elements of the social, and it
> analyses relations between linguistic/semiotic elements of social events and
> linguistic/semiotic facets of social structures and social practices, including
> 'discourses'." (p. 916)*

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[78] https://ghc.anitab.org/news/from-telle-why-were-inviting-men-to-the-table-at-ghc-2014

Fairclough used the term "*dilemma*" to describe the problematization of conventions that are based upon contractions. With respect to gender, he noted

> *"the problematization of conventions of interaction between men and women is a widespread experience in many institutions and domains. Such problematizations have their bases in contradictions – contradictions in this case being traditional gendered subject positions into many of us were socialized, and new gender relations" (p. 96).*

Fairclough argued that "what crucially determines how these contradictions are reflected in specific events… is the relationship of those events to the struggles which are going on around those contradictions" (p. 97). At a time when Silicon Valley valorizes male leaders in tech, to the point that they become famous (or even infamous), the implications of implicit bias and its impact on women has serious implications, both in terms of attribution, visibility, opportunity and reward. No longer is unconscious bias just a phenomenon described in the academic literature; it had emerged to become a dominant topic in the discourse and practice of diversity policy in both and corporations and academic institutions, and especially in Silicon Valley.

A Moment of Discourse: Nadella's "Good Karma" at GHC14

On October 9, 2014, the opening session of the Thursday program of 2014 Grace Hopper Celebration (GHC14) was advertised as "*Satya Nadella in Conversation with Maria Klawe*". Nadella was the new CEO of Microsoft[79] and Klawe was both the president of Harvey Mudd College and a member of Microsoft's Board of Directors[80]. The plenary began with the two speakers running to the stage - Nadella wearing a hoodie

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[79] Nadella succeeded Steve Ballmer as Microsoft CEO in 2014.
[80] Klawe stepped down from the Microsoft Board at the end of her term in Dec. 2015. See: https://news.microsoft.com/2015/10/19/microsoft-proposes-election-of-new-board-members/

and Klawe in jeans and a tee shirt. After being seated, their conversation began with the banter and familiarity of colleagues, followed by a rich discussion about women in tech and Microsoft's culture. What was otherwise an inspiring discussion turned into a problematic situation near the end of the session when Nadella responded to a question posed to him regarding how women should ask for a pay raise. Nadella responded, "it's not really about asking for the raise, but knowing and having faith that the system will actually give you the right raises as you go along"[81]. Nadella continued, using the metaphor "good karma" to suggest that women who earned trust within the system should be assured that the rewards they deserved would be forthcoming.

> "…. and that, I think, might be one of the additional superpowers that, quite frankly, women who don't ask for a raise have. Because that's good karma … it will come back… because somebody's going to know that's the kind of person that I want to trust; that's the kind of person that I really want to really give more responsibility to… and in the long-term efficiency, things catch up."[82]

Despite an otherwise inspiring talk, the "good karma" metaphor went viral, on social media. On Twitter the immediate reactions were expressions of disbelief, exasperation, and irony as seen in examples such as the tweet *"Faith in the system" is akin to magic, and one of the super powers of women who don't ask for raise. It's good karma says Satya Nadella."* There were also many tweets pointing out the irony of his statement such as*, "Will Satya Nadella's male employees also wait for good karma? Or karma is meant only for women?"* When Nadella became aware of the reaction that was brewing, he responded on Twitter as shown in Figure 11 the same day of his comment saying,

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[81] https://www.brainyquote.com/quotes/satya_nadella_760389
[82] GHC plenary video transcript at position 1:34:28.82.

Figure 11. Tweet from Satya Nadella

Despite Nadella's attempt to correct for his "good karma" narrative, the tweeting continued. Some commentators expressed anger, such as the Women's City Club of New York City saying that "*[g]ood karma doesn't put food on the table.*" Others expressed skepticism, and even used sarcastic humor such as the reporter[83] for Bloomberg who said, "*[t]he only way 'good karma' will help women make more money is if they're reincarnated as men.*"

By this time, the mainstream press and major cable news organizations were already reporting the story. A media frenzy ensued over the next two days where Nadella was instantly and paradoxically cast as a paragon of gender bias and insensitivity regarding the equity issues that many women confront in the workplace. Kara Swisher, a well-known tech journalist and editor of *Recode*, reacted quickly with "*Oh dear. Oh my. No, no, no*." The title of her article clearly revealed her view on what happened at GHC plenary: "*Open Mouth, Insert Foot: Microsoft CEO Tells Women Techies to Trust 'Karma' on Pay Inequity.*" Swisher was quick to note the public relations implications of Nadella's statement, saying "*when the leader of one of tech's biggest companies makes a*

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[83] https://www.bloomberg.com/authors/AP5w2GPBCv4/christopher-flavelle

gaffe like that and in a place dedicated to promoting women in tech, this is what's known as a PR nightmare" [84]. Another notable reaction was from two CNN news anchors[85] who discussed the situation on the cable news channel, dramatically expressing their disbelief while bantering with both humor and exasperation[86]. When their dialog turned serious, the female anchor held her head in her hands while shaking her head saying "…*ugh... Microsoft is really trying to walk it back like crazy.*" She then moved on to educating the public about the realities of gender pay gaps in the workplace and pointing to a graphic charts of median pay difference by gender. She asserted, "*[l]ook at these numbers – this is the pay gap! Karma is not going to get you more money!*"[87].

As shown in Appendix J, the reactions in the news media were widespread including notable coverage by other cable news broadcasters (CNN, BBC, NBC News, Fox News), stories in top newspapers (NYTimes, USAToday, Washington Post, the Guardian), and articles in magazines (New Yorker, Forbes, Time). With cries of indignation and anger beginning in social media, followed by such reporting by the national and international news, we see how one moment of discourse could the ignite counterforces of resistance.

Unpacking the Moment of Discourse

As a moment of discourse, this incident presented a tension and a paradox that was meaningful for the analysis of discourse and social practice. The plenary session

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[84] Swisher, http://recode.net/2014/10/09/open-mouth-insert-foot-microsoft-...1
[85] Significantly, the two CNN Money anchors were a female and an African American male.
[86] See CNN video at http://www.cnn.com/2014/10/10/living/microsoft-ceo-gender-gaffe-women-parents/index.html)
[87] http://money.cnn.com/2014/10/09/technology/microsoft-ceo/index.html

featured a male leader who was otherwise exhibiting behaviors on stage that were representative of a supporter of women specifically and of diversity more broadly (a "male ally"). Early in the plenary discussion, Klawe had profusely praised Nadella for his values and past performance at Microsoft, establishing him as a male ally.   Yet, the Nadella incident provided an example of how a rupture in discourse could expose an underlying contradiction – a hidden layer of unconscious bias that may not have been as easily discernable through other forums of discourse and other discursive styles.

When contradictions such as this rupture in the Nadella plenary occur, the relationship of discourse, practice, and social change can be studied using critical discourse analysis (CDA). We learn from Fairclough (1992) that the combination of structural contradictions and discursive events can either reinforce (i.e., "preserve and reproduce") gender relations or they may contribute to transforming gender hegemonies through the "naturalization" of new discourses and practices. Taking Fairclough's position that both discourse and social practice are key drivers of social change, I used CDA to reflect on the value of the contractions and dilemmas that manifest in the discourses of gender in the workplace.

> *"Such contradictions, dilemmas, and subjective apprehensions of problems in concrete situations have their social conditions in structural contradictions and struggle at the institutional and societal levels. To pursue the example of gender relations, the contradictory positioning of individuals in discursive events, and the dilemmas that result from this, originate in structural contradictions in gender relations within institutions and society as a whole" (Fairclough, 1992, p. 96).*

During the plenary, Klawe, herself, was the first person to call out the contradiction of gender that were embedded in Nadella's comment. Immediately after

Nadella made his "good karma" statement, Klawe reflected on her own experience as a woman and said directly to him,

> "We let me tell you a story about myself. because this is actually one of the very few things I disagree with you on [audience applause].... I've always been uncomfortable about asking for things for myself... and I'm really great about asking for things for people who work for me."

Elaborating on her personal experience, Klawe revealed that when she was offered the position of Dean of Engineering at Princeton, she accepted the job without having been offered a salary. She revealed that she was uncomfortable and said, "oh just pay me whatever you think is right." She received about $50K less than she would have if she had negotiated. Klawe continued to reveal that she also did not negotiate her salary for her current position as president of Harvey Mudd and that she received significantly less than she thought was appropriate. With this point, she then turned to look directly to the audience, saying,

> "... So here is my advice to all of you... First of all, do your homework. Make sure you actually know what a reasonable salary is if you're being offered a job. Do not be as stupid as I was..."

This segment exposed an essential set of *contradictions,* which in Fairclough's CDA are signs of a "dilemma," essentially cues that reveal that there is something significant to be uncovered in the discursive moment. This moment required analysis to understand the implications of the statement made by Nadella and its relationship to social change.

Throughout the plenary, Nadella used many optimistic and spiritual metaphors in his speech. Much of his message to the audience was focused on finding your "passion"

and making a difference for humanity. One metaphor that he repeated throughout the discussion was the notion of individual "super powers," telling women to be aware that they have such special abilities. Nadella's use of the "super power" metaphor climaxed in his gaffe about "good karma." After the rupture, Klawe revealed elements of her own hidden personal discourse on gender and how it manifested in important negotiations of salary in an organizational context. Klawe revealed her own contradictions as a powerful woman whose personal sentiment had aligned with well-known gendered stereotype in the workplace (i.e., women as caregivers), while simultaneously urging the women in the audience to focus on themselves and negotiate with power (i.e., don't be passive; assert yourself). Also notable was that Klawe was not as forgiving of *herself* as she was of Nadella, saying to the audience of women, "do not be as stupid as I was."

In response to this whole exchange, Nadella's body language expressed contrition and embarrassment as he looked downward nodding his head. Nadella had unwittingly revealed his own substrate of unconscious bias. Overall, this discussion about gender and negotiating a salary exposed the contradictions of two formidable leaders with regard to their differential positions of power in a gendered hegemonic order.

Afterward, in an interview with National Public Radio, Klawe was asked if she was surprised by Nadella's answer and what her thoughts were about the audience applauding when she disagreed with Nadella. Klawe answered "in middle of interview, I'm not processing all of the implications of what was said," but regarding the audience's reaction she said,

"… they were taken aback. He had been so obviously such an advocate for women and technology throughout the 45 minutes of the interview that preceded that response. And so people were just sort of like 'where did that come from?!'[88]

This element of surprise was an important aspect of the discourses of the Nadella moment. But how did the conversation lead to such a surprise? Using Fairclough's CDA method, I uncovered two notable elements of this conversation that contributed to a hidden discourse becoming manifest discourse - informality in the discursive style and contradictions of gender and authority.

The Role of Informality in Discursive Style

The informal discursive style of a "conversation" presented a certain degree of uncertainty about how the discussion between Nadella and Klawe would unfold. This was an unconventional type of plenary that had not been done before at GHC. As a plenary for such a large audience, the Nadella event would typically have been done in the style of delivering a speech. However, this plenary was actually performed in the "conversational style" (Fairclough, 1992, p. 124) and was consistent with the "interview genre" (p. 124).

Fairclough's CDA suggests that the analyst look for inconsistent elements such as "mixtures of formal and informal styles, technical and non-technical vocabularies, markers of authority and familiarity, more typically written and more-typically spoken syntactic forms, and so forth" (p. 97). Even though some discussion items and audience questions for the plenary were known ahead of time, there were numerous signals of

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[88] https://www.npr.org/sections/alltechconsidered/2014/10/10/355100973/microsoft-ceo-nadellas-remarks-add-to-techs-sexism-problem

informality from the beginning and the open style of the session left space for uncertainty, spontaneity and risk-taking in the discussion of gender issues.

Klawe referred to notes that served as an unstructured interview guide and she issued many probes and provided anecdotes as the conversation developed. She also exposed some of the nature of her notes, ("my script says personal anecdote; that was my anecdote."). Nadella did not read any of his responses. The plenary format provided a context where Nadella could express and represent himself as a reflective and thoughtful leader in an ostensibly natural conversational setting between two people with a formal relationship in their roles as CEO and Board Member of Microsoft. The two presented themselves in a very relaxed way and both made notable use of anecdotes of personal experience.

Contradictions of gender and authority

Klawe was playful around the discourses of gender roles and authority in the plenary, which ignited discursive signals related to contradictions around gender. Many of the verbal and non-verbal signal (body language and emotional affect) expressed during the conversation reinforced informality and spontaneity. This included an unusual performance of informality when Klawe's visually demonstrated to the audience how she was able to persuade Nadella to agree to speak at GHC14. In Figure 12, we see Klawe rising from her chair and taking a kneeling position in front of Nadella which solicited laughter from the audience.

Figure 12. Klawe's use of body language in establishing informality

When Klawe recovered from this visual performance, she used humor to position herself back in a dominant position as a Microsoft board member.   Having established a discourse style as a conversation between "friends," Klawe began to establish ambiguity of roles and authority. Continuing the banter, Klawe immediately returned to discussing her role on the Board and the decision to hire Nadella as CEO.   Klawe was playing with contractions of status, power, and gender roles in this segment.

> *"It was a rough year the last year… the Board members had been looking for a new CEO.   I have to say…., I was a little worried that Satya wasn't going to be strong enough to be able to stand up to Bill and Steve. I mean they are forceful people"   <audience laughs>.*

Klawe poked at Nadella about whether she thought he was good enough to meet the demands of the Microsoft job and as Klawe bantered with Nadella who smiled and responded humorously, "Man I don't know where this is going, but go on..." Then there was a significant statement, with a bit of hyperbole and humor, where Klawe aligned the discussion in the direction consistent explaining why GHC featured a male CEO for the first time in an opening plenary.

> *"I adore this guy. He's amazing!   He's really strong. He's a spectacular human being. He has very strong values. And I just consider it such a privilege to spend time working with Satya to bring Microsoft forward.   There are lots of headwinds and…. ah,… I love you Satya."*

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In her statements during the context-setting of this conversation, Klawee endorsed Nadella as a worthy *male ally* for diversity, which is important for understanding how the "good karma" moment emerged as a surprise near the end of the plenary, providing an exposure of unconscious bias.   As a moment of discourse, Nadella's "good karma" statement was a rupture that revealed elements of a hidden discourse that lurked beneath the manifest discourse. While the Nadella's statements were not manifest expressions of bias, they were indicative of "*a voice as silent as a breath*" (Foucault, M., & Gordon, 1980; Foucault, 1972) that revealed something that was lurking gently behind Nadella's expressed words. This is an example of how unconscious bias can be revealed though a critical analysis of discourse.

Post-Event Responses to the Moment

Foucault, Fairclough, and Edwards all agree that a discourse includes elements of both the "text" and the surrounding context (where a "text" can be both spoken or written words).   After the immediate response on social media and the press to Nadella's statement, he responded. In a memo that Nadella posted to Microsoft employees and on the company's public website, he said,

> *"I answered that question completely wrong. Without a doubt, I wholeheartedly support programs at Microsoft and in the industry, that bring more women into technology and close the pay gap. I believe men and women should get equal pay for equal work." He added, "If you think you deserve a raise, you should just ask.[89]"*

Also, in an interview with the mainstream press, Nadella said,

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[89] Microsoft news, https://news.microsoft.com/2014/10/09/satya-nadella-email-to-employees-re-grace-hopper-conference/

"My answer to that one question, which I interpreted super narrowly, was just wrong, because I answered by my own experience of how I managed my career.... But the mistake is to take your own personal experience and project it on half of humanity. It's just insensitive" (Mandaro, 2014).

In an interview with Fox 10 Phoenix twenty-four hours after the plenary ended, Klawe said that she was "really quite surprised" by Nadella's answer to the pay raise question and summarized her overall reaction as "… it's uncomfortable, it's embarrassing, it's a really good thing."[90]   Klawe said that Nadella's "flub" was a really good thing because she believed it would cause Microsoft, and other tech companies, to take a closer look at pay equity and the other issues around women and computing. In another interview with National Public Radio, Klawe answered some tougher question about her immediate reactions to Nadella's statement and also her positioning as a Microsoft board member.

"I feel badly for Microsoft getting the bad press because I don't believe they deserve it. On the other hand, I'm really proud to be a director of Microsoft. And I'm very proud to be part of the board that hired Satya Nadella because I believe he's a spectacular leader because of the person he is. And I'm sorry he said that. I really am - for everybody. I mean, I'm sorry for him. I'm sorry for Microsoft. I'm sorry for me because I felt guilty about it. But this whole furor that has happened over the last 24 hours - we're going to end up in a better place, and I just hope we get there sooner rather than later."[91]

Fairclough (1992) also asks us to consider how cultural factors and ideologies are embedded and naturalized in both discourse and practice (p. 90). On the surface, we can observe the manifest discourse of Nadella's comment about raises as an earnest

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[90] Fox 10 interview of Klawe: Jessica Flores interviews Klawe at GHC, Fox 10, October 10, 2014, https://www.youtube.com/watch?v=DOOy0R5rVHE

[91] NPR interview of Klawe by Melissa Block, https://www.npr.org/2014/10/10/355187963/microsoft-ceos-comments-reflect-a-larger-workplace-problem

reflection, with Nadella using a spiritual metaphor to articulate his corporate ideology; in the long run, employees could *trust a system* that would correct itself for imbalances. Klawe, herself, in an NPR interview, interpreted that Nadella's statement about women not asking for raises and his use of the terms "super powers" and "good karma" was influenced by his cultural origins growing up in South India. In a media interview 24 hours later at GHC, Klawe also defended Nadella with a sympathetic suggestion that, "he was talking about a more utopian view of the world than actually exists."

When Discourse Meets Practice

Fairclough asks us to consider whether the contradictions that expose a dilemma have a positive or negative impact on social change. Discourse can serve to reinforce hegemonic systems and values or promote movement towards resolution of inequality and social change. The previous section analyzed a moment where words revealed a gender struggle that was exposed through Nadella's "good karma" statement. The frictions caused by Nadella's statement were signs of the gender dilemma that was lurking beneath the surface of Nadella and Klawe's friendly and intimate dialog in a public forum. The conversational style was a *genre of discourse* (Fairclough, 1992, pp. 124–127) that contributed to the exposure of a more latent discourse that may not have been easily discernable had Nadella had given a prepared talk, or if the discussion was moderated in accordance with a more formal protocol.

In practice, the Nadella incident can be interpreted as a crisis and a rupture in gender relations that could make more men wary and less willing to speak up on issues of gender and for fear of being criticized or finding themselves in a similarly uncomfortable

situation. On the other hand, the incident can be viewed as an instructive moment that helps the leaders in the tech workplace take practical steps towards r*esolution* of a dilemma. As a moment of discourse, it is situated more broadly in a network of forces – assertions, reactions and responses, counter discourses, policy and actions of practice. When understood this way, the discourse of unconscious bias became manifest in Nadella's spoken words, and a dialog of resistance emerged from the audience on Twitter. When news organizations picked up the story, a wider public discourse on pay equity emerged from a moment featuring a CEO of well-known tech company.   A publicly visible memo for improvement in corporate practice and policy took a priority position at Microsoft (i.e., Nadella's "what to change?" call to action). On the other hand, a moment that was seen only in partial relation to the totality of discourse on gender and computing might have been received by other male leaders as warning, rather than a model for positive change.

In my interviews with leaders from both ABI and NCWIT, I asked about their views of the Nadella plenary to gauge their overall reactions and probed about what the moment meant for issues of unconscious bias and male allies. The reaction of ABI leaders was concern about what had happened at GHC14.   This was the first year that GHC tried to expand its programming to include several prominent sessions featuring "male allies" in recognition that women and men working together was a key part of successful interventions for diversity. As a board member from ABI said,

> *"There were a number of board members, men and women, who were worried that if Grace Hopper becomes a place that people are just going to get smashed for not being the right gender, then that's going to prevent the stuff we're trying to*

do…. And if everybody doesn't feel welcome, and especially if the men who are trying really hard move backwards instead of forward."

Another ABI leader who was in the audience during the Nadella plenary said,

"… I actually think he gave a great talk. Yes, he stuck his foot in his mouth but I was certainly stunned by the level of response within the larger more viral community. And to his credit he took it head on. He sent a "don't act" to his company and he has continued to be focused on this as a topic I mean they have released their numbers in terms of analysis of pay at Microsoft. I've certainly talked to him a number of times about some of the things that they're doing inside Microsoft. So, I do applaud his continuing focus on this area. I mean, obviously I'd love to see more.

Unconscious bias training has become an important dimension of Microsoft's diversity program. It has also become a common intervention by the major Silicon Valley companies that had publicly released their diversity data in 2014 (as discussed in Chapter 8). The question remains as to whether this newer approach to diversity training – unconscious bias training - will yield different outcomes than previous attempts at diversity training.

In 2015 Microsoft announced that 70,000 of its employees had already taken its internal unconscious bias course and that by the end of that year end all Microsoft employees would take it (Houston, 2015). That same year Microsoft also made its internal training course available to the public as an "eLesson" on its public website[92] with the stated motivation that *"[b]y working to counter unconscious bias, we can all help create a world where people are empowered to do amazing things*"[93]. Notably, this

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[92] Microsoft eLesson available on Microsoft's Global Diversity and Inclusion website at https://www.mslearning.microsoft.com/course/72169/launch
[93] Microsoft Diversity and Inclusion, accessed Nov. 10, 2016, https://www.microsoft.com/en-us/diversity/training/default.aspx

was one year after Nadella spoke at a plenary session at the 2014 Grace Hopper

Celebration where he publicly made a statement that unintentionally revealed his own

unconscious bias.

Outside the immediate policy actions taken by Nadella at Microsoft, we don't yet

know the impact on diversity at Microsoft's and long-term effect on workplace practices

at the company. Lucy Sanders, CEO of NCWIT, provided insight when reflecting on the

aftermath of Nadella's comment when she said in a public discussion with Peggy

Johnson, Microsoft's Executive Vice President of Business Development at the NCWIT

Summit, 2015, "even controversial moments lead to progress and change".

Sanders was speaking to change leaders of the 2015 NCWIT Summit in a

discussion session with Johnson[94]. The topic of this session was *corporate change

leadership* and it began with Johnson discussing her own career experience as a former

engineer who is now an executive level woman in tech[95] at Microsoft. Sanders brought

up the topic of the Nadella incident, noting that "a bit of an uproar ensued" and "we all

make mistakes", and asked Johnson to explain what happened next at Microsoft.

Johnson's answer began with her personal knowledge of Nadella[96], who she said

had been "such proponent for diversity and inclusion many years before that and he's one

of the reasons that I'm at Microsoft." Reflecting on what happened next at the company,

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[94] https://news.microsoft.com/exec/peggy-johnson/
[95] See: www.ncwit.org/video/2015-ncwit-summit-%E2%80%93-qa-peggy-johnson
[96] Johnson had been at Microsoft for only six weeks when Nadella made the "good karma"
statement. This discussion with Sanders was approximately seven months after Nadella's
statement at GHC14.

she said, "he used it as a true learning moment" and that he brought them all together ask asked "what do we need to do, internal here at the company, to make change?" Johnson reported "we dug in" and that Microsoft examined what their teams look like; ways that everyone can get their opinions got heard (esp. directly asking quiet people); unconscious bias training; and "a huge focus" on recruiting and retaining talent. Lastly, regarding equal pay for equal work, she said that this may seem obvious, but it's not because certain people "are squeaky wheels" and that can obscure those you don't see and those who do not ask.

Other NCWIT leaders reported similarly to me about the actions Nadella took at Microsoft after the GHC incident, "[r]egarding the impact of Nadella incident, …so far, we've had conversations with Microsoft and it had a positive impact on things.". NCWIT is also motivated to promoting an understanding how to engage male allies, and concern were expressed such as *"… we don't want a big backlash against men who do try to be male advocates. So just like not all women do it right, right? Not all women give the right messages or say the right things about how to do this, neither do the men, and they need the same kind of tools."*. This comment is consistent with the research that shows that both men and women demonstrate unconscious bias.

In 2014, Nadella was already viewed as a "male ally" by ABI leaders when he was invited to speak at GHC. An ABI executive leader expressed why it was important to have him at the conference and why the ABI board became concerned after Nadella's moment.

"There are male allies, they matter a lot. We're really looking to change power, and a lot of that power is in the hands of the men. You don't ask the under-represented group or the un-empowered group to empower themselves. You need help and so that was, on the part of the board and the people in the organization, a little bit of the concern.... We don't just want to be a place where people go and trash people just because they're men."

This brings me back to the significance of the Nadella moment as a moment of discourse. Nadella's "gaffe" may not have been as problematic as it initially appeared. While it was a moment that exposed the hidden breath of unconscious bias, it also exposed a dilemma where gendered subject positions entangled. It was also a moment of public accountability, that was not anticipated by Nadella, by ABI leadership, or by Microsoft as a company. In fact, three years after GHC14, Nadella was interviewed by Judy Woodruff on PBS NewsHour[97] about his new book. Woodruff asked Nadella why he wrote his book, which was also like a memoir, especially when most CEOs do not write such books while they are still working at their company. In that interview, Nadella answered that most business books are "look-backs, either at grand successes or grand failures" but that he wanted to reflect on hard questions as a sitting CEO and to deal with the hard questions and answers while actually going through the process of making change.

"...The thing that I realized is, this process of change is not something that is a one-time process. It's this continuous journey of pushing yourself to renew, and the difficulties of doing it, because the one thing with change is, it's easy to talk and hard to do."

Three years had passed since the "good karma" moment at GHC14 and Woodruff explicitly brought up Nadella's comment about women and pay raises, asking "You have

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[97] PBS Newshour, November 17, 2017, https://www.pbs.org/newshour/show/how-microsofts-ceo-has-hit-refresh-in-business-and-in-life

talked about how it made you think differently about women in the work force. How so?"

Nadella responded about what happened when he went back to Microsoft.

> *"When I…met with some of the senior women who work with me is when I really understood in a deep way all that is wrong with our system. So, for me to go to a women's conference and say, trust the system, is to disjoint from the realities…. [I]t was a moment where I was able to see it through their eyes, but, more importantly, understand my responsibility."*

In going public with his thinking, Nadella made the argument that the process of change is not a one-time activity, but that instead it's a continuous journey where you keep pushing yourself, reviewing where things are at, and continuously learning and adapting. More importantly he argued that this is the responsibility of a CEO of a company to do this. In the aftermath of the Nadella moment, we see the significance of a leader who positions as organizational catalyst (e.g., like NCWIT's change leaders) - those who commit for the longer haul to being a continuing and essential force for institutional change.

Conclusion

In this chapter, I showed how discourse can play a significant role in the process of catalyzing social change. I examined the Nadella incident at GHC14 as a moment of discourse and analyzed it to see how it informed the process of institutional and cultural change on the issues confronted by women in the tech workplace. Nadella's "good karma" moment at GHC14 surfaced a hidden discourse that ignited counter discourses and thereby served as an example of a type of intervention that was not planned.

As CEO of Microsoft, Nadella was positioned in the most powerful position at his company and he was put on the program of GHC because he was viewed as advocate for

women and would forward ABI's goal of engaging "male allies" in the GHC program.
With the largest gathering of women in computing watching, Nadella made a statement
that revealed his own unconscious bias, and he was forced to confront the implications of
the moment with his statement going viral in social media and being picked up
internationally in the press. In that moment, Nadella was put in the position to
demonstrate public accountability, as well as how to address the issue internally at
Microsoft. Nadella's statement at GHC14 provided audiences at the conference, and
beyond, the opportunity to glimpse a substrate of unconscious bias, by an otherwise well-
intentioned male ally. As an element of discourse, the moment demonstrated the need
for accountability, especially public accountability in making long-term change.

Ironically, Nadella's moment of public reckoning may have had more impact, in
practice, than Microsoft's unconscious bias training program could do alone. As a semi-
durable moment, Nadella's statement has already lived longer than the length of the
effect of a typical diversity training session. Indeed, the unfortunate finding of Dobbin's
and Kalev's (2016) 30-year longitudinal study on diversity programs concluded that
"[t]he positive effects of diversity training rarely last beyond a day or two, and a number
of studies suggest that it can activate bias or spark a backlash." (p. 54). This is not to
suggest that unconscious bias training is devoid of value, but it should not be treated as
the new "silver bullet" for addressing gender bias in the tech workplace. While
unconscious bias training may be helpful within an overall program of change, more
research is needed to see if the results of the latest approaches to bias training programs
differ from those of previous decades.

In the next chapter, I explore in more detail the role of the male ally and the male advocate. Both ABI and NCWIT, as not-for-profit organizations, have taken the position that motivating men to act alongside women as change agents is essential to improving the cultures in tech.   For the case analysis, I examine their work in this area to understand the opportunities and the challenges of bringing men into a collaborative position with women to directly address issues of bias.

CHAPTER 7
The Prospect and the Dilemma of Male Advocates and Allies

What about the role of men? This chapter delves into the questions about the role that men can play and their motivations to contribute to improving the status of women in computing.   How are men participating in the discourses and practices that affect women in the technology sector? How can men be engaged in discussions about gender? How do they become motivated to be part of the solution to the underrepresentation of women in computing? As Prime and Moss-Racusin (2009*)* observed,

> *"Since much of the discourse on gender has focused on women's experiences, relatively little attention has been paid either to defining masculine norms or their impact in the workplace. This imbalance is regrettable, because how men negotiate masculine norms is a key determinant of whether they support or resist efforts to close gender gaps in the workplace." (p. 3)*

Both NCWIT and ABI have developed new programs to explicitly engage men in more meaningful ways. These programs have been framed as engaging "male allies" and "male advocates." Both of these terms share the common element of allegiance; in practice, the distinction between them is subtle and it is more useful to consider them interchangeable, while still acknowledging that there is a difference between speaking in allegiance with women and taking specific actions in support of women. In 2018, the work of NCWIT and ABI in engaging male allies has even more resonance given a preponderance of mainstream press coverage about gender bias, discrimination, and sexual abuse in the workplace, as expressed by the #MeToo hashtag[98] that evolved to become a movement.

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[98] #MeToo moment on Twitter, https://twitter.com/i/moments/919676975698112512?lang=en

In this chapter, I begin by reviewing the history and context of the two dominant motivations for diversity interventions in corporations – *business performance* and *social justice*. With this background, the next section considers a specific discourse artifact produced by NCWIT based on its qualitative research about why and how men are motivated to become male allies and advocates. Since 2012, components of the "NCWIT Male Allies Toolkit" have been disseminated by NCWIT to guide practitioners in cultivating and engaging male allies and to inform those who are interested in organizational change. The centerpiece discourse artifact that grounds the toolkit is the research report about male advocacy published in the 2015[99]. The planners of the Grace Hopper Conference are among those who have used these NCWIT resources on male allies and advocates. Specifically, GHC staff members acknowledged that they used these resources when planning the first "male allies panel" at the 2014 Grace Hopper Conference (GHC14). In the final section of this chapter, I analyze what happened at that male allies panel, along with the aftermath a year later at GHC15. As an empirical example of engaging male allies in practice, this case focuses on the discourse of the male panelists and the female audience members' reactions. Four male panelists spoke to a majority female audience when friction erupted on Twitter, allowing elements of discourse that had been repressed and unspoken to became spoken. This case illuminates the power of discourse in terms of unintended consequences, the power of resistance, and how discourse can catalyze positive social change.

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[99] https://www.ncwit.org/resources/male-advocates-and-allies-promoting-gender-diversity-technology-workplaces

From a theory of discourse perspective, I observe that the direct engagement of male allies at the GHC14 panel provided for an ahistorical "irruption" of a real event, where important perspectives could be glimpsed and reclaimed from the realm of Foucault's "never said." For Foucault (1972), this is a silence in a manifest discourse that is *"… really no more than the repressive presence of what it does not say"* (pp. 27–28) . Until provoked, silence is a repressed knowledge that can undermine that which, itself, represents.

Motivations for Diversity – Good Business and Social Justice

This section prepares the reader for the case study section later in the chapter. To consider the overall motivations and effects of diversity policy, it is necessary to consider what particular policies are intended to do and what the measures of success can be. Thinking in terms of a framework for gender policy analysis, I have conceived of two axes that represent the dominant motivations for diversity policy in corporations - business performance and social justice. When a policy intervention is rooted in principles of justice (e.g. equality of opportunity, public good), critiquing it for a lack of concrete material results or measurable financial gain could be considered an unjustified confounding (muddling?) of the goals of justice with the means of production. Conversely, a judgment made about a policy that was instituted with an explicit goal of improving measured output (e.g., higher production volume) or institutional performance (e.g., higher profit), but was evaluated solely on principles of justice, could be seen by some as a confusion of ends and means. But, thinking about policy through the frames of justice and performance *together* can help us observe how the two sensibilities interact, and can shed light on those examples where both justice and utility can be served by a

single policy, or by multiple policies that, in aggregate, have the effect of serving both. Next is a review of history and basic principles of the two axes - performance and justice – that are central to the discourses of diversity policy.

The business motivation - innovation and improved performance

The dominant public narrative of most corporate diversity programs – both past and present - is about producing products and reaching broader markets, suggesting that the primary motivation for diversity policy at companies is still business performance. If we look at the diversity policy statements of three tech giants of Silicon Valley, we see elements of this business narrative.   Facebook's Director of Global Diversity said, "*diversity helps us make better products, make better decisions, and better serve our community.*"[100] Google's CEO says "*a diverse mix of voice leads to better discussions, decisions, and outcomes for everyone.*"[101]. Janet Van Huysse, Twitter's VP of Diversity, "*[w]e want the makeup of our company to reflect the vast range of people who use Twitter. Doing so will help us build a product to better serve people around the world*"[102]. Overall, while such arguments express various notions of inclusiveness, eventually they all come down to the corporate bottom line of performance, which suggests that many business leaders will feel the pressure to motivate diversity with the business case first.

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[100] https://newsroom.fb.com/news/2017/08/facebook-diversity-update-building-a-more-diverse-inclusive-workforce/
[101] https://www.google.com/diversity/.
[102] https://blog.twitter.com/official/en_us/a/2015/we-re-committing-to-a-more-diverse-twitter.html

Looking at the history of the term of "valuing diversity" we can see that it became a common part of narratives of corporate policy in the 1980s. While prior to this time there had already been justice-driven national interventions (civil rights act/equal pay/affirmative action and the compliance requirements of the EEOC), by the 1980s, the notion of diversity as a business strategy became prominent in the newer narratives of diversity management that asserted that diversity could lead to increased performance and profitability. Ozbilgin and Tatli (2011) define "diversity management" as a "management philosophy of recognizing and valuing heterogeneity in organizations with a view to improve organizational performance" (pp. 1230–1231). From a motivational standpoint, many companies embraced the argument that diversity is one of many components of a good business strategy that included attracting the best talent, opening up new markets, and thereby improving profitability (Cox & Blake, 1991; Robinson & Dechant, 1997; Weigand, 2007).

Early corporate diversity programs were notable for the role that CEOs and top executives played in advocating for equality and explicitly linked gender and racial diversity to business performance. In 1935, IBM was one of the first companies to recruit professional women into its workforce and to articulate principles of equal pay and equal opportunity before the civil rights era (Thomas, 2004). IBM founder T.J. Watson Sr. declared, "men and women will do the same kind of work for equal pay - the will have the same treatment, the same responsibilities and the same opportunity for advancement" (IBM, 2012; Thomas & Kanji, 2004a). However, despite IBM's early history of hiring women and minorities, by the 1980s and 1990s it was increasingly perceived as a company of "men in white shirts" (Thomas & Kanji, 2004a, p. 5).

Confronting new competitive challenges of a changing computing environment, IBM was forced to adapt. The new CEO[103] declared that workforce diversity would be an area of strategic focus and a senior VP[104] recognized a dilemma –the tendency of IBM to value uniformity could also be a liability for the company. They set in motion a program to instill a sense in management that *difference*[105] was valuable for *business progress* (Thomas, 2004; Thomas & Kanji, 2004b).

The "good for business" narrative was expanded when other companies promoted the notion that *diversity fuels innovation.* In the 1980s, this refinement of the business argument emerged at Corning Inc., one of the companies to explicitly articulate and promote the relationship between diversity and innovation. The diversity program of Corning was initiated in the 1980s under the leadership of CEO Jamie Houghton who was quoted as being "appalled" that women and people of color did not feel valued and felt they were not able to contribute (Robinson & Dechant, 1997, p. 28). Corning also framed its diversity initiative in relation to the goals of Total Quality Management (TQM) program arguing that the loss of female and black employees presented a "high cost to quality" (Dobbs, 1996, p. 354; Dyer & Gross, 2001, p. 409). Over time, Corning more explicitly linked diversity with the term "innovation", consistent with its narrative

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[103] in 1993 Lou Gerstner took the helm as CEO of IBM.
[104] At that time IBM vice president was Ted Childs
[105] It is worth noting that over time companies began to expanded the definition of diversity to include age, class, differences in knowledge and skills, differences in values and beliefs, differences in personality, differences in status, and position in social networks (Mannix & Neale, 2005, p. 36).

of how it was promoting its overall corporate identity[106] ("Corning Culture of Innovation," 2014; Henderson & Reavis, 2009, p. 6; Leary, 2007, p. 13).

The justice motivation - fairness and the public good

The early examples of corporate diversity programs discussed above are notable for the role that CEOs played in setting policy to improve the recruiting and retaining of more women and racial minorities. These CEOs also articulated principles of equality and fairness, which were endemic to the fundamentals of the justice argument for diversity.

In the 1980s and 1990s, theories emerged in the area of *business ethics* and corporate responsibility that served to temper hard-core economic views[107] of diversity. Werthane and Freeman (1999) argued against the "separation thesis" that divorced issues of ethics from issues of business.   Once the separation of business and ethics is abandoned, they argued, actors in business can be participants in a common morality whereby corporate responsibility and institutional policy become components of creating a good society (p 7).   Tensions between American values of capitalism and democracy have also been explored by McClosky and Zaller (1984) who observed that "[w]hile most Americans favor a competitive private economy in which the most enterprising and

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[106] Throughout its history, Corning maintained continuous cycles of innovation, starting with glass bulbs for Edison's light in 1880, to Pyrex for consumer and scientific applications, to flat glass display panels for computers, to optical fiber for communication networks, and Gorilla glass for smartphones

[107] Classic theories of market-oriented economics might be viewed by some as a form of extreme utilitarianism, built upon foundations such as Adam Smith's self-interest or Milton Friedman's rational choice, both foundations for ideologies that claim the greatest good can be best achieved in a capitalist society.

industrious individuals receive the greatest income, they also want a democratic society in which everyone can earn a decent living and have an equal chance to realize his or her full human potential" (p. 272). Hendry (2004) wrestled with these tensions in what he described as a "bimoral society" that wants both moral obligation and market self-interest. This dichotomy presents challenges that demand a new business ethics that can close the breach (pp. 168-171).

Today, motivating men to embrace responsibility for diversity still remains a challenge. A recent study conducted by Lean In and McKinsey found a disconnect between men's beliefs and their action when it came to engaging with issues of diversity and bias. Survey results indicated that while 62% of male senior managers felt that diversity was personally important, a smaller percentage actually called out issues when they saw them. Specifically, 53% of men thought that giving priority to gender diversity issues would compete with their focus on individual performance. (Lean In & McKinsey & Company, 2016, pp. 19–20) These results suggest that a significant percentage of the men surveyed were not "walking the talk." As argued by Prime and Moss-Racusin (2009), when considering "why have so many programs missed the mark?", the answer is that most have not directly engaged men in a meaningful way.

> *"Regrettably, in their exclusive focus on women, rather than engaging men, many companies have unwittingly alienated them, inadvertently jeopardizing the success of their gender initiatives. Without the avid support of men, who are arguably the most powerful stakeholder group in most large corporations, significant progress toward ending gender disparities is unlikely." (p. 2)*

Motivating and Cultivating Male Allies

NCWIT's original research study on male advocacy found that 77% of men were convinced by "business-case" arguments such as attracting diverse customer markets, hiring essential talent, and improving innovation through diversity. Only 38% of men said they were convinced by moral reasoning aligning with the justice argument (C. Ashcraft et al., 2013). While these findings reinforce the significance of the business argument, NCWIT researchers also reported that many men responded well to anecdotes, stories and ethical reasoning that align with principles of justice and fairness.

>*"While economic arguments were important in gaining initial buy-in, many men suggested that it was the anecdotes and the moral reasons for change that motivated them to action and that kept them going" (2013)*

This qualitative research study by NCWIT shed light on several things: how men understood themselves in the role of male advocate; why men were willing, or not, to be one; what motivates men to speak up or remain silent, and why they do/don't take action when they observe an incidence of gender bias or discrimination. More broadly, in an interview with me, NCWIT CEO Lucy Sanders recognized the importance of paying attention to diversity as a business issue when talking to executive-level leaders in Silicon Valley and the tech sector.

>*"The corporate tech space has not looked at it as a business issue until just recently - as an issue that deserves CEO attention. And when you have an issue in business and the CEO is not paying attention to it, then it's not a business issue. DONE! - you're not going to get traction."*

With men being the dominant group in Silicon Valley and the tech sector, their involvement as male allies and advocates becomes a critical factor in the transformation of the workplace. With regard to the work of cultivating and motivating male allies, an

understanding of the *multi-modal discourse* that underlies these efforts is essential.

Specifically, the two primary justifications for diversity policy discussed earlier - the

economic argument (i.e., diversity is good for business) and the justice argument (i.e.,

fairness and moral principles) are key elements of the discourse of male allies and

advocacy.

Discourse Perspective on Male Allies

When approaching the concept of male allies and advocates from a discourse

perspective, I considered the integration of multiple "texts" in the Foucaultian total

discourse sense. Methodologically, Fairclough (1992) encouraged an analytical

framework of *intertextuality* to surface patterns of discourse that are "multiply

determined." This approach not only acknowledges that history is absorbed into texts,

but also attends to the power dynamics of the "processes of contesting and restructuring

orders of discourse"[108] (pp. 101–110). Analysis of intertextuality can surface multiple

meanings and subject positions in "texts" and reveal underlying tensions that have the

potential to erupt.

> *"Intertextuality is the source of much of the ambivalence of texts. If the surface of
> a text may be multiply determined by the various other texts which go into its
> composition, then elements of that textual surface may not be clearly placed in
> relation to the text's intertextual network, and their meaning may be ambivalent;*

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[108] Note how intertextuality relates to theories of hegemonic struggle in the broader sense. In
Fairclough (1992) words, "[t]he combination of hegemony theory with intertextuality is
particularly fruitful. Not only can one chart the possibilities and limitations for intertextual
processes within particular hegemonies and states of hegemonic struggle, one can also
conceptualize intertextual processes and processes of contesting and restructuring orders of
discourse as processes of hegemonic struggle in the sphere of discourse, which have effects upon
as well as being affected by, hegemonic struggle in the wider sense" (p. 103)

different meanings may coexist, and it may not be possible to determine "the"
meaning. (p. 105)

With the recognition that different subject positions co-exist, a framework of

intertextuality can reveal the relationships among different elements of discourse that

may contradict each other, or that may obscure the other facets of discourse, especially

when some elements are not explicitly stated.

I also observe that particular genres of discourse can facilitate and amplify the

visibility of struggles that are unresolved, or that are in different stages of resistance. In

the next section, I examine utterances of male allies in a public forum, and the

relationship of these to the broader discourses of gender bias and diversity in the

workplace. Through this analysis, we can see how hegemonic struggle can erupt (e.g.,

revealing the dilemma of male allies), but also how signs of movement toward resolution

can emerge (e.g., the prospect of male allies in contributing to social change). Before

moving to the case example, I highlight an element of discourse that focused attention on

a particular theme in of male advocacy (Figure 13).
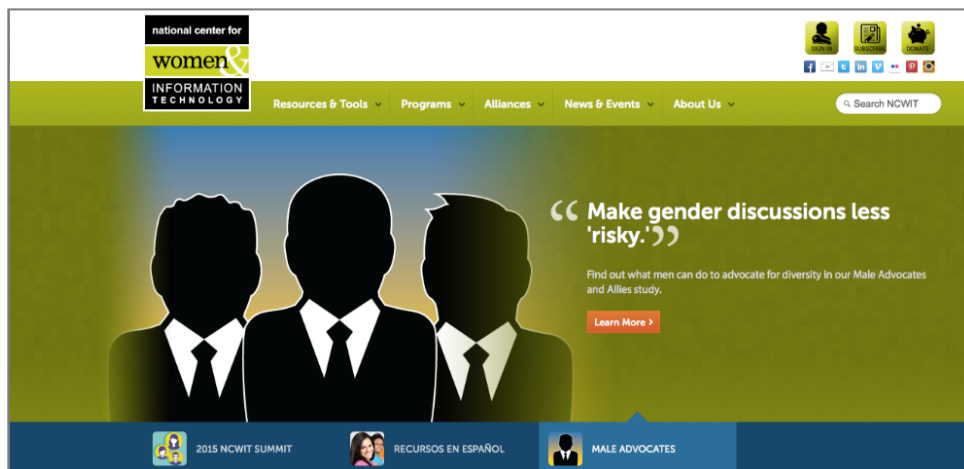
Figure 13. Male Advocacy Risk Message on NCWIT Website[109]

The above artifact adds a message of *risk mitigation* to the discourse of male

allies with a simple and stark assertion on the NCWIT homepage: *"make gender*

discussions less risky".   This is a sign of underlying tension and struggle, specifically

that women need men to speak up about gender bias in the workplace, but that men can

be reluctant to speak up about gender bias due to feelings of discomfort, fear,

nervousness, and a generalized sense of risk (Catherine Ashcraft et al., 2013). This

webpage was linked to multiple NCWIT Resources that provided the broader context of

the message, including a full report and other derivatives.   For example, the "Top 10

Ways" [110] practitioner guide (Figure 14) puts the risk message alongside other best

practices for being a male advocate (see item #9 highlighted in the enumerated list).

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[109] NCWIT Homepage, captured 8/17/15 by Internet Archive Wayback Machine
http://web.archive.org/web/20150817144143/https://www.ncwit.org/
[110] Top 10 Ways to Be a Male Advocate, 2012, https://www.ncwit.org/resources/top-10-ways-be-male-advocate-technical-women
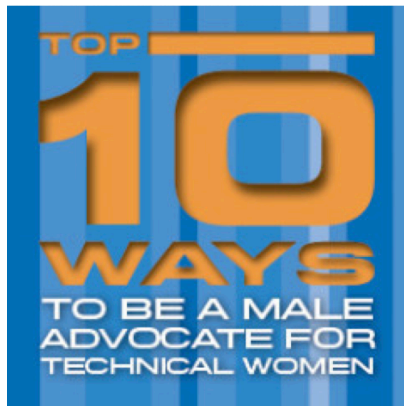
1. Listen to women's stories
2. Talk to other men
3. Seek out ways to recruit women
4. Increase the number and visibility of female leaders
5. Mentor and sponsor women
6. Notice/correct micro-inequities or unconscious bias
7. Establish accountability metrics
8. Model alternative work/life strategies
9. **Make discussions of gender less "risky"**
10. Reach out to formal and informal women's groups

1

Figure 14. Top 10 Ways to Be a Male Advocate[111]

An intertextual analysis can bring to light lurking tensions in the texts and broader

discourses surrounding of male allies. The intersections of the discourses of gender bias

and male allies have many potential ambiguities and tensions that sometimes can erupt

with tensions and dilemmas. But they also reveal possibilities for resistance and the

creation of new discourses.   Next, I look at one case that demonstrates how the discourse

of male advocacy can manifest as a dilemma filled with tensions in one moment, and an

exemplar for social change in another.

Case Example: The Dilemma and the Prospect When Things Erupt

Consistent with the views of NCWIT leadership, the CEO of ABI, Telle Whitney

has been very clear about the importance of men and women working together in an open

and honest way to achieve culture change in tech.

> *"[O]rganizations need to look squarely at their cultures and reshape them to
> ensure women can thrive. It is critical for organizations to effectively engage both*

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[111] Source: www.ncwit.org/top10maleadvocate

their female and male leaders—many of whom are well-intended and help them understand how to create these changes in their own cultures"[112].

At the strategic level, the goals of ABI and NCWIT are in sync about the importance of men and women working together in dialog and practice to make culture change. But the GHC14 male allies panel faltered in the specific manner that it was executed. Prior to the GHC14, Whitney publicly announced in her blog the rationale for engaging of male allies on the front stage at the Grace Hopper Celebration. She revealed to the public that ABI intended to provide a forum to engage both men and women in healthy dialog about the issues women face, the experiences of men, and the challenges of changing embedded cultures together.   Whitney also announced the creation of a Twitter hashtag (#MoreThanWords) that she hoped the broader community would use to further engage in discussions about male allies[113].

The GHC14 male allies panel that was held on Wednesday evening October 8, 2014 was the first program of its kind at Grace Hopper. The panel consisted of four male executives – Blake Irving, CEO of GoDaddy, Alan Eustace, SVP of Google, Mike Schroepfer, CTO of Facebook, and Tayloe Stansbury, CTO of Intuit.   There were signs of tension and friction even before event was kicked off. Some complained that ABI was devoting an entire plenary session to men when GHC was supposed to be about gathering women and showcasing women's accomplishments.   Others were upset about the particular panelist invitations, especially that an invitation was extended to Blake Irving, the new CEO of GoDaddy.

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[112] See Whitney's comment in blog, https://anitaborg.org/blog/from-telle-why-were-inviting-men-to-the-table-at-ghc-2014/
[113] MoreThanWords, https://ghc.anitab.org/news/whywomencode-morethanwords/

My interviews with both NCWIT and ABI leaders indicated that the GHC staff members had engaged with NCWIT's resources about male allies and advocates when planning the male ally events at GHC14. But the devil can be in the details. Prior to the male ally panel event, it was widely recognized that GoDaddy was a tech company that was notorious for offensive and sexist portrayals of women in its advertising. These concerns and others were expressed online in Twitter attached to the hashtags *#ghcmanwatch* and *#ghc14*. Examples tweets included, "some people think it's completely inappropriate to have GoDaddy's CEO on panel" and "I get that that this is hard to reconcile. Those ads were horrendous."   A minority of tweets in this channel expressed support for the male allies panel and for the GoDaddy CEO, which Irving responded to on his blog[114].

In response to these early reactions, Whitney wrote to the GHC community explaining the inclusion of Blake Irving, the GoDaddy CEO, on the male allies panel.

> *"People have asked me about GoDaddy or have complained that they would even be included. In the past, GoDaddy has used branding and messaging that was offensive to women, yes. They've also changed CEOs since then, hired an extraordinary female CTO, and sought out the counsel of the Anita Borg Institute and many other thought leaders in this area—and actively listened…. I've met with their CEO, Blake Irving. I've met with their executive staff. I've heard from many of the women who work there. They are embarking on a journey of change, and my experience is that changing culture takes time."*https://anitab.org/blog/from-telle-why-were-inviting-men-to-the-table-at-ghc-2014/

Whitney maintained her focus on the bigger mission and on how ABI was working with everyone – women and men - to change the culture of tech. She stood

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[114] In fact, Blake Irving thoughtfully responded to the skeptics on his blog. See: https://blakesblog.com/2014/09/a-thoughtful-minute-for-liz-henry/

steadfast in her position that she and the ABI Board were committed to engaging male

allies and would continue to try new things when developing new programming to enable

useful dialog to occur.   Nevertheless, not everyone understood why the male allies panel

was useful.   Some didn't like that the panel was staged as a group of men talking among

themselves in the public forum of a majority of women and without Q&A session.

Others interpreted the panel as an event where men would just "talk at" women in the

audience using old and worn platitudes. Others thought the panel took over a significant

time slot at a conference whose purpose was for women to gather and showcase their

achievements.

Flames at the Male Allies panel at GHC14

Viewpoints, such as those highlighted above, were expressed on Twitter by the

"Union of Concerned Feminists,[115]" a group that defined itself on Twitter as "*a guerilla*

intervention group which seeks to support actual feminist activism in tech, not dude

CEOs." The Union was active on the topic of the GHC14 male ally panel, with tweets

ranging from general comments to pointed criticism and activism. Some members of the

group staged a Bingo game for women in the audience to participate, encouraging players

to flag every time a male ally panelist made a statement signaling gender bias.   As seen

in Figure 15, when the male allies panel was in progress, audience participants were able

to play a game of "Ally Bingo" using bingo cards whose blocks contained phrases of

anticipated sexist or biased statements.

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[115] Twitter Union Concerned Feminists, https://twitter.com/concernedfems
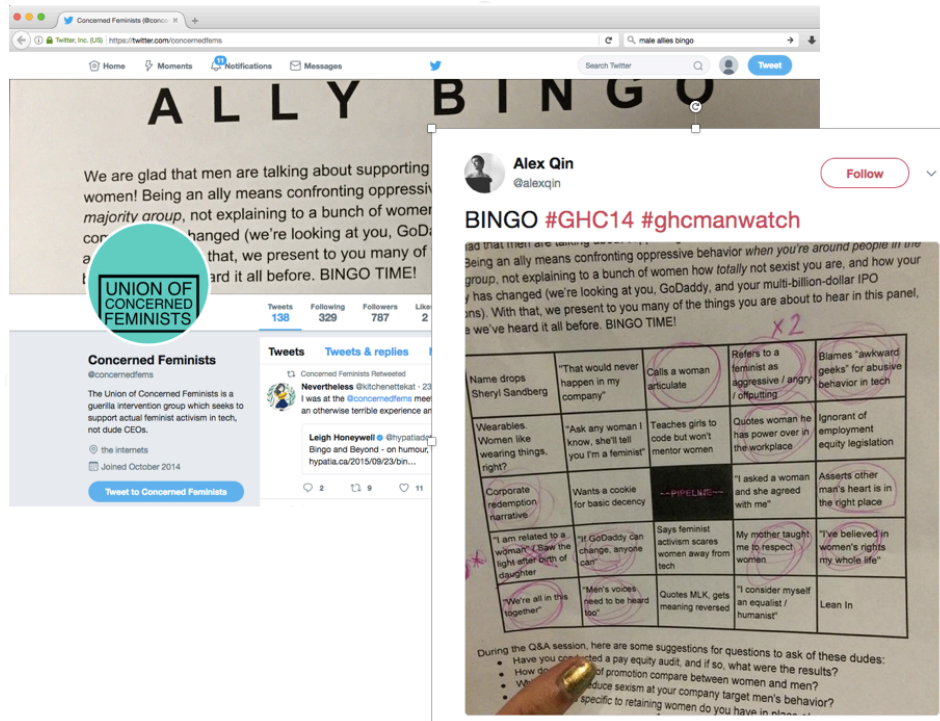
Figure 15. Ally Bingo at GHC14[116]

The rules of the game were that an audience member wins the game when completing the either a row, a column, or diagonal on the Ally Bingo card. As seen in Figure 15, the winner yelled "Bingo!" when she completed a diagonal on the card, having checked off comments that included: ["*if GoDaddy can change, anyone can*"] and ["*blames awkward geeks for abusive behavior in tech*"], along with any general reference to the *["pipeline"]*. After the winner yelled out "Bingo" from within the live the audiences, she tweeted "*the mallies were very confused*",[117] an indication that the game was viewed by the participants as a type of subterfuge.

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[116] Source: https://twitter.com/concernedfems
[117] Winner of Male Allies Bingo,
https://twitter.com/alexqin/status/520034661943107585?lang=en

Twitter commentators continued to expressed concerns and anger before and after panel. Some were frustrated and thought the male panelists were repeating well-worn advice and not providing any new insights. One commenter said, "we've been listening to the same rhetoric year after year; it's time to take more action – by those with $ & position."   Another tweet implied that the male panelists were only motivated by their own interests of money and power, while others gave a particularly negative reaction to the presence of the GoDaddy CEO. Some suggested that the panelists were making statements that showed a lack awareness of gender issues. As a contributing writer to ReadWriteWeb opined, "the real problem turned out to be the remarkable tone-deafness of all the male panelists, none of who seemed to understand what women go through."[118] But many others in the audience did not speak or were not aware of the activity that was on Twitter during the panel.

The post mortem – could this dilemma have been avoided?

The immediate aftermath came in the form of opening up a forum for a counter discourse by the women of the audience. As seen in a tweet after the panel ended (Figure 16), this was initiated by one of the male panelists, Alan Eustace of Google.

Alan Eustace @alan_eustace · 9 Oct 2014
#ghcmanwatch. Let's reverse the male allies panel. You talk. I listen. Telle gave me West 201 board room at 2pm today at GHC.

Figure 16. Tweet from Alan Eustace

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[118] Larson, ReadWrite, https://readwrite.com/2014/10/09/technology-sexism-male-allies-grace-hopper-celebration/

In response to the activism in the audience, Eustace organized this event to provide a context where the male ally panelists could listen to women's concerns and promote constructive dialog between the panelists and the women who were the audience[119].

From the ABI perspective, the male allies panel was part of a new strategic programming effort that was motivated to increase involvement of men in pursuing the ABI mission. While the male allies panel was well-intentioned when the ABI conceived of it, there was significant backlash after it execution. Several people I interviewed at NCWIT indicated that it was a "disaster" and a "debacle," while most of them saw it as very unfortunate. In my interview with her, one ABI leader reflected on the unintended consequences of both of male allies events at GHC14 with notable concern.

> *"...[T]here was a bunch of Board members who had gotten on this male allies panel and it hadn't gone well.   And, of course, you try this stuff and see how it goes, and so that coupled with the Nadella thing. There were a number of board members, men and women, who were worried that if Grace Hopper becomes a place that people are just going to get smashed for not being the right gender, then that's going to prevent the stuff we're trying to do."*

There seemed to be some disagreement (or possibly misunderstandings) about how, and whether, the male allies event at GHC14 could have gone better. GHC planners believed they were influenced by NCWIT's research and tools in the planning the male allies panel. For example, the morning after the male allies panel happened, ABI's VP of programs announced at the opening plenary that ABI had engaged with NCWIT's

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[119] Twitter reactions to the reverse panel can be seen at https://storify.com/catehstn/ghcmanwatch-mark-2

research and tools when planning the male allies panel[120].   She provided the audience

with a special URL to NCWIT's website where attendees could access NCWIT material

that had influenced the planning of the male allies event. Eventually this URL on

NCWIT's website was redirected, breaking the direct linked association of the NCWIT

resources with the GHC male allies event. We can see evidence this redirect of

NCWIT's GHC male allies page using the Wayback Machine.[121]

However, members of the NCWIT research team reported that they had a minor

role in "prepping" ABI staff for the GHC male allies events, limited to a couple of

conversations and access to NCWIT resources. Another NCWIT leader observed in my

interview that some members of the GHC14 audience "came loaded for bear" and that

following the advice and best practices outlined in NCWIT male allies resources could

have prevented the outbreak of tension. The evidence of the interchanges between GHC

and NCWIT before GHC14 occurred is ambiguous. A transcript of the male allies panel

contains a statement by ABI's VP of programs who made the point that "male ally work

is about men helping men talk to men."   She continued,

> *".... Because they don't need to talk to us. We know what's going on. They need to talk to other men about why this issue's important and point out where unconscious bias is, how they manifest."*http://juliepagano.com/blog/2014/12/02/male-allies-panel-transcript/

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[120] ABI staff also tweeted this. See https://twitter.com/ghc/status/520233271016177667

[121] As of July of 2015 this page (http://www.ncwit.org/GHCmaleallies) was redirected, as seen in the Wayback Machine. This is significant to the extent that NCWIT and ABI disagreed about how NCWIT's male allies research was used to informed the male allies panel. See https://web.archive.org/web/20150705123857/http://www.ncwit.org/GHCmaleallies at the Internet Archive.

While NCWIT encourages men to talk to each other, key members of the NCWIT research team believed that the staging of the GHC male allies panel with only men talking to each other was a critical error in ABI's strategy for the GHC14 program. One NCWIT researcher reflected on the predictability of what had happened at the male allies panel and the "big blowup at Hopper." Taking a critical and empathetic position, this NCWIT team member said in my interview,

> *"[W]e would never have an all-male panel, especially to an all-woman audience. So, there were things like that that they didn't do... things about that panel that you could see, right away... You could predict that it wouldn't go so well. But I'm not going to say that they willfully ignored things, I mean… they just didn't do things that we would do or recommend. I think … they violated some principles that lots of people have violated, right? Because these are tricky things to do…. and I don't really know why or how that happened, but it ended up being a little bit of a backlash. I think they ended up handling, or at least one of the panelists ended up handling it, really well."*

This NCWIT team member also reflected in that interview on how one of the panelists handled the backlash constructively. She was referring to Alan Eustace who convened a "reverse panel" to convene the next day at GHC where women could talk back and ask questions.

> *"when it kind of went up in smoke, he [panelist Eustace] created sort of an impromptu session the next day for them to just listen and hear feedback from the women and advice from some of the women on what went wrong. In the end, I think it was actually a really powerful example of how even when something goes wrong, if you have a good response, you get some productive things that come out of that."*

Ironically, the reverse panel took place the same day that Nadella and Klawe morning plenary occurred making Wednesday and Thursday at GHC14 two days when the discourse of the prospects and dilemma of the male ally had an international reach.

In terms of what was to be learned from the GHC14 experience of the male allies panel, NCWIT staff believed that the key to having had a successful male allies panel was to include both *men and women* on the panel. There was the recommendation, stated in an interview, to have events that were not just men "…to make sure they don't look like they are coming out on white horses telling women what to do."

GHC15 - one a year later

In 2015, outside of the discourse of the main conference sessions of GHC15, discussions continued on Twitter including a tweet linking to an independent blogger's admission to being the instigator of the Allies Bingo game at GHC14.

> *"I've long found bingo cards to be a particularly hilarious form of social commentary. Bingo cards are a way to point out commonly used weak arguments by people who don't understand a social justice cause… That's right. You heard it first right here on hypatia dot ca: I was the primary voice behind the "Union of Concerned Feminists," and instigator of last year's bingo card shenanigans."[122]*

I was onsite as a participant observer at GHC15, and one of my goals was to observe how male allies would be addressed at the conference one year later. During the opening plenaries, I listened for public acknowledgment of what had happened at the previous year's the male allies panel, as well as any comments about what happened at the Nadella plenary. I was struck by what was *not said* during the most well attended public plenaries of the 2015 conference. I expected more acknowledgement of what was learned from ABI's first attempt to engage male allies in a public forum of discourse, and the silence in the main plenary sessions took me by surprise. Finally, late in the afternoon on Day 1 of the conference, the silence in

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[122] Hypatia.ca Blog, https://hypatia.ca/2015/09/23/bingo-and-beyond/)

the public plenaries was broken. A panel session was kicked off by the Chair of

ABI's Board, Fran Berman, who announced to the audience, *"this is going to be very*

special panel. Today we are going to talk about something that most of us think

about a lot… transforming the culture of tech." This was not the male allies panel

redux, but a session with four speakers, three females and one male on the topic of

institutional change.

In her introduction, Berman reflected that transforming the culture of tech is

hard, that it takes a really long time, and that ABI works with companies to develop

strategies for transforming organizations. This plenary, she said, was planned to

engage individuals who are working hard, and one of these was Blake Irving, the

CEO of GoDaddy.   Berman introduced Irving as someone who "put his resources

where his mouth is to create a cultural shift at GoDaddy, a company that has bad

reputation for sexist advertising."[123].   Berman avoided acknowledging the tensions of

the GHC14 male allies panel, but Irving took that on himself.

Prospect of Male Allies - GoDaddy CEO Takes the Stage at GHC15

After Berman's introduction, Blake Irving called out the white elephant in the

room. Having been the most controversial panelist on the GHC14 male allies panel,

he opened with the statement,

> *"I know what some of you are thinking … because I read your tweets…. I was on*
> *the male allies panel last year. So, let me just say it. 'Why is god's name am I*
> *here, and what am I doing taking up your time on your stage? Aren't you the*

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[123] http://bubbva.blogspot.com/2015/10/ghc15-transforming-culture-of-tech.html

company that objectified women in their advertising for years?' Yes, that was GoDaddy."[124]

Irving was there to tell a story. He was there to offer transparency and to reveal the reasons he took the position as CEO of GoDaddy. Regarding GoDaddy's past history of its sexist advertising Irving said, *"... what should bother us is that those ads brought a massive amount of business to the company." And yet there were women there. How was that possible?".*

Blake pursued the last question. Why were women working at GoDaddy given the company's tawdry public reputation? Irving saw two truths when he examined the state of the company, saying "Never had I encountered a company that was so different on the inside than the external view of company." What Irving encountered at GoDaddy was a company with the same percentage of female employees as other tech companies (he acknowledged this was not enough), but he also saw an internal culture at GoDaddy that was compassionate and highly motivated to serve its customers. Significantly, he recognized that GoDaddy's major customer base was small businesses, and that 58% of small business in United States are run by women. In deciding to take the job of CEO, Irving saw the prospect of reconciling the dissonance he saw between the public view of GoDaddy and the internal culture of the company.

This was the story of transformation of a company with a tawdry public reputation. It was a story of how a strategy built upon principles of both business performance and social justice can be successful. Focusing on GoDaddy's results since

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[124] https://ghc.anitab.org/2015-speakers-honorees/2015-speakers/blake-irving

he became CEO, Irving shared the new diversity statistics of the company,[125] revealing

the progress that had been made in hiring women into tech positions, as well as

promoting women at the highest executive levels at the company. GoDaddy now had

females in the roles of CTO, COO, and senor product executives.

The Irving plenary was a powerful correction for what had happened the previous

year in ABI's first attempt to engage male allies at GHC forum of discourse. This year,

what the audience heard was a CEO who wanted to show the world what a real male ally

looked like. Irving became the model for the male ally/advocate and concluded his talk

by posing a challenge to Silicon Valley.

> *"I want to challenge my peers and other tech companies… to shine a light on*
> *your practices. If you are a leader of a tech company be vulnerable again and*
> *again. Learn to lift the problem from the dark. Don't hide it. Go public with*
> *your diversity stats. Do the research to create an environment where everyone*
> *can thrive."*

He ended by thanking the Anita Borg Institute for letting him tell the GoDaddy story.

Having been on site at GHC15, I directly observed Irving's talk, as well as the

audience's reaction to it. Irving was passionate and compelling. Here was a CEO

reflecting on how to dig deep while leading a diversity turn-around of a major tech

company. Irving discussed how he paved a new path for GoDaddy - one that everyone

could be proud of. Irving revealed his personal story and gave a behind-the-scenes view

of what motivated him become CEO and why he chose to return to GHC after what had

happened at male allies panel the previous year. He revealed his personal inspiration, his

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[125] GoDaddy diversity and salary statistics, https://www.godaddy.com/garage/godaddy-2015-gender-diversity-and-salary-stats-infographic/

sister who had died, and his promise to her that he would fight for women, just as she did

in her life and career. He would fulfill his promise as a compassionate leader in Silicon

Valley. Irving was direct and uncompromising, saying to the audience, "*bad things live*

in the darkness" and that we must shed light on them. He believed that the GoDaddy

story revealed both the complexity and the prospect of male allies.

> *"It's our job as leaders to provide transparency … again and again we see when*
> *you bring things into the light they improve. As a leader in tech, it's my*
> *responsibility to shine the light on state of women in technology, shed light on*
> *real problems across the industry, and shed light on the statistics."*

In the previous year at GHC14, Irving was the centerpiece of the discourse of

resistance in critical tweets. In great contrast, a year later at GHC15, Irving received a

standing ovation at the end of his plenary.   I observed how ABI changed its approach to

engaging male allies in the public forum of discourse of the Grace Hopper Celebration.

This year the panel format was different, featuring a style of discourse grounded in

personal narrative and a compelling story of transformation.   After his talk, Irving joined

a panel with female technology leaders on stage[126] to engage in a discussion about

organizational change, with moderation by ABI's Board Chair, Fran Berman.

Considering the strategic value of the sheer size of the audience of GHC15 (see Chapter

5), there was evidence of durable *mainstream media effect*.   As recently as July 2017,

Irving's discourse at GHC15, and his leadership actions as a male advocate who

produced results, was reported in New York Times in an article optimistically entitled, "*If*

GoDaddy Can Turn the Corner on Sexism, Who Can't?" (Duhigg, 2017).   Irving's

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[126] At GHC15 Blake Irving joined two senior female leaders in tech, Megan Smith, the CIO of the
United States and Clara Shih, technology entrepreneur and CEO.

passionate plenary at GHC15 was not just a recovery story about reversing GoDaddy's history of sexist advertising; it was also an instructional moment of discourse and a counter narrative about the role of male allies in combining discourse and practice towards goals of social change. My personal interview with ABI's Board Chair, Fran Berman, also supported this view. Berman reflected on the positive outcomes of the 2015 engagement of male allies and praised the GHC staff.

> *"I think this year they did a lot of things that I think were really great. First of all, they had a very different kind of program. And as part of the program, the male allies themselves created a network with each other and shared those practices and got to know each other. And of course, I got to moderate the panel with the GoDaddy CEO and the CTO for United States. I was really impressed with him…. And I thought, way to go, this is exactly what we want to see, as well as having men on the stage with women."*

While in 2014 ABI had unwittingly exposed the tensions and dilemmas of engaging male allies, the next year the GHC staff chose to have the most controversial male ally from the previous year come forward for a return visit. This was a strategic response that enabled ABI to recover from the male allies intervention, but more importantly to make the type of progress on engaging male allies that was their original goal. A "debacle" was transformed into a demonstration a better approach to engaging male allies. A new model of the male ally/advocate was established[127], and from the standpoint of discourse and practice, the GoDaddy story served as an example of how speech and action can reinforce each other, coming together as a positive force for social change.

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[127] https://anitab.org/news/abi-in-the-news/blake-irving-transformed-godaddy/

CHAPTER 8
Changing the Focus – Culture Not Numbers!

Both ABI and NCWIT are committed to raising awareness of issues related to gender in tech while also advocating for *change* in organizations. This involves developing creative strategies for making the best use of diversity data (i.e., what data and how it is interpreted) while fostering perspectives focused on new interventions that address issues of culture. The executive leadership of ABI and NCWIT generally embrace this perspective for addressing the underrepresentation of women in computing with a discourse that is grounded with terms such as "cultural" and "systemic." For example, as the CEO of NCWIT passionately argued in one of my interviews, "we believe it's a cultural issue; we don't believe women are broken…. It's a systemic issue. And we need to own it and fix it all together - men and women together. " In terms of the scope of the problem and who is responsible for fixing it, Fran Berman, the Chair of the Board of Trustees of ABI, explained to me that the underrepresentation women of computing is "… a whole community problem… not a women's problem… an everybody problem".

When dealing with interventions for improving diversity, practitioners in the corporate sector can often operate as if there is a *chasm* between a data-centric and quantitative paradigm versus a culture-centric and qualitative paradigm. I frame this chapter with two moments that can be viewed as the two sides of the metaphorical chasm – the first moment is focused on *numbers* in the form of diversity data and the other moment is focused on the cultural complexities of gender bias and occupations. For analytical purposes, I designate the metaphorical *moment of data* as the period of time when Silicon Valley companies publicly revealed diversity data for the first time in 2014.

I then explore a *moment of culture,* which was a provocative plenary session at the NCWIT Summit that asked practitioners to consider bleak and unfortunate truths about cultures that forge occupational identities that must be dismantled before the underrepresentation of women in tech can be resolved. To examine examples of the work that takes place in the chasm between these types of moments, I examine specific cases of programs of ABI and NCWIT that are motivated to improve the value and use of diversity data (i.e., better data and different data), while at the same time shifting the overall focus of diversity initiatives to issues of culture (i.e., committing to the challenging work of organizational and cultural change). The work of the not-for-profit organizations provides a lens into the discourse and practice of social change, specifically motivating companies to make a durable commitment to organizational transformation to benefit the women in the technical workplace and society more broadly.

Bridging Data and Culture

The EEOC, as the primary enforcement agency for equal opportunity, published a special report on diversity in high-tech that recognized that focusing only on the numbers would not solving the underrepresentation of women in tech. The agency reported on contemporary research on gender bias in the workplace and made an important statement about the cultural reasons that diversity matters in Silicon Valley[128]. A significant amount of this report focused on social science research about gender bias and cultural issues. In recognition that the tech sector is *the key area* of future projected job growth in the United States, the EEOC asserted the significant implications that diversity in tech has for society in general.

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[128] It is also notable that the EEOC report heavily cited scholars such as Joan Williams (2014, 2015) and other key research on the issues of unconscious bias (U.S. Equal Employment Opportunity Commission, 2016).

"This is a timely and relevant topic for the Commission due to the growth of this sector, the quality of the jobs it provides, and the influence that this work has on other industries and on society in general" (U.S. Equal Employment Opportunity Commission, 2016).

An important insight in this report was that the EEOC made a distinction between the contemporary technology industry and traditional industries[129]. At the macro level, this is significant because this is a report from the primary enforcement agency in the United States acknowledging the significant difference in the employment patterns of the tech sector. Most significantly, the EEOC argued that interventions that address cultural factors are necessary because the modern tech sector has implications for "society in general."

Not-for-profit organizations such as NCWIT and ABI were already working with this understanding. As not-for-profits, they were well positioned to occupy a middle ground that *bridged the chasm* between a world of corporate numbers and the world of society and culture.

In the next two sections, I examine key initiatives of ABI and NCWIT that show how these organizations addressed interventions that were data-centric and those that were culture-centric. The first case shows a bridging of the chasm through *better data*, with an examination of ABI's Top Companies "measure what matters" program. The second case is bridging the chasm through the use of *different data*, highlighting NCWIT's project on the analysis of gender and patents filed in the U.S. patent office. This is one example of how other types of data analysis can surface indicators and proxies of gendered patterns in the cultures of innovation. The third

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[129] In its study of Silicon Valley, the EEOC reported the macro level demographics that showed the lower of percentages of women in companies whose *primary business is technology* (30% women and 70% men) vs. conventional non-tech companies (49% women and 51% men).

case provides a perspective on what happens when the chasm is totally crossed and there is a pure focus on applying knowledge generated by historical and cultural analysis.

A Moment of Data: Silicon Valley Companies Release Diversity Numbers

In 2014, top Silicon Valley and tech companies began to publicly release their diversity data for the first time. This followed a period of increased exposure of diversity issues in the press and external pressure on companies to account for the sector's observable lack of gender and racial diversity. The major companies that revealed their diversity data confirmed what many in the public had already observed – that Silicon Valley was dominated by white men. The social activism of Jesse Jackson had already publicly challenged Silicon Valley for its lack of diversity, making compelling appearances at corporate board meetings and other public events (Hardy, 2014; Miller, 2015).   But once corporate diversity data were actually revealed, some viewed it as a watershed moment of transparency and applauded those companies. Others saw the public release of data as a step forward that could open up the new possibilities for change[130]. Still, others were skeptical as, for example, the *New York Times* columnist who framed the moment as the "diversity parade" and noted that

> *"… when it comes to the persistent lack of diversity in their work forces, Silicon Valley companies are quick with excuses and slow — very slow — to disclose even the barest data about the problem, even though they have been collecting and reporting the information to the federal government for decades" (Goel, 2014).*

A brief history of reporting diversity data

The United States Equal Employment Opportunity Commissions (EEOC) is the US agency that has the responsibility of enforcing federal laws that prohibit discrimination in the

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[130] PBS Newshour, https://www.pbs.org/newshour/nation/google-discloses-workforce-diversity-data-good

workplace, especially the provisions of Title VII of the Civil Rights Act of 1964 that made it illegal to discriminate on the basis of race, color, religion, national origin, or sex in the workplace. The Act required that federal contractors and companies with at least 100 employees report their demographic data annually to the EEOC[131] using Form EEO-1, specifying the number of employees employed by the company[132] in several job categories. These EEOC job categories are coarse-grained, only differentiating the roles of executives, first and middle level managers, professionals, technicians, sales workers, and administrative support[133]. The EEOC does not mandate further detail that breaks down the data into specific positions within these categories. Notably, the category of *professionals* covers a vast array of hundreds of job types, including computer programmers and software developers. But the professional category also includes a heterogeneous array of jobs such as public relations specialists, human resource specialists, management analysts, artists, lawyers, and even mental health counselors, registered nurses, clergy, and more.

The 2014 Data Revealed

In the contemporary tech sector, use of the aggregate category of professionals to count gender representation has served to obscure the *specific types* of jobs that women and men occupy in companies, especially the tech focus of those jobs. This is especially relevant for Silicon Valley where the distinction between technical versus non-technical professional roles has significant implications for individual employees, such as who designs and creates new technology, as well as who gets the opportunities for advancement, rewards, and recognition.

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[131] https://www.eeoc.gov/employers/reporting.cfm
[132] https://www.eeoc.gov/employers/eeo1survey/faq.cfm
[133]https://www1.eeoc.gov//employers/eeo1survey/jobclassguide.cfm

The aggregate obscures the extreme gender skew in the tech sector workforce. As history has shown, there has been an over-represented of women in lower level jobs, and an over-representation of men in higher level and influential positions. The reality of this pattern of occupational segregation by gender was hidden in plain view within companies, yet the data that was reported served to obscured it. External access to company diversity data had been difficult, even for those who are working for the public good such as NCWIT and ABI. As the NCWIT leadership revealed to me,

> *"… until this past year when a lot of the companies released their diversity data publicly on their website, there was just no way to have them share that kind of information with us. I had talked with organizations if they could report on a very aggregated number of new women that they have in their organization, and [for] some of the companies, it's just the legal complications, the concerns about competitive advantage of the companies not wanting to share that kind of information. It has been really hard to get around."*

But when companies began to publish their numbers, they were already aware that there was something wrong with their EEO-1 reporting, notably what it did not reveal. For example, one year before public release of its diversity data, Google made the following statement in its report to the EEOC:

> *"We find it useful to also divide our workforce into "technical" (e.g., software engineers, product managers) and "non-technical" workers (e.g., those in sales, marketing and finance). A third category, "leadership," cuts across technical and non-technical areas to reflect the diversity at the more senior levels. These segments provide us with greater insights into our workforce, so that we can to take action and improve.[134]"*

Google asserted this message as a footnote directly on its 2013 EEO-1 form (Appendix 8.1), claiming that is was "useful" to collect and report the tech vs. non-tech view of diversity data. The notion that such information is useful was an understatement; dividing diversity data across

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[134] https://www.documentcloud.org/documents/3921221-Google-2016-EEO-1-Report.html

these categories is *essential* to revealing the most basic nature of the gender segregation in the

technical workforce.   Since the moment of data began, many top companies began to publicly

reveal their tech vs. non-tech composition, signs of a movement to reveal more than what EEO

required. Table 2 highlights data from some of these top companies that reveals the extreme

gender disparity in technical jobs. These percentages were reported on company websites and

further propagated through the mainstream and tech press. In the table, the column of interest –

women in tech – is highlighted showing that in 2014 women in *technical roles* at these top

Silicon Valley and tech companies[135] were in the range from 15% to 20%.   The table also

highlights the percentage of women leaders (management and senior level) and overall

percentage of women in the company.

The watershed moment of the release of these data in 2014 was highly publicized and

mentioned in articles in the press and media. All of the companies highlighted in Table 2

provide aggregate views of data on their public diversity and inclusion websites.

Table 2. 2014 Diversity Data of Top Silicon Valley & High-Tech Companies

Company	Percentage of Women		
	Tech	**Leaders**	**All**
Yahoo https://yahoo.tumblr.com/post/89085398949/workforce-diversity-at-yahoo	15%	23%	37%
Facebook https://newsroom.fb.com/news/2014/06/building-a-more-diverse-facebook/	15%	23%	31%
Google[136]	17%	21%	30%

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[135] Use of the term "Silicon Valley" has become synonymous with "high tech" in much of the discourse about computing, even though many companies do not have their home base in the geographic area that was originally designated the Silicon Valley. For example, companies such as Amazon and Microsoft are based in Seattle

[136] PBS Newshour, https://www.pbs.org/newshour/nation/google-discloses-workforce-diversity-data-good; also NYT Bits, https://nyti.ms/2kECpat

https://diversity.google/commitments/			
GoDaddy https://www.godaddy.com/garage/godaddy-2015-gender-diversity-and-salary-stats-infographic/	19%	23%	24%
Apple https://www.apple.com/diversity/	20%	28%	30%

Each uses a different way to visualize the data either in traditional charts or interactive graphics (i.e., infographic). For example, Apple provides an interactive infographic that enables exploration of diversity data by year, and other facets such as tech vs. non-tech, gender, and race.

The common pattern of these companies is to report the 2014 data and provide an annual update. If we consider 2014 the baseline and compare to current data in 2017, we can see that most of the companies have small increases in the percentage of women in technical positions (Apple 23%; Google, 20%; Facebook 19%[137]), but also others that registered a modest decrease (19% GoDaddy). This is a pattern of modest or no significant change that is common across Silicon Valley and tech-sector companies. All of the companies have diversity and inclusion websites that acknowledge commitment to diversity and express recognition that change is slow. Sometimes, we see another response that I refer to as obfuscation by data. One example of this is when companies can't show impressive data about what they can count, they can still highlight what they can count as important. While it is reasonable to expect companies to report all types of progress, directing to the focus to selected data successes can obscure other issues that are not represented by data slices.

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[137] Facebook diversity update 2017,
https://fbnewsroomus.files.wordpress.com/2017/08/fb_diversity_2017_final.pdf

Obfuscation by Data?

Companies can present their diversity data in a manner that can obfuscate unfortunate realities. For example, even Apple, the company with the best women-in-tech data (as reported above) has examples of promoting and highlighting those fragments of data that register the best percentages.   As seen in Figure 17, a graphic for a selected fragment of the overall data about the workforce appears near the top of Apple's Diversity and Inclusion web page. The graph plots data points along two lines that are above the 30 percent level, which is an eye-catching statistic for women in tech. But only by reading the fine print of the data graphic do we learn that Apple is "proud of the progress we're making" and the revelation that in 2017 "*36% of our employees under 30 are women.*" What do these data actually mean?
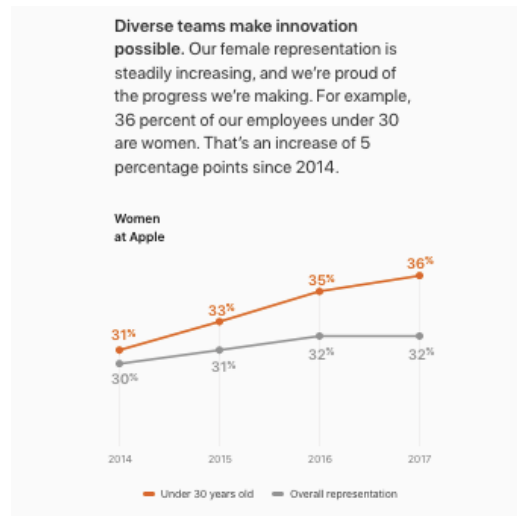
Figure 17. A Fragment of Data on Apple's Diversity Webpage

There are several things to consider about Apple's prominent highlighting of these data. First, the focus on the metric "*employees under 30*" obscures the rest of the diversity data about Apple's existing workforce – both the percentage of women in particular types of roles (especially tech vs. non-tech), as well as their levels of advancement and retention. The overall

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webpage is dominated by a collage of statements and testimonials, with only a few highlights of diversity data, such as the fact that Apple has increased its *overall* percentage of women (by 2%). This example raises more questions than answers. What does a threshold metric of "under 30" obscure? One wonders if this age threshold could be used to highlight a respectable range in tech (above 30% range). A critical eye might interpret this as a clever marketing move to mention only the type of data that looks good for the company (rather than an appeal to the next generation). What does the data tell us about Apple's stance for women whose age is in the 30s and 40s? These are key decades for advancement, as well as the age when child care responsibilities emerge (often falling more on female than male employees). Older mid-career women might wonder if they would be victims of ageism at Apple. This type of selective highlighting of metrics can take attention away from other things such as the conditions in the workplace for women *over thirty*, or for those planning families, or for mid-career women.

In recognition that Apple's Inclusion and Diversity website is focused on celebratory stories about diversity at Apple, we must also recognize that this web page is predominantly a public relations piece that is marketing Apple as having an open and inclusive culture. However positive this discourse is, the website is also a place where the public can view Apple's corporate diversity numbers. I use this as an isolated instance of "obfuscation by data" since it shows how even the best of companies can invoke strategies in reporting their data that can make selective use of data to (1) reveal only those data that are attractively significant, even if these data do not reflect the most pressing issues, or (2) draw less attentions to those data that do not provide a favorable view of the company. In the case of Silicon Valley and the tech-sector, appealing metrics about women in tech are few, and especially with the newer disambiguation of tech vs. non-tech, we see most companies drawing the public eye to the overall percentage of women in

the company.   We see this in infographics that introduce an element of friction in the process by requiring the web user to interact with a visualization to be able see particular views of the underlying data[138]. When diversity metrics reveal specifics about the low percentages of women in tech, the cultural issues that contribute to this must still be made visible by other means.

Bridging the Chasm I - Better Data

Better diversity data can surface the variations within aggregate categories of employment, but better data alone can still not fix the problem of the underrepresentation of women in technical and computing positions in the workplace.   As the previous section revealed, the mere act of reporting the current state of diversity data as aggregate workforce demographics has been considered a step forward for Silicon Valley companies. But others, especially academics, and some progressive companies, understand that cultural factors continue to stubbornly fuel the underrepresentation of women in computing. As not-for-profits, ABI and NCWIT work strategically and synergistically with companies to bridge the divide, connecting the world of data to the world of culture change.   ABI works with companies by offering a "data-centric" program that engages companies with a metrics orientation, which appeals to the private sector. At the same time, it encourages them to consider the meaning behind the data they collect. For NCWIT, a key focus is on different ways to gauge "meaningful participation" of women in technology, which can include analysis of alternative types of data that are proxy indicators of bias. Both of these strategies are discussed next.

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[138] See especially Google and Apple's infographics that require the user to explore the different facets of the data).

ABI's Top Companies Program - "Measure What Matters"

ABI manages a data-centric initiative for companies appropriately named "Measure What Matters." This work exists under the umbrella of ABI's "Top Companies" program that was started in 2010 to help companies establish their baselines for diversity data and to be able to compare themselves to other companies[139]. ABI worked with participating companies to standardize their procedures for data collection and reporting. They also provided a consistent model for diversity data that could serve as a benchmark for each company while also enabling the data to be compared among participating companies. This work was motivated by encouraging more transparent diversity reporting and responding to the corporate practices of collecting and reporting data beyond what the EEOC required. The Top Companies program was rolled out in multiple stages (i.e., ABI's three "Dimensions"). Dimension 1 was focused on collecting *better data* in the form of diversity metrics.

In 2016, ABI engaged 60 companies from 10 industries as participants, representing a mix of technology sector companies and traditional sector companies that include banking, finance, and insurance industries (Anita Borg Institute, 2016b). Using ABI's methodology, all companies collected the same data and received a "score" that could be used as a benchmark internal to each company and could be used by ABI to compared companies to each other[140]. The company with the highest score received an award from ABI, which was intended to give the company visibility for its success in diversity.

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[139] Wayback Machine, ABI 2011,
https://web.archive.org/web/20110120183741/http://anitaborg.org:80/top-company-award/
[140] https://anitab.org/top-companies-methods/)

Quantitative data was the focus of the first phase of ABI's Top Companies program. There were seven metrics - four addressing the career level of the technical women (entry, mid, senior, executive) and three measuring advancement of women (recruitment, retention, and promotion). While these seven metrics are still about counting women, the data do break out women in technical roles from entry level to executive level and also covers the rates of recruitment, retention, and promotion. As such it surfaces key indicators of career trajectories and advancement of women. As an example of a practice of better data we can see how companies can move beyond what the EEOC requirements mandate, as well as how a standard model enables data to be compared across companies.

Diversity metrics and the scoring of companies

After data were collected for all participating companies, ABI took responsibility for data analysis and scoring of the companies. Based on these scores, companies were placed in one of several categories: (1) overall "Winner" that is the company with the top score; (2) the "Leadership Index," which are those companies that scored above the mean; and (3) the "Change Alliance," those companies with scores below the mean. It is significant to note that most of the top scoring companies were *not from Silicon Valley* or the tech-sector. Looking at the 2017 results,[141] the "winner" was a tie between Accenture, Geico, and ThoughtWorks. Also, the most common types of companies in the *above average group* were from the banking, financial and insurance sectors[142]. There are only four tech-sector companies with above average scores for diversity (Google, IBM, Intel, Intuit), and all other participating companies from the tech sector

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[141] ThoughtWorks is consulting company focused on *services* for software development predominantly serving industry clients.
[142] ABI Top Companies 2017 Results, https://anitab.org/accountability/top-companies/2017-results/

fell in the *below average group* (Amazon, Cisco, Dell, Dropbox, eBay, GoDaddy, HP, LinkedIn, Microsoft, Oracle, Uber, Yelp).

One of the results that ABI chose to highlight was a three-year view of the career levels that women had attained across the participating companies (Figure 18). This chart was published in an ABI report that was made publicly available on its website. There is a tendency for artifacts like these to highlight aspects of the program that appeal to the corporate sector, notably that Top Companies is a "data-driven program" and that it uses a "rigorous methodology"[143]. In fact, the methodology consisted of common and standard methods for descriptive statistics such as Z scores to see the distribution of how companies varied from the mean (i.e., standard deviations from mean). Yet, the act of discursively making these points about rigor in the data and the methodology suggests that this was important for ABI to highlight and display prominently.

Representation by career level
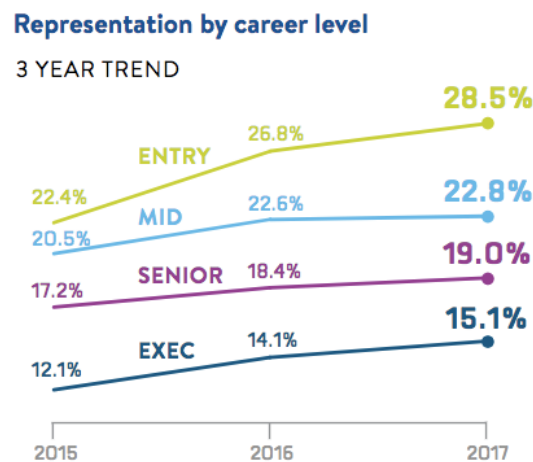
3 YEAR TREND

Figure 18. Top Companies Results - 3 Year Trend by Career Level[144]

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[143] https://anitab.org/news/measure-what-matters/;
[144] *Source: ABI, 2017, https://anitab.org/accountability/top-companies/2017-results/*

As shown below in Figure 19, the report further described the methodology and scoring using a curious rhetoric - "No subjective or black box data. Just the numbers" (see lower left). This is a *discourse of legitimacy* that can appeal to business audiences and those who value quantitative data and statistical methods, essentially those stakeholders who needed to be convinced that the program was "objective" and who could be assured through the language of numbers.

HOW COMPANIES ARE SCORED

Organizations that participate in Top Companies are scored based on seven metrics. These are:

THE REPRESENTATION OF WOMEN IN TECHNICAL ROLES AT
① *entry*
② *mid*
③ *senior*
④ *executive levels*
RATES OF
⑤ *recruitment*
⑥ *retention*
⑦ *promotion*

Every company is scored on the same seven metrics. No subjective or black box data. Just the numbers.

The statistical methodology

Data submitted by participating companies is normalized for comparability using a Z-score method. Z-scores are calculated based on deviation from the mean divided by the standard deviation. For each metric, a company receives a Z-score, which measures how that organization compares to the overall participant pool. There is no weighting; all scores are based on how each organization statistically compares to other participants.

Top Companies results are based on the sum of all seven Z-scores.

Policies and programs data

Top Companies gathers additional data on policies and programs to find insights on the effectiveness of diversity efforts. This data does not affect an organization's score or impact program results.

Top Companies also offers a Workplace Experience Survey distributed to randomly selected male and female technical employees. The survey was piloted in 2016, and will be expanded in 2018.

Page 3   TOP COMPANIES FOR WOMEN TECHNOLOGISTS - 2017 KEY FINDINGS AND INSIGHTS   ©2017 AnitaB.org   ANITA B.ORG

Figure 19. Top Companies Methodology and Scoring[145]

But these metrics and the related scoring mechanism were just the first stage of ABI's Top Companies program. ABI leaders were motivated to shift the focus to culture change and, in 2016, ABI expanded the scope of Top Companies to move beyond the quantitative metrics. They piloted two new dimensions of the program, one to identify what policies and programs the

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[145] Source: https://anitab.org/wp-content/uploads/2017/09/2017-top-companies-insights-report.pdf

companies were using to improve their work environment and to support women technologists, and another dimension to capture qualitative about employee experience in the workplace.

Moving closer to culture

In expanding the scope of Top Companies, ABI was interested in moving beyond the metrics and the scores, as clearly stated in its overall motivation of the Top Companies program on its website.

> *"At a time when women technologists are significantly underrepresented in building technologies, Top Companies data helps us clearly understand whether the industry is improving, who is committed to change and advancement, and what policies, procedures, and actions are most effective in driving progress."*[146]

The new dimensions of Top Companies have continued to be expanded as seen below in Figure 20 which highlights plans for 2018. Here we can see that "the numbers" are framed as a foundation that continues to be the basis for a company award based on representation of women. But the other two dimensions focus on actually interventions in the workplace that are significant to addressing the underrepresentation of women. Bridging the chasm of numbers and culture, in this case, requires focusing on what a company actually does in practice and policy and what are the experiences of employees (i.e., "the voice behind the numbers").

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[146] https://anitab.org/accountability/top-companies/2017-results/

DIMENSION 1:
Foundation of scoring methodology
• Award based on representation of women in the technical workforce

DIMENSION 2:
Expanding in 2018. Analyzed but not scored
• Capture qualitative data through surveys distributed to randomly selected male & female technical employees

DIMENSION 3:
Analyzed but not scored
• Identify which policies & programs support a culture where women technologists thrive

"The Numbers"
REPRESENTATION

"The voice behind the numbers"
WORKPLACE EXPERIENCE

"What companies are doing to increase the numbers"
POLICIES & PROGRAMS

Figure 20. Top Companies plans for 2018

Notably, these new qualitative data were not part of a company's "score." ABI's program moved to collect better data by having more rounded view of the state of the company. The two new dimensions bring other elements of discourse into the overall view of diversity at the company, notable around policy, the work environment, and individual experience,; all things that are not part of company's quantitative "score."

Awarding based on the numbers

It is worth noting that ABI continues to award companies based on the foundational *numbers*. Even with better quantitative data, many questions about the value and meaning of that numeric data still remain unanswered. The notion of awards was assumed to be important in the design of the Top Companies program. However, this is hard to reconcile in light of the recognition of the need to measure culture change, which is difficult to do quantitatively.

The awards aspect of the program has also been critiqued by others, including several leaders of NCWIT and other participants in the forums of discourse of ABI and NCWIT. As one

NCWIT leader said to me, "…they declare these companies to be the best companies to work for … but what it means is that it was one of the top 10 companies that they got data for." The self-selected sample of companies in the program does not reveal anything about those companies that did not participate. For those who did, we do not learn much about the reasons these companies chose to participate and why some dropped out. Also, in discursively designating the "below average" scoring companies as the "Change Alliance," we see the least diverse companies of the group painted in a positive light, presumably helping those companies avoid a negative brand image with regard to the diversity of the companies. On a positive note, ABI was able to use the 2016 qualitative data that showed these companies had some growth in the policy and program focused of leadership development and flextime. ABI interpreted this as evidence of a company's willingness to change.

Over the years that the Top Companies program has been in existence, ABI has spoken about it in multiple voices. Despite the voice to certain audiences highlighted earlier (i.e., the "just the numbers" stance), another voice emerged later in the program with the introduction of qualitative dimensions (i.e., *the first and only program of its kind that benchmarks workplace experience (employee sentiment) across companies")* (Anita Borg Institute, 2016c)

ABI's Top Companies program provides an example of the work of bridging the chasm from the world of numbers to the world of culture. At this time, the overall results of better data, as seen through the metrics lens of Top Companies, continue to be small or modest. More broadly, companies must continue to address the questions of what to do when data do not look very promising. Change is happening very slowly in Silicon Valley and in the tech sector, and too much of a focus on "just the numbers" can serve to obscure the dynamics of real people

communicating and interacting in actual workplaces – the stuff of organizations and cultures that

present barriers to opportunity and advancement.   Continuing to explore how to change of focus

from numbers to culture, I will next examine a case that does focus on another type of *different*

data in the form of macro signals.

Bridging the Chasm II - Different Data

In this section I examine how data can be approached from a different perspective – as

macro level signals that can shed light on gender bias in the macro processes of innovation.

Counting the number of women in technical positions can still often hide the fact that women are

proportionally more likely to be structurally positioned in ways that make it difficult to move

into the most influential positions in the process of innovation.   NCWIT has worked hard to

shed light on situations like this.   The NCWIT leadership has also embraced the term

"meaningful participation" which challenges companies to look more deeply into the nature of

the specific types of positions women occupy in the workplace and what this means in practice.

In one interview with a woman in leadership, I was told:

> *"A couple of years ago they [companies] were not measuring women in tech. They were*
> *measuring gender for the company, but not measuring by tech. Now they are starting*
> *to… but now the next hurdle, is to say, well **what** are your women doing - what roles are*
> *they doing it in? And they say to me, what do you mean?   And I say to them, in every*
> *organization I have ever been in, worked in, or led, there were low status tech jobs and*
> *there were high status tech jobs. And where are the women and minorities? And they*
> *say, 'I don't know?' It's when you see it clustered by gender or race that you start*
> *wondering."*

The message expressed above is that when executives of companies look differently at

what they are measuring, they are challenged to consider the deeper meaning of their metrics.

NCWIT programs are particularly focused on who occupies the creative technical design and

leadership roles at companies. They have looked at different types of data that are key indicators

of cultural and systemic bias, which are not the typical metrics that count the hiring and promotion of women.

One example of such different data is the data about *patents granted to inventors*. NCWIT's analysis of patent data provided a powerful view of gender and innovation. The project involved crawling the US patent database for information technology (IT) patents and using gender-matching software to code the gender of individuals registered on the patents over the last 30 years. The findings indicated that, over the past 30 years, approximately 88% of patents are male-only invention teams, while 2% of patents are female-only, and 10% gender mixed gender (which typically means 1 or 2 females on the team (C. Ashcraft & Breitzman, 2012). Regarding the overall value of this type of data-centric project, NCWIT leadership made a key point to me,

> *"We are still the only organization that looks at gender patenting rate. We do care about numbers, but we also care about what are they are doing…. So, you know that means most likely women are not in jobs that lead to patents."*

A look at the trend over time reveals more. In the first phase of its work, the NCWIT research team examined patent data from 1980 to 2005 and found that approximately 9% of patents had at least one female inventor (i.e., gender mixed team). But many of these teams had multiple male inventors, so when this was accounted for the *adjusted average percentage of female inventors* moved downward to 4.7 percent (C. Ashcraft & Breitzman, 2007, p. 4). NCWIT published an updated report in 2012 for the period 1980-2010 (i.e., the full 30 years of patent data), determining that the adjusted percentage of female inventors was still only 6.1 percent. A modestly encouraging finding was that in the most recent four years of data (2006-2010), the adjusted percentage of female inventors was 7.5 percent. Still, especially in terms of

solo invention, 40% of the patents were by a single male, while only 1.9% were a single female patent (C. Ashcraft & Breitzman, 2012, p. 10).

NCWIT's patent data project is just one example of how thinking differently about data and about different data can help provide a type of evidence that can prompt a deeper commitment to addressing root causes. A significant part of NCWIT's ongoing work is advocating for companies to expand the types of data they collect to be inclusive of *qualitative* approaches, as well as advising companies on *how* companies should reveal their data.[147]

There are many types of "different" data that can be analyzed to reveal obscured truths, such as who is involved in the critical processes of innovative work at companies, Analyses of these data can prompt vigilant leaders to consider the both the structures and cultures that both create and reinforce inequality. This means that when observing the extreme gender skew in diversity data, such leaders can acknowledge that these are just indicators of the need for additional types of analysis that can move beyond what basic hiring metrics reveal. This is true even when standard diversity data is further broken out, as for instance, by tech vs. non-tech jobs.

Among the other types of "different" data that can be statistically analyzed to reveal latent patterns is social network data. In particular, these data can reveal gendered patterns in the structures of relationships in the workplace, which can have implications for who acquires social capital, which can be an indicator of power and influence. Burt (2001) defined social capital using a market-oriented metaphor whereby people benefit by exchanging goods and ideas.

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[147] NCWIT Tips for announcing diversity data, https://www.ncwit.org/resources/ncwit-tips-8-tips-announcing-your-workforce-diversity-numbers/ncwit-tips-8-tips-announcing

According to Burt, "holding a certain position in the structure of these exchanges can be an asset it its own right… That asset is social capital, in essence, a concept of location effect in differentiated markets" (p. 32). Borgatti et al. (1998) provide a taxonomy of network measurements that are associated with social capital in a social network, both from the vantage point (focus) on the individual or on groups of collective actors. Social network researchers have identified the types of network structures that are believed to produce social capital,[148] meaning that certain network positions can endow the individuals who occupy them with the advantages of power and opportunity. Burt (1992, 2001) found that people who straddle the space between two groups (i.e., "structural holes") have a competitive advantage because they are exposed to different flows of information and are also in a position to broker the flow of information between groups. The structural hole argument resonates with Granovetter's (1973) paradox of the "strength of weak ties": "weak ties, often denounced as generative of alienation … are here seen as indispensable to individuals' opportunities and to their integration into communities; strong ties, breeding local cohesion, lead to overall fragmentation" (p. 1378). Thus, social network data that is coded for gender can represents women's structural position in a social network model. Such models can be the basis of quantitative social network analysis to detect signals of power such as social capital. As a proxy for power the network data suggest how much social capital an individual can acquire, as well as how it can be "invested" or redeemed.

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[148] Burt (2001) differentiates these by analyzing the arguments of structural holes and network closure as network sources of social capital. Burt observes that structural hole argument has a long lineage reaching back to Merton and Simmel, specifically their notions of how associations that have conflict or difference can result in competitive advantage and increased power (pp. 32–35).

Social network analysis can also give meaning to gender paradoxes too. For example, what can social network data tell us about gender and how employees advance in a corporation? Burt (1998) observed that network structures that would normally predict the benefits of social capital did not apply to women in overcoming the "legitimacy bias" (a type of unconscious bias that affects both women generally, and sometimes young men). He found that when women formed their own professional networks in a pattern similar to successful men (i.e., "entrepreneurial" network structures), women did not advance quickly. However, when women were structurally positioned in a hierarchical network, they did advance more quickly. Normally, hierarchy in a social network is a form of *constraint* that presents dependency on a key central contact. However, Burt's analysis of network data found that women in a company fared better when they were strongly connected with a senior male with high social capital. Burt (1998) characterized this phenomenon as "borrowed social capital" where the benefits of a successful manager's wealth of "structural holes" in a network can be indirectly tapped by a woman who aligns with such a successful senior manager (p. 21). In short, social network data was analyzed to reveal evidence that when senior managers play a sponsoring role for women they can help them overcome the plight of perceived "illegitimacy" in the organization.

But even these types of different data are not enough for resolving the dilemma of the underrepresentation of women in computing. While the numbers matter, and the way data are analyzed matters, the ultimate meaning of these data only becomes fully understood with other methods of analysis that probe into the context and the cultures of the workplace. To show what it looks like on the other side of the number and culture chasm, I will explore this as a moment of culture that has elements of gender identity, culture, and the workplace as an institution. This case is instructive for revealing the entanglement of the forces of structure, agency, discourse,

and practice and how they intersect. It is also useful for understanding issues of power that

underlie the issue of the underrepresentation of women in computing.

A Moment of Culture: Ashcraft and Lean In as "cruel optimism"

In this concluding section, I examine a moment of discourse that does the work of

illuminating some of the complexity of the cultural side of the numbers versus culture chasm.

My selected case invokes Karen Ashcraft[149] who was invited by NCWIT to give a plenary talk at

the 2015 Summit. Ashcraft provocatively argued to change leaders at the Summit that they

should be wary of "fairy tales of gender equality."   Her goal was to reveal insights and

uncomfortable truths about gender bias in technical occupations, especially those occupations

that have historically been more associated with men. As a speaker at the Summit, she engaged

both corporate and academic audiences and exposed them to research from social science,

historical, and critical theory perspectives on issues of culture. Invoking her own research,

Ashcraft revealed how issues of power and gender relate to occupational identity in the

workplace[150]. One of the goals of the annual Summit is to *equip* change leaders (and change

agents) with "evidence" from latest research. This is an example of one strategy that exposed the

membership to an interdisciplinary scholar who could bridge knowledge from the fields of

gender studies, communication, psychology, sociology, law, history, and critical theory.

While I designate the Ashcraft plenary as a moment of culture, I also point to it as a

moment of discourse that engages NCWIT's key constituencies. The Summit is intended to be a

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[149] In Chapter 3, I mentioned Ashcraft as one of my theoretical influences in the areas of gender, identity and organizations.

[150] Ashcraft is an interdisciplinary scholar whose research integrates historical, critical, cultural, gender studies, and communication perspectives.

place where the membership can deliberate and take discourse into actions of policy and practice. As a moment of discourse, the Ashcraft plenary also revealed a "dilemma" through the reactions of audience members who spoke uncomfortable of tensions between theory and practice and different perspectives of what is considered "evidence" and how it translates it into action.

Provocations and paradoxes

> *Success… can actually present problems, roadblocks, challenges, dangers…. Preparing for success means taking a closer look at our assumptions of happily ever after (Ashcraft, NCWIT Summit, 2015)*

Ashcraft began the NCWIT plenary[151] with a slide that featured Sheryl Sandberg, author of the book "Lean In" and COO of Facebook, along with the verbal disclaimer that she did not intend to single out Sandberg and this particular text. Ashcraft explained that she wanted to use Lean In as representative of a *"long standing trend, which I would refer to as a tradition of gender self-help"* that needs to be reflected upon. Specifically, she argued that Lean In is an example of a text about the *"ways women are told they can advance themselves in the workplace… and this is an important cultural fairy tale that we tend to tell"*. Ashcraft reasoned that the Lean In narrative sends a message to women, as a group, that they share habits that can hold them back. The promise is that if they try hard enough, they can counter these habits to help themselves to succeed in the workplace. The simple reduction of this is that the more women lean in, the better success they will have in the workplace.

Having used Lean In to seed her plenary, Ashcraft argued that female success in male professions can actually present problems, challenges, and even dangers, for women and that

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[151] Ashcraft NCWIT 2015, https://vimeo.com/160279021

preparing for success means taking a closer at our assumptions. Ashcraft presented a scholarly

analysis of the symbolic dimension of occupations, revealing a perspective on what an

occupation is *associated with*, not just who it is *occupied by* - a subtle distinction that is

necessary for understanding the socio-cultural dynamics of the underrepresentation of women in

computing, especially programming cultures. It is important to remember that I am framing this

plenary as a moment of discourse, with Ashcraft speaking to a mixed audience of practitioners

(i.e., from companies, industry, entrepreneurship) and academics (i.e., university, colleges, K-

12), building on themes from interdisciplinary scholarly research on gender, occupational

identity and occupational segregation.

The substance of a cultural argument

After the Lean In provocation, Ashcraft informed the audience that 50 years of research

and evidence reveals a paradox - when women collectively succeed in male dominated

professions, this can lead back to gender inequality in different ways (Ashcraft NCWIT Summit,

2015)[152].   A key principle Ashcraft put forth to the Summit audience was that the nature and

value of work is *invented and not intrinsic* and that cognitive schemas limit our notion of who

"fits" a particular role. She planted a seed for deliberation: *"[o]ccupations are known by the*

company they keep". After establishing these principles, Ashcraft warned the audience that she

would proceed to reveal the "daunting truth" about gender and occupations, and that after this

grim accounting, she would end with an optimistic stance on what the evidence tells us that can

lead progress for women in computing.

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[152] The video recording of the Ashcraft plenary can be found at https://vimeo.com/160279021.

Ashcraft was dynamic, and her presentation attempted to take the audience on a brief

journey of decades of research that established the firm foundation upon which her research

stands as a scholar. Ashcraft's lay person's primer focused on the social processes of

professionalization, masculinization, and occupational segregation.   Among the grim truths she

highlighted were:

- gender has been used to both enhance and degrade occupational value
- many of today's professions emerged after strategies of masculinization
- professionalization by masculinization involves capturing the work as manly, often through association with the technical and the scientific
- feminization of work has never been associated with increased value

Moving into theory, Ashcraft differentiated between physical bodies (i.e., as in particular

humans who occupy a job) and the symbolic (i.e., the codes and imagery that surround a job).

Ashcraft invoked historical case studies from her research, notably the "ladybird pilots" case that

showed how when female pilots were emerging, how male professionalization strategies pushed

back[153].   Ashcraft invoked a case closer to home for the audience which was the

professionalization of the computer programmer, as was discussed earlier in Chapter 2.

Culminating her theory argument, Ashcraft revealed to the audience that "we discriminate

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[153] Ashcraft's research examined gender and professionalization in the early 20th century aviation industry. The rugged daredevil imagery of male pilots did not work well for selling the safety of planes to the public. The campaign and media blitz of the "lady birds" (female pilots) provided a different image of aviators that could be used to sell the safety of planes to the public.   With the entry of women, commercial pilots and the pilot unions responded with a professionalization strategy to recreate the pilot as white, male professional with scientific credentials with an overhaul of the pilot's body (e.g. pilot uniform) and paternal imagery.

against occupations, not just people", then emphatically declared - "*Jobs have social identities! And that is a difficult truth to process…. Ouch.*"

Ashcraft proceeded to introduce to the audience her theory of the "glass slipper," that is based on the notion of the "figurative practitioner" (discussed in Chapter 2), a manifestation of an occupation in symbolic form.   For computing, the figurative practitioner is the white male computer programmer, a well-known symbolic form that is bolstered by imagery from Silicon Valley including the tech entrepreneur; the inventor in the garage; the brilliant male coder; the white guy with hoodie; the brogrammer, the hacker; etc.

Symbolic "occupational identities" can be stubbornly rooted and reinforced, which can help us understand how unconscious bias creeps into everyday practice. For Ashcraft, the argument is that we may be doing women a disservice by sending them off to the workplace *without fully acknowledging the nature of the barriers to their success and the obstacles that they may encounter along the way.* Essentially, the only solution was to break the mold, which is the core theme of Ashcraft's theory on occupational identity - the "glass slipper." Metaphorically, this translates to a model of the programmer that was made to fit a specific type of person and that eventually became a universal image of who fits the occupation. As a durable association to a particular type of person, new strategies are necessary to creating new occupational identities and destroy the old one (i.e. breaking the symbolic identity of the male programmer/entrepreneur as the figurative practitioner of tech). Speaking to both practitioner and academic members of the audience, Ashcraft urged reflection and deliberation on how to achieve this in the workplace.

Ashcraft brought to the Summit audience an interdisciplinary perspective that integrated scholarly knowledge from the fields of history, discourse studies, gender studies, and organizational communication. She also positioned with a theoretical stance that warned the audience to "beware of uncritically embracing the opening of the door." In other words, opening the door for women to enter the tech workplace, too often, can lead to pressure for women to accommodate and adapt to norms and behaviors that were created for and reinforced by the male figurative practitioner.

What's a practitioner to do?

At several points, Ashcraft took the risk of potentially alienating some members of the audience. She elaborated further on why she thought it was "a bit cruel" to keep telling women to "lean in", invoking the humanities scholar Berlant's *Cruel Optimism* (2011) and using it as part of her critique of Sandberg's *Lean In*. Again, Ashcraft was asking the audience to reflect and deliberate about the Lean In narrative of female empowerment, arguing that it asks women to press harder to tackle tech's gender burdens in an environment that was already stacked against them. As discussed in Chapter 4, Berlant argued that "cruel optimism" is the relational attachment to "clusters of promises" that are relentlessly pursued, even when the pursuit of the aspired ideals can actually inhibit the individual's the ability to achieve the promised ideal[154]. Berlant reflected on the unintended consequences of pursuing the imagined "good life" and Ashcraft picked up this theme to encourage a reflective perspective about the complexities of pursuing a career that was defined in someone else's ideals (i.e., the contemporary males of computing and programming). But Ashcraft warning to *approach with caution* was a tricky

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[154] See slides from the plenary online: https://www.ncwit.org/sites/default/files/2015_ncwit_summit_-_plenary_slides_by_karen_ashcraft.pdf

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stance to have taken with a practitioner audience that was well aware of Lean In, and Sandberg

as one of the most successful female executives in Silicon Valley. Essentially, Ashcraft

encouraged the audience to engage with a different type of socio-cultural "evidence," something

that would not be found in diversity metrics and quantitative analytics. In terms of what the

audience could take away from the talk, Ashcraft argued for a "kinder optimism" concluding

with a call to action and these explicit messages:

- DO take an intersectional approach to diversity (gender + race + age, etc.)
- DO beware of job descriptions that masquerade at neutral
- DO promote environments that let difference flourish
- DO encourage humility and curiosity
- DO promote constructive motivations recruiting women to computing

After observing the Ashcraft plenary, I spoke with academics and practitioners who

attended the plenary talk. Generally, most said that they either found the plenary to be thought-

provoking or provocative (i.e., what she intended). However, as my informal interviews

revealed, practitioners from the corporate sector were frustrated because they were not able to

extract the *specific and concrete advice* they had hoped for. They wanted something to take

away, something they could implement *now* at their companies and organizations. A few said

they were confused and "disturbed" by some of Ashcraft's argument. Several commented that

Ashcraft's plenary was "depressing." Others said they were not sure how to operationalize her

ideas to make specific changes at their workplace.   Overall, I observed a split between the

reactions of members of the Academic Alliance and the Workforce Alliance. The practitioners I

spoke with viewed Ashcraft's plenary as just "theory" when the actually wanted best practices

that they could directly use in the workplace. They did not perceive the plenary as action

oriented, and as one practitioner remarked, "*OK, so what are we going to do about it?*" Some

practitioners felt like they were made aware of things about culture that they didn't know what to

do with. Even with Ashcraft's take-away list, (i.e., the DO's mentioned above), my observation

is that it was positioned too late in the talk and viewed as too abstract to be actionable. Overall, I

observed a discomfort with the ambiguities of the cultural interventions that require more

deliberation by change leaders before concrete and measurable actions could be implemented.

Tensions among kindred spirits

Ashcraft's critique of Lean In was a notable feature of this plenary, especially amid the

extensive media coverage of Sandberg and the enthusiastic alignment of many professional

women with the Lean In movement. Yet Ashcraft was not alone in her critique of Lean In, as

other feminist scholars, leaders, and activists also took a critical stance, including feminists in

academia (K. L. Ashcraft, 2016; hooks, 2013; Rottenberg, 2014; J. C. Williams, 2014) and

feminists in the workplace and the media (Covert, 2013; Faludi, 2013; Leahey, 2013; Slaughter,

2012). We see in the moment of culture of the Ashcraft plenary, signs that even among feminists

and those committed to the improvement of conditions for women, there are tensions among

those who would consider themselves kindred spirits in the struggle for equality.

For example, these types of tensions are seen clearly in comments by the NCWIT

leadership about the general advice of "leaning in." Some thought that the Lean In movement

had emerged to the point where women were embracing it as an *ideology*, rather than an

evidence-based intervention. As one NCWIT leader said to me, *"… people would see it as a*

conflict in ideology because, I think generally, we would put Lean In, in the camp of the "fix the

woman" people." Another NCWIT leader saw "leaning in" advice as something that could have

unintended consequences such as *"… when you say to somebody, go Lean In, that might be the*

worst thing that she might do in her context – the absolute worst thing, and you imply that she's

broken." Another concern was about the silence of the discourse with regard to issues that exist

at the intersections of gender and social class. As a discourse of empowerment, Lean In was

seen as the language of a person of privilege, as seen in the comments to me such as *"...Sheryl*

Sandberg says, we all need to lean in, so let's all Lean In? Well, please tell a single mom in the

Bronx that she just needs to try harder. That's a very middle-class, upper-class, privileged view

of the world." Similar comments were made to me that focused on differences in power even

among professional women, such as *"... the Lean In advice is going help women who are*

already pretty well off but who could just benefit from some professional advice. But it's not

going help to change big, systemic patterns and it's not going help women who are not relatively

privileged to begin with at all."

These are examples that reveal tensions between the forces of organizational structure

and the agency of the individuals, one of the key concerns that the Lean In critiques brought

forth. The argument against the "fix the women" was summarized to me as *"[w]e're very big on*

looking at the structural institutionalized biases in the system versus "leaning in" or aggressive

mis-trainings…. we want focus on organizational and culture change, not on fixing the women."

From NCWIT, there were both strong feelings and logical arguments about the limitations of

encouraging individual women to "lean in" as general advice. While there was consensus that the

Lean In narrative was intended to inspire women, there was also concern that what it was

recommending could be infeasible, or even damaging, depending on the particular context of a

woman's work and that nature of the organization she worked in[155].

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[155] While the NCWIT organization is registered as a supporter the Lean In Circles program, this is
allegiance with the cause, not an endorsement of Lean In as a method backed by evidence. As seen

Looking more broadly at the moment of culture of the Ashcraft plenary, we can see signs of complexity and tensions in the processes of achieving social change. The case reveals elements of the struggles that exist at the intersections of the multiple interacting forces that were discussed in earlier in Chapter 2 - the forces of structure, agency, discourse, and practice. The Ashcraft plenary touched upon all of these. It was able to show how occupations themselves can have identities that can interfere with individual acts of agency. Also, institutions can reinforce these occupational identities through structural issues of policy and practice. A not-for-profit organization such as Lean In can also promote a discourse that some view as a type of ideology. Other historical discourses of gender and technology can reinforce the notion of who is viewed as the appropriate type of person for computing roles. Organizational practices that encourage women to "lean in" can assume that this is appropriate without considering the different contexts that of individual and the implications of actions within particular institutional and work life contexts. All of these are examples of the types of tensions individuals and organizations that are attending to the work of culture change must be aware of and contend with.

More recently, the limitations of Lean In - as practice – have been revealed in the context of women who have reached the highest levels of a career. A clear case is the experience of Ellen Pao (Giang, 2015) who recounted her experience to the public at a top Silicon Valley venture capital firm. Pao brought a gender discrimination suit against the company, arguing that despite her demonstrated successes and accomplishments, she had been subjected to gender bias and obstacles in achieving the highest level of partner in a male dominated venture capital

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above, many at NCWIT disagreed with Lean In (i.e., as a behavior or a practice) and argued that women and organizations should not uncritically embrace it. While Sandberg, herself, cited many sources of research in her book, the particular concern of NCWIT was a lack of research for the effectiveness of Lean In as an intervention.

company. In the tech and business press, this came to be known as the "Pao effect." One business/legal viewpoint was that the Pao trial was a watershed event that had the effect of inspiring more women to speak up about discrimination in the tech workplace (Giang, V., 2015). A technology press article in *Wired* noted that even when an executive level woman follows the Lean In approach, the Pao effect shows that *it may not work* (Hempel, 2017). As recently as 2017, the so-called Pao effect was seen to share common ground with the #MeToo movement on Twitter where the act of one women speaking out empowered other women to speak out publicly about what they had suffered in the form of sexual harassment in the workplace by men in power.[156]

Conclusion

This chapter provided an exploration of diversity interventions. Beginning with a 'moment of data', I opened with the year 2014 when top Silicon Valley companies publicly revealed their diversity data for the first time, exposing the extreme gender disparity that had been hidden in plain sight (and anecdotally revealed). But, revealing these data, alone, could not solve a problem that is deeply embedded in the organizations and cultures of the tech workplace.

In collaboration with participating companies to move the use of data forward in productive ways, ABI's "measure what matters" program provided a standard model for the collection of better types data that revealed the types of positions women were actually in and what level of career their jobs were at. *Better data* is necessary to determine the types of roles that men and women occupy.   Traditionally this type of data has been captured and reported at a

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[156] For example, see Slate podcast
http://www.slate.com/articles/podcasts/if_then/2017/12/ellen_pao_discusses_sexism_in_silicon_valley_and_metoo.html

coarse-grained level, with the EEOC mandating the reporting of data in several macro-level categories of employment. The general EEO category of "professionals" obscured the distinction between technical and non-technical jobs. Independently, NCWIT showed how different types of data could be used to provide more insight into who occupies key roles in the process of innovation. *Different types of data* can be used to identity patterns and latent phenomena that reveal the possibility of biased assumptions about aptitude and technical talent. Examples are patent data that shows the absence of women in the types of positions where technical innovation is recognized. I also argued that social network data can reveal patterns of associations and social relationships that are productive/un-productive in the accumulation of social capital, which is a proxy for power.

But the current underrepresentation of women in computing is fraught with underlying complexities of bias and gendered assumptions about who "fits" in technical roles of the workplace (Ashcraft 2013; 2015). Furthermore, the discourses of the technical workplace simultaneously encourage and discourage women from entering technical roles, and also influence whether they remain after finding the path to entry. As much of the existing research has shown, many women have been discouraged early in the game, or overlooked later in the game, and many talented women have been left behind, either by internalizing a sense that they "don't fit" or by being devalued or sidelined in the workplace by others who incorrectly make assumptions about capabilities and potential. The Ashcraft plenary was framed as a moment of cultural discourse that highlighted the symbolic and cultural roots of bias as revealed by qualitative and theoretical scholarship. NCWIT chose to expose the alliance members to a scholar like Ashcraft who could illuminate the tensions and complexities that lurk beneath the data and in the popular rhetoric about diversity interventions (i.e., Lean In). In contrast to the

data-driven approaches that many practitioners in the corporate sector are more familiar with, there are other types of evidence that can be found in qualitative, historical, and critical research methods that can reveal the subtler dynamics of diversity interventions. The intention of the Ashcraft plenary was to inspire practitioners to think more critically about culture and gender bias in the workplace.

CHAPTER 9
Conclusion: Keepers of the Flame for Durable Social Change

I began this dissertation with the position that there can be 'no hiding behind the pipeline' when addressing the underrepresentation of women in the tech workplace. I ended with the position that a primary focus of interventions for addressing the underrepresentation of women in computing must be on culture change in the tech sector. An ongoing question then arises: *who are the agents of change* and *how do they most effectively focus* to make progress on issues of diversity, technology, and culture for the overall benefit of society? At the macro level, tech sector companies are structural forces, which means they can be barriers or forces for change. For example, as forces for change, companies can institute new policy as they work in concert with academia, government, and not-for-profits that are committed taking technology in directions that are good for society. Also, individuals can be agents of change – for example, those who step forward as "change leaders," male allies and advocates, and all those who choose speak out about issues to promote better workplaces and a just society. But there are still open questions about the short and long terms effects of such interventions and how they can remain durable over time.

Navigating Durable Social Change

When addressing issues of diversity in tech and the underrepresentation of women in computing, culture change can be understood as a complex process that involves working at the intersections and the borders of the structures of institutions, the agency of individuals, the policies of specific organizations. The process of navigation also requires engaging with mutually reinforcing forces of discourse and social practice, with a recognition that both opportunities and tensions can be located amid the areas where they interact. When the goal is *durable* social change for women

and computing and the tech sector, we must acknowledge the necessity and the challenge of navigating multiple forces. From an analytical perspective, I embraced both a discourse and socio-technical systems perspective. In Chapter 2, I reviewed theories that grounded my thinking in critical theory of discourse (especially Foucault and Butler), theory on the relationship of discourse to social change (especially Fairclough), theory of gender and occupation identity (especially Ashcraft), and theory of structure and agency (especially Giddens' structuration). My analysis embraced the view that gender is a frame in the analysis of socio-technical systems, especially taking inspiration from Wajcman who brought gender into ANT and SCOT. With these influencing theoretical perspectives, I empirically engaged with the concrete layers that were instantiated beneath the macro abstractions – the specific instantiations of a networks of people, institutions, and artifacts (i.e., similar to STS notions of the "seamless web" and the "heterogeneous network").

Why discourse matters

As discussed earlier, Fairclough (1992) invoked Foucault's "orders of discourse" (1992, pp. 68–70) and developed a method for analyzing discourse by focusing on its elements, with a particular attention to the *relationships* between them and *boundary* zones where frictions and tensions can often be observed. This type of analysis becomes especially rich when looking at problems that present as mixed genres of discourse elements, as was the case in my examination of the discourses of women and computing.

> *"The boundaries between elements may be lines of tensions… It is feasible that*
> *boundaries between settings and practices should be so naturalized that these subject*
> *positions are lived as complementary. Under different social circumstances these same*
> *boundaries might become a focus of contestation and struggle and the subject positions*
> *and discursive practices associated with them might be experienced as contradictory."*
> *(pp. 68-69)*

Above, Fairclough speaks of boundaries and tensions that are fertile zones for analysis of institutional structure and social practice (i.e., "settings and practices") in which individuals exist (i.e., "subject positions are lived") and where they occupy different social positions and roles (i.e., "different social circumstances"). Within this terrain, elements of discourse are explicit representations social life, as well as less visible, obscured, or implied representations. I chose the method of critical discourse analysis (Fairclough, 1995) as an entry point into the networks of people, institutions, and artifacts that are relevant for addressing the underrepresentation of women in computing and how it is being addressed in practice.

My analytical focus was on selected moments that surfaced signs of friction, tension and dilemmas, but that also signaled the possibility of a transformative event. Chapters 6, 7, and 8 were key empirical chapters that showed how the analysis of the elements of discourse and practice can reveal instructive moments. My analytical process involved tracing pathways through interconnected moments and applying methods of critical discourse analysis to identify points of tension amid interventions for social change on issues of gender bias and the underrepresentation of women in the tech workplace. As seen in these chapters, moments of discourse were not linear, but that there were networks of moments of discourse and social practice, with multiple related discursive elements and non-discursive elements. Among the notable themes that came forth in the analysis were the challenges of addressing unconscious bias, the prospects and dilemmas of engaging male allies, and the tensions embedded in the numbers vs. culture paradigms These next three sections are argued from the standpoint of three main benefits that the discourse perspective offered to my work in uncovering instructive moments.

I.   Moments of discourse revealed tensions, frictions, or contractions that arose from *different gendered subject positions* within the terrain of women as individuals and tech sector companies as institutions.

II.   Moments of discourse revealed *tensions and disagreements within alliances* and among "kindred spirits," showing how similarly motivated agents of change can enter zones of discursive conflict.

III.   Moments of discourse surfaced *differences in institutional paradigms* regarding the processes of social change - differences that must be navigated and negotiated for durable social change to happen.

As will be discussed next, my analysis addressed diversity and the underrepresentation of women in computing from the perspective of moments of multiple intersecting discourses and realms of social practice. These sections review moments that explored navigating different subject positions, tensions within alliances, and different institutional paradigms.

Moments I – Navigating Different Subject Positions

My analysis of moments of discourse was able to surface tensions, contradictions and dilemmas among individuals with different gendered subject positions. For example, a female employee and a male CEO can have different experiences around gender and power in the tech sector, as can a female and male leader at similar levels in an organization. There were notable moments that highlighted tensions around different subject positions, especially around issues of gender and power. Two specific themes in the discourses of diversity interventions that emerged through my analysis were "unconscious bias" and "male allies." The prevalence of these terms in transcripts of meetings and discussions, institutional policy, texts and document artifacts were signals that suggested deeper investigation and I selected particular moments of discourse to unpack as zones for analysis of variations by subject position (e.g., individuals of different gender, different roles, different social context).

Unconscious bias

In Chapter 6, I explored the phenomenon of unconscious bias, a topic that emerged academic research to becoming something that was being addressed as discourse and practice in many workplaces. Unconscious bias is now a dominant term in the diversity discourse of Silicon Valley and the tech sector, and many companies have responded by introducing unconscious bias training into their diversity programs. The not-for-profit organizations (especially ABI and NCWIT) worked to introduce leaders of many top companies to the research and the thinking – specifically, what unconscious bias means, how it has been measured (e.g., Project Implicit), and how it can be used in diversity training programs. Evidence of the *motivation* to take action on the social issues of gender bias was seen when unconscious bias training was embraced by companies as the way forward. But there are still many open questions about the effectiveness of these new training programs, how companies measure their impact, and whether there will be longer term commitment by companies, especially those that privilege a limited view of financial performance over the value of diversity and social justice.

As the academic research on unconscious bias has shown, this type of bias, also known as "implicit bias," is a phenomenon that both men and women can exhibit. By definition, unconscious bias can manifest in situations where people least expect it and this is one of the challenges and dilemmas of addressing it, notably because does not operate at the level on conscious awareness and intention. From a discourse perspective, signs of this phenomenon can be detected in verbal utterances of individuals, as well as texts of organizations (e.g., job descriptions, policy statements). When moments of unconscious become visible, they can be powerful, especially when they are seen as a crisis of discourse. Such moments can be signs of unspoken and unresolved tension, as well as harbingers of change. Both types of cases are

worthy candidates for analysis of navigating different subjects positions, as seen in the moments summarized below.

Moment: **Nadella's "good karma" for women's pay**

Chapter 6 unpacked a moment of crisis where unconscious bias was exhibited by a senior male leader who was identified as a male ally for women in tech. This moment was at GHC 2014 when Satya Nadella, the male CEO of Microsoft, was in a "conversation" with Maria Klawe, president of Harvey Mudd College and member of the Microsoft Board of Directors. Things went well until the discursive eruption when Nadella responded to a question about how women should ask for a pay raise when she finds it uncomfortable. In responding, Nadella suggested that women should not have to ask, but trust in "good karma" as the system and its institutional structures would ensure they received the right thing over time. In this one moment, Nadella exposed a notable example of his own unconscious bias, a blind spot about structural forces that have a precedent of maintaining significant disadvantages and barriers for women, which also affects promotions, recognition, status, and pay.

By publicly exposing his lack of awareness of the underlying gender issue to the audience of the largest international gathering of women in computing, Nadella immediately became the target of criticism. At the same time, he was an example of how a well-intentioned male leader can operate with an underlying cognitive substrate that includes elements of unconscious bias. Nadella's gendered subject position as the male CEO of Microsoft enabled him to comfortably assert his "good karma" metaphor while operating in the institutional context of the tech sector where there are known issues of women being underpaid or undervalued. From different subject positions, including those of the women attending GHC in person and those on social media, this

utterance was a moment that had much to unpack. The Nadella comment triggered a network of moments of crisis expressed as multiple elements of discourse including reactions on Twitter and mainstream press coverage that expressed disbelief, anger, and outrage. The power of the moment was seen when Nadella's statement had an international reach the brought awareness to a broader public of an issue that many knew about, but didn't talk about. What some had initially expressed as an unfortunate error by Nadella, others saw as a productive element of discourse for social change. The Nadella moment also showed signs of durability over the next 3-year period in the media [157], and it was reflected again in Nadella's autobiographical book written as a sitting CEO[158].

Moments II – Navigating Tensions and Disagreements within Alliances

Male allies… they can be motivated, they can be flawed, and they can be committed. Even amid their flaws and frictions, they are still essential participants in the processes of social change. The Nadella moment showed an essential tension in the gendered subject position of the male ally, one where elements of discourse could expose a high-profile male CEO who unintentionally exhibited unconscious bias, thus contributing to an international conversation about gender bias in the workplace. In 2014, the GHC program also staged another event committed to engaging men who identified as male allies. The GHC14 "male allies panel" brought male leaders from the tech sector to the front stage to talk among themselves about issues of women in tech, diversity, and inclusion. There were no women on the panel, yet there was a large audience of women who were not given the opportunity to engage with the panelists

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[157] See recent coverage of Nadella on PBS Newshour, November 17, 2017,
https://www.pbs.org/newshour/show/how-microsofts-ceo-has-hit-refresh-in-business-and-in-life
[158] Nadella, S. (2017). *Hit Refresh: The Quest to Rediscover Microsoft's Soul and Imagine a Better Future for Everyone*, HarperBusiness.

on stage. Before the panel began there were tensions looming, as was revealed by the moment of discourse known as "Allies Bingo" that was a type of disruption and resistance mounted by members of the audience.

***Moment*: "Allies Bingo" at the GHC male ally panel**

Allies Bingo was initiated by one woman who identified herself as a member of the Union of Concerned Feminists, a self-proclaimed guerilla action group whose purpose is to support feminist activism in tech. As a moment of discursive activism, and unbeknownst to the male ally panelists, the Allies Bingo game was played on Twitter by GHC audience members while the male allies panel was in session. When an audience member successful yelled out "Bingo" there were many who were satisfied at the immediate impact of the discursive online intervention, and others were surprised and confused, including the male panelists and those who were not privy to the game.

Allies Bingo represented an eruption of existing tensions of different subject positions within an assumed coalition. As Butler (1999) warned, even within a coalition for women, there can be different viewpoints. The male ally moment at GHC revealed the voices of activists who took a position of skepticism about the men on the allies panel, the voices of moderates who expressed appreciation to the men for their participation, and the voices of the optimistic who believed that culture change required collaboration of women and men together. The male allies panel and the Bingo game were situated in a network of discourse elements that included: statements on social media that preceded the event; statements by those who questioned the motivations of the event planners in featuring the male panelists at GHC; statements of the CEO of ABI who defended the panel's purpose; and statements after the event on social media, blogs,

and the tech press. There was also the collection of NCWIT Resources about male advocacy and allies that was consulted by ABI staff when planning the male allies event.

Overall, in these moments of discourse, there were tensions and gender struggles that were exposed as different subject positions expressed different interpretations of what constitutes a male ally, both symbolically and in practice. By the time GHC14 was over and the frictions were widely exposed outside the event, the leadership of the ABI not-for-profit organization and partner corporations were deliberating about appropriate responses. These were all points where discourse and social practice intersected and at this moment anything was possible, including: men choosing not to speak up as male allies in the future; backlash discourses that could discourage individual agency, pro-social discourses that would encourage women and men to speak up even if they felt it was too risky; advocacy to align men and women to work together in coalitions; and new policy and programs to combat bias. There were elements of all of these in the aftermath of GHC14. There was also a notable example of corrective discursive action one year later at GHC15 taken from the male subject position when one of the male ally panelists returned to showcase himself as the model of a committed male ally.

Moment: GoDaddy CEO as model male ally!?

Moments can influence other moments, and ABI choose to feature a male ally again at main plenary session at GHC15, this time a solo appearance of the CEO of GoDaddy, the company that was notorious for its sexist advertising. CEO Blake Irving was a conspicuous target of the criticism levied at the male ally panelists in 2014, so much so that ABI CEO Telle Whitney made public statements endorsing Irving's involvement in the 2014 panel. Irving was already in the process of making changes at GoDaddy that included building a diverse senior

management team with women in three top position and making notable progress on pay equity

and advancement for women. With these actions already in progress, Irving was able transform

what he was doing in practice *into a powerful element of discourse* that contributed to the

broader discourse of gender, male allies, and tech sector leadership. After the debacle of the

Nadella incident and the male allies panel at GHC14, Irving rose to the occasion at 2015 to give

an impassioned talk that invoked his personal beliefs and professional experiences and also

revealed the source of his personal motivation for working as an ally for women. In being

transparent about how he made progress in his company in practice, he discursively challenged

every other male CEO in Silicon Valley to do the same by speaking up and taking action as male

ally for women in tech. The pariah of the GHC14 male allies panel received a standing ovation

after his moment of discourse at GHC 2015.

Together these male ally moments contain many powerful elements of discourse. For

example, they are moments that both reflect and re-constitute social practices of activism, both

the feminist activism of women who challenge men, and the activism of men who accept the

discourse criticism and participate in re-constituting the male ally discourse. These moments of

discourse were significant for making visible what many women experience and think, as well as

how some male colleagues and male leaders can behave and think about gender issues. These

moments of discourse were also significant in terms surfacing dilemmas that can emerge, in

practice, when engaging male allies. Moments of discursive crisis helped inspire an organization

(e.g., ABI) and an individual agent (CEO Blake Irving) to stage an event where the most

controversial male ally of the GHC14 panel came back a year later to make a discursive

intervention. As a moment of discourse designed to promote action, Irving challenged other

CEOs in tech to demonstrate, as he did, being a male ally for women in tech. In short, the

moments highlighted in this section showed the dilemmas of the subject position of the male ally

and the prospects of both women and men engaging with male allies in the fight for social

change.

There can even be friction among "kindred spirits"

Even organizations and individuals that are viewed as "kindred spirits" can be observed

to have tensions that reveal cracks in the assumed unity of a coalition. I invoke Butler's (1999)

observation about feminist coalitions again.

> *"The insistence upon the coherence and unity of the category of women has effectively
> refused the multiplicity of cultural, social, and political intersections in which the
> concrete array of 'women' are constructed." (1999, p. 19)*

Within alliances that have a shared sense of purpose (e.g., organizations with common

goals of advancing that state of women in tech) there can still be differences that can be seen in

discourse as tensions or contradictions. My research surfaced one such lesser spoken tension

that was evident in the friction between advocates of Lean In (often coming from a business

perspective) and critics of Lean In (often coming from academic perspectives). Interviews with

members of the NCWIT not-for-profit revealed such tensions, with some staff expressing the

view that Lean In stance had become an "ideology" and that, as an intervention, the Lean In

approach was not subjected to research that could provide "evidence" of its effectiveness as a

method[159]. Others felt that there were issues of class and race that were not being adequately

addressed by Lean In.   Other feminists have critiqued Lean In from the standpoint of gender and

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[159] NCWIT's narrative of "evidence-based" supports a critique of Lean In since there is no social science
research that provides evidence that "leaning in" is a successful behavior for all women (or only some
types of women).

power[160]. From the perspective of leaders of the not-for-profit organizations I engaged, there were different views about Lean In with some embracing Lean In Circles as an important professional development opportunity for women and others characterizing Lean In as an example of the "fix the woman" narrative and that the Leaning In (as an action) was not based on evidence. Despite such critiques from academics, leaders in the not-for-profit sector, and feminist activists, Lean In is a highly visible and popular diversity movement for women in the workplace. This is one example of how the analysis of the discourse of organizations and individuals can reveal tensions among kindred spirits, such as those who share the goals of gender equality in the workplace work yet align differently on means for improving opportunities for women in the tech workplace.

Moments III: Navigating Different Institutional Paradigms

Moments of discourse are able to surface tensions and misalignments of different institutional paradigms related to the process of negotiating social change. In Chapter 1, I discussed the notion of the "pipeline" and how it could be used as a type of abstraction that could be invoked by leaders of companies to pass responsibility upstream when it came to diversity issues in corporate policy and practice. When considering the low percentages of women in technical roles in the sector, the discourses of a pipeline for qualified women in computing being dry could allow startups, and even established tech companies, to relinquish responsibility and avoid taking a reflexive stance to evaluate their participation in cultures that contribute to the gender problem in tech. This type of hands-off stance, taken in practice, serves to reinforce and

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[160] Lean In critiques as previously cited in Chapter 8, include feminists in academia (Ashcraft 2016; SIGCSE '16; Rottenberg, C., 2014; Williams, C., 2014; hooks, b, 2013) and feminists in the workplace and the media. (Slaughter, A., 2012; Leahey, 2013; Faludi, S., 2013; Covert, 2013).

reproduce discourses of a masculinized computer programmer within the contemporary white male dominated tech sector.

For over thirty years, the corporate sector has attempted to address the underrepresentation of women in leadership and technical roles through a range of diversity programs built around measurement in the form of diversity data and metrics that usually focus on the number of women hired and retained in a company. There has also been a limited focus on measuring the number of employees that have been mentored, received professional development, or received diversity training (e.g., such as the latest unconscious bias training). Despite these efforts, we still see that computer science continues to be an outlier when compared to other STEM disciplines both in the percentages of women receiving degrees and employment in the workplace. This means that computer science and the computing workplace remains the only STEM area where the percentage of women has gone downward over a multi-decade period. While seeing this data in aggregate is important to raise awareness of this anomaly, the meaning behind the trend is where the real work still must be done. For Silicon Valley and the tech sector, the public acknowledgement of employment demographics of particular companies was viewed by many as a critical first step, but there are many other steps to have an impact on turning the trend around.

Moment: Silicon Valley publicly releases diversity data

The corporate sector has historically operated with an institutional paradigm that values data and quantitative measurement of results, and this has followed into the realm of measuring diversity. The U.S. government gave the Equal Employment Opportunity Commission (EEOC) the responsibility for enforcement of Title VII of the Civil Rights Act of 1964, which prohibits

discrimination in employment on the bases of race, color, national origin, religion, and sex. Since then, employers with a threshold number of employees have been required to collect and report the aggregate employee demographics to surface employment patterns by gender, race, and ethnicity. However, the EEO data had been too coarse-grained to surface the type of gender disparity seen in the tech sector. The EEO data obscured the reality of the low percentage of women in *specific types* of professional computing roles in tech sector companies, in particular the influential and well-rewarded technical design and development roles. A key moment in the discursive terrain for women in computing was the public release of diversity data by top Silicon Valley and tech companies, a move that not only validated what was hidden in plain sight (the lack of diversity), but confirmed that Silicon Valley was dominated by white males. When this descriptive diversity data is connected to other qualitative elements of discourse about sexual harassment and gender bias in the workplace, it represents an evolving national discourse on gender and power in the workplace. What the Silicon Valley diversity data revealed can now be placed in a broader discursive terrain that illuminates the meaning of the data in context of the social forces and systems of a gendered technical workplace. Thus, the moment of Silicon Valley's 2014 diversity data was not just an element of discourse about jobs and the tech sector economy; it also revealed a hollowness in Silicon Valley rhetoric about serving the world by providing "transformative" technologies for all types of people, but not being designed and developed by all types of people.

The ABI and NCWIT not-for-profit organizations have played a role in taking the next step through interventions aimed at changing the focus of interventions from issues of numbers to issues of culture when addressing the underrepresentation of women in computing. Both NCWIT and ABI began influencing companies to collect other types of data that could help

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reveal the dynamics of culture. Both not-for-profit organizations disseminate discourses that the problem is not intractable and that culture change in possible. Both not-for-profit organizations are able to make their claims from a structural position that enables them to engage with different institutional paradigms about data and culture, knowledge and action. From this position, they mediate different orientations of the corporate, academic, public and private sectors with the overall goal of influencing coordinated and durable change.

With companies starting with a numbers and metric paradigm for diversity interventions, the task at hand was to meet those companies where they had begun and be able to influence them to move forward on the next steps for diversity data. NCWIT and ABI began at this bridging point and worked to inform and motivate organizations to look differently at "data" by expanding the definition of data beyond numbers and metrics. ABI did this in its "Measure What Matters" program that began by improving the data model and processes for companies collecting and analyzing quantitative data, and then moving on to qualitative data that could reveal dimensions of human experience and cultural dynamics and help in understanding *why* there have been decades of minimal progress for diversity in the tech sector. Still, other types of data analyses can infer patterns that are signals of gender and power, such as NCWIT's patent project that used name analysis to reveal things such as the percentage of women were granted patents in the U.S. patent database. Patents are a reflection of who occupies the types of positions that provide opportunities for innovation. They also register claims of expertise. The patent study is one example of thinking creatively about *different data.* There are other approaches, such as quantitative social network analysis, that can provide insights to structural patterns that influence the flow of resources and social capital and ultimately power. When gender becomes an attribute in such network models, there is the potential to reveal things about

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where an individual is positioned within network structures and zones where power is exchanged. Looking more broadly at the notion of different types of data brings us to the case of "text" as data, where new developments in "humanities computing" can explore the extraction of knowledge through techniques developed at the intersections of humanities and computer science. Algorithmic analysis of such data can identify patterns that can be further analyzed to help reveal disparities of power within institutions. Since many historical texts have not focused on women, and recent texts may have little narrative about the experiences of women in tech, this approach can suffer from the challenge of finding what is not there, essentially trying to find meaning in what is relevant but absent or hidden. From the institutional paradigm on diversity data, text can be thought of as a different type of data, but it is not clear under what conditions companies would be interested in engaging text analysis techniques for probing questions on gender bias and power. This remains an open area of scholarly research.

Moment: Ashcraft Plenary - Lean In as "cruel optimism"

Tensions can be uncovered when looking at diversity from different paradigms. This was seen in a moment of discourse at the 2015 NCWIT Summit during a plenary that unpacked a cultural perspective on issues of gender bias and the dynamics of power in the creation and maintenance of symbolic occupational identities in the workplace. My analysis of the Ashcraft plenary revealed a *tension within the coalition* of individuals and organizations working to improve opportunities for women in workplace. This moment contained an element of discourse that invoked a particular narrative about the Lean In movement by Ashcraft's framing it as a form of "cruel optimism" (i.e., NCWIT Summit with Ashcraft invoking Berlant's metaphor). This moment of culture presented practitioners with a theory about the power of the masculine *figurative practitioner*, a symbolic construction that is culturally and discursively reinforced.

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The paradox of the creation and maintenance of the symbolic persona was the "cruel optimism" of a culture that encourage women to uncritically pursue an ideal despite cultural conditions that are not in their favor.

My analysis revealed a tension at the NCWIT Summit where many in the practitioner audience were left in a muddle after hearing Ashcraft's socio-cultural and critical perspectives that also challenged the foundations of Lean In as a popular career-oriented movement. This revealed differences in institutional and knowledge paradigms, where practitioners looked for concrete actions that they could bring back to their companies, while an academic was providing historical and cultural insights to reveal a complexity that requires navigating a network of forces for interventions to succeed. Some members of the practitioner audience did not easily embrace such culture arguments that introduced more ambiguity; they were dismayed by the absence of unambiguous advice with clear actions that could be taken.

This moment occurred at a time that was ripe for discussion about this history and culture of gender bias in technical occupations, especially given that issues of gender bias in Silicon Valley had become more visible in the press and public media after the 2014 release of diversity data. There were many who expressed relief that companies had finally released "evidence" through the act of making their diversity numbers public. But the Ashcraft plenary provided an example of how these data can have surface appeal from particular "evidence-based" paradigms[161] but still do not address the complexity of the meaning behind the numbers – in this

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[161] It is notable that NCWIT uses the term "evidence-based" in many of its discourse artifacts, which can be an appeal to the corporate sector that values measurement through metrics and quantitative approaches (as "hard" evidence). But NCWIT is actually validating other types of evidence in promoting scholars like Ashcraft at the Summit. Evidence is historical and cultural, the stuff of rigorous social science and theory. This has often been de-valued by those who are operating from data-centric paradigms. Thus, I

case the organizational and identity issues that are fraught with tension and ambiguities regarding gender.

The plenary and the discussions at the NCWIT Summit also revealed tensions around different institutional paradigms of *knowledge* and *action*. Regarding knowledge, the Ashcraft plenary brought to the surface the question of whether knowledge was to be found in data and quantitative analysis, or through cultural analysis. At the same time, the Ashcraft moment revealed a tension that even when bringing forth evidence from a rigorous historical/critical and social science research program, some practitioners will not comfortably embrace that knowledge if they have a hard time translating it into "action" at their companies. This reveals the challenge of navigating different paradigms where some stand on the value of quantitative data, with the assumption that concrete actions can only be taken in response to measurements, and that change translates to altering the trends that are recorded by such data. Others, including academics, feminist activists, not-for-profit leaders, industry visionaries, and diversity professionals, seek meaning in understanding the symbolic, the experiential, and the observations made of the lived world. It is with these hybrid forms of knowledge that new strategic interventions can be mounted. This stance also acknowledges that ambiguity exists and that there are some areas where there is a lack of answers. It is from here that both scholars and practitioners can introduce new forms of inquiry and research can raise new questions.

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interpret their promotion of the term "evidence-based" as both rhetorical appeal to industry and a validation of social science and qualitative data as essential evidence when navigating issues of identity, justice, and culture.

The Path to Social Change

This dissertation has shown both convergence and tension among different discourse communities (academic, corporate, government agency) regarding the need for culture change in the tech sector and the means of addressing gender bias and the underrepresentation of women in computing. The analysis revealed tension between those whose dominant orientation is from a "business case" perspective versus "social justice" perspective. This is also true of those whose posture and dominant discursive orientation aligns along numbers-centric versus culture-centric interventionist and feminist paradigms. These, and other tensions, must be navigated along the path to social change for women in tech. Next, I will summarize with some take-away points.

Some progress has been made by companies that have committed to increasing awareness about the realities of gender bias and the significance of the cultural issues that lie behind diversity numbers. This is a positive development for a corporate sector that has traditionally been oriented to a data-centric perspective on diversity and metrics that can obscure the underlying meaning of the cultural issues. There has also been some progress in diversity policy and programs in the areas of work-life balance, mentoring and diversity training that are intended to benefit female employees in the tech workplace. But as Dobbin & Kalev (2016) found, there are still questions about the effectiveness of diversity training programs and we don't know yet if the newer unconscious bias training will have different results than former attempts. Both for the companies and for the not-for-profits I engaged with, there was acknowledgement of many open questions regarding effective ways to measure results and impact of interventions aimed at culture change. With tensions among proponents of the metrics-centric vs. cultural perspectives. both ABI and NCWIT have worked to bridge this gap through the creation and dissemination of

discourses on best practices, and especially education and deliberation at forums of discourse such as GHC and the NCWIT Summit.

Keepers of the Flame

As the metaphorical *keepers of the flame*, not-for-profit organizations that are pursuing a social mission focused on women in technology are positioned as leaders in the network of individuals and institutions that have an interest in closing the gender gap in tech. ABI and NCWIT occupy a position of power as leaders of discourse communities, which is especially visible at the forums of GHC and the Summit.   The leadership at both ABI and NCWIT have worked to bridge institutional paradigms regarding what is knowledge, what is "actionable" knowledge, and what is measurable in terms of impact, and what is the meaning of justice and the public good.   There are different views of these questions in both the corporate and academic sectors.   As 501(c)3 not-for-profit organizations, ABI and NCWIT are structurally positioned to be able to converse with multiple constituencies, and to navigate both sides of the numbers versus culture discursive divide. They are able to mediate, disseminate new elements of discourse, and to work with the tech sector on ways to improve opportunities for women, grounded in a public mission based on principles of what is good for society.

While both NCWIT and ABI are working to promote culture change through women and men working together, the Grace Hopper Celebration may not be able to significantly shift away from its identity as a forum primarily for women with a focus on female empowerment and female celebration. While ABI leadership agrees that more men must also be engaged, there is a challenge of social identity that was apparent at GHC as there are many who would like to GHC to remain that "nirvana" for women in tech, as was described by Berman.   There are others who

believed that GHC had become too large and was catering to corporations as a place for career networking and job hunting. In either case, GHC remains the only large international gathering of women in tech that focuses on promoting female identity in computing, provides an opportunity for women to showcase their work at the ACM co-sponsored conference, and influences visions of a world with technology that is designed and developed by both women and men. Taking a slightly different stance, NCWIT's leadership assert that "NCWIT is not a woman's organization" meaning that they would like others to view NCWIT as an organization of women and men who care about women and computing. As a non-profit organization, NCWIT has been described as the "NPR of women and tech," the "Consumer Reports of women and tech" and the "TED of women in tech." From this standpoint NCWIT is positioned as a knowledge organization with a major goal of influencing the tech sector to move forward to ensuring "meaningful participation" of women in computing, especially in the design and development of software and computing technology.

Sustainability and Durable Change

Long-term culture change requires *durable* commitment, continual focus, and reinforcement. This is being done through relationships among individuals occupying different subject positions and organizations with different institutional and knowledge paradigms that must necessarily align to forge substantive and lasting change. For the foreseeable future, none of these agents of change can give up; they can't become complacent. NCWIT, ABI and other not-for-profit organizations in the WIT ecosystem occupy an essential structural location that can bridge different sectors (i.e., academic, government, corporate) and operate at the nexus of discourse and social practice. They operate in a complex terrain that engages at all levels of the from K-12, higher education in computer science and related disciplines, and the technical

computing workplace that includes both established companies and start-ups. The slippery slope

that must be acknowledged is that over time threats can emerge that challenge their successful

interventions including: backlash[162] and the re-emergence of behaviors of gender bias in the

workplace, lack of enforcement of diversity policy. We must be aware of subtle and insidious

erosion of improvements in organizational cultures, as well as apathy that dilutes the will to act

on principles of diversity. It is necessary to be vigilant about injustice when economic and

market forces stimulate an environment where competition can trump principles of fairness and

good sense. A recent example of backlash can be seen in the 2017 event of a male Google

employee who wrote an internal memo questioning and criticizing Google's diversity efforts.

The employee was fired by the company (Wakabayashi, 2017) and later the employee claimed

wrongful firing (Tiku, 2018). There have also been other recent reports that reveal signs of

backlash in Silicon Valley (Benner, 2017). For these reason, at least in the foreseeable future, it

organizations like ABI and NCWIT can serve as a watchdog and a force of inspiration as the

keepers of the flame for women in technology.

Limitations of this Study

I am not able to provide, nor was I expecting to provide, a simple, uncomplicated answer

to the question that provoked my interest in doing this work - "where are the women" in the

computing workplace? I was able to lean on a significant body of historical and social science

research has approached this question from many directions, providing insights about what

happened since the 1980s when I entered the computing workplace at its peak participation level

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[162] An earlier analysis of the phenomenon of backlash against women and feminism is worth revisiting, For a feminist analysis of backlash see: Faludi, S. (1991). *Backlash: the undeclared war against American women*. New York: Crown.

for women. Standing on this research that explored reasons for the decline, my intention was to look at the *interventions* that have been mounted to address this underrepresentation, especially since the emergence of the Web in the 1990s. Unfortunately, there is not a "silver bullet" intervention for eliminating gender bias in the tech sector, nor is there one reliable and "proven" method for solving the problem of the under-representation of women in computing. While my analysis was focused the period 2014-2016, I have included references to many recent news items about events as recent as 2018 that reveal more about the current state of bias for women in tech and workplaces more broadly in many sectors. The type of analysis I did herein can continue to help reveal where complexities lie and inform the ongoing process of paving new pathways for durable culture change in tech.

On the question of measuring impact of diversity interventions, this begs the question of impact *for whom*? A company? An entire sector? Individual women? Girls? Men? Measuring impact brings up the complex issue of how to measure culture change and also introduces a temporal dimension to the analysis where culture change happens slowly and faces the durability challenge of longevity and sustainability over time. My research was not about measuring the specific impacts of the interventions that I studied. This would be both a short-term and long-term proposition that would require deep access to internal corporate information such as company policy, strategy, and data.   I did conduct deep interviews with industry leaders (CEOs, CTOs, HR and IT professionals) regarding the particular interventions they are doing in their companies to address bias and increase gender and racial diversity. Instead, I relied upon their public discourses. I also did not interview the leaders of the other well-known organizations in the WIT ecosystem (e.g., Lean In,) and others that are approaching the underrepresentation of women from a grassroots level by teaching coding and programming skills to women (e.g., Girls

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Who Code). Since I was interested in that state of women in the tech workplace today, I also did not study not-for-profit these organizations that were predominately focused on K-12 girls in computer programming. I recognize the significance of this work especially the impact it can have in changing gendered identities around the computer and programming that begin at a very young age.

The scope of my study was to analyze interventions through the lens of organizations and the leaders of organizations who were working for change in employment in the tech sector. My participation in the forums of discourse allowed for observation of the agency of individual women and their viewpoints through informal discussion with them about their experiences, encounters of bias, and improvement they have seen. My engagement with such individuals was done through informal participant observations at the GHC and the Summit and, to a limited extent, in my observation of Girl Develop It events, the Systers email community, and membership in a Lean In Circle. Deeper observation and ethnographic analysis would be needed to open up the agency dimension more, which can include deeper investigation of individual variations in the identities of women in computing, such as how identity variations around age, experience, and international/geographic, ethnic, gender variations may result in different experiences and responses to bias. Future work can open up more analysis of individual agency from the perspective of the variety of women who are the beneficiaries of the changes that have already been made and those that current interventions hope to catalyze. This and other areas of reflection and can become zones for future work, as discussed next.

Further Reflections and Future Work

In conducting this research, I positioned with an interdisciplinary stance at the intersections of the fields of Communication, Science and Technology Studies, and Information Science. I argue for the value of this type of interdisciplinary research, not only from the standpoint of the unique perspectives and knowledge it can produce, but how it can inform each of these respective academic fields. Next, I provide some reflections on issues from the perspective of each field and also my ideas for future work. Critical discourse analysis and qualitative research can provide perspectives on gender and power as expressed in the processes of designing and developing new technologies. Whether these technologies are Web applications, platforms for knowledge creation and dissemination, or social media there are elements of discourse and practice that can be analyzed to reveal who has the power to create and who is affected by what is created.

The scholarly analysis of diversity in computing must continue to answer questions about the presence (and lack of presence) of women and other minorities in the design and development of software and technological systems. There continue to be questions about what is considered technology and who is considered the "true technologist?" As, Oldenziel (1999) observed,

> *"The history of the selection, labelling, and designation of objects as technology is essential for our current understanding of who is believed to be a true technologist or an inventor, who possesses the right kind of technical knowledge; and who or what may be the authentic bearer of technology.* (Oldenziel, 1999, p.19)

Oldenziel made this observation in her analysis of the association of masculinity and machines in the industrial era, but it can inspire us to ask the question of whether modern software technology can become similarly gendered in the Web era. Scholars have explored the

history of computing from the 1940s when computers were machines that required "coders" to

make them perform, through the mid 20th century when programmers did their work on "big

iron"[163] mainframe computers. We have seen the evolution of software as a recognized form of

technology in its own right. In the current Web era of "virtual computing," the language of

machines is still ever-present in the form of "virtual machines" and "machine images."

Currently, a discourse of modern computing has emerged that compares "bare metal"[164] (or bare

machine) with "virtual" and "cloud" servers[165]. Utility computing has appeared virtually as

"cloud infrastructure" that is heavily dependent on sophisticated software that allows many

physical computers to operate as one large machine. Web applications and services can now be

developed and deployed as "software as a service" (SaaS), with the most common example of

this approach being software applications in the form of "virtual appliances" running on virtual

utility infrastructure[166]. Software applications that are being developed for the Web are

increasingly deployed in "containers" (e.g., Docker[167] images) that include both software for the

operating platform as well as the application.

I suggest the discourse of modern software development has new binaries that evoke the

"soft/hard" divide in computing as discussed by Edwards (2003), re-inscribing an association of

masculinity and machines in new ways. We can examine how this plays out the roles that align

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[163] See an exhibit on "Big Iron" mainframe computers at
https://newcomputermuseum.org/guide/mainframe/

[164] "Bare metal" is used to refer to a computer executing instructions directly on logic hardware without an operating system software.

[165] See one example of this in an IBM blog entry at https://www.ibm.com/blogs/cloud-computing/2014/07/25/bare-metal-vs-virtual-servers-choice-right/

[166] The common example of this is the use of Amazon Web Services (AWS) to use utility infrastructure ("the cloud") where and an Amazon Machine Image can run on virtual computing utility (Amazon Elastic Computer Cloud or EC2) with virtual cloud storage (Amazon S3).

[167] Docker, https://www.docker.com/what-docker

along metaphors such as "frontend developer" vs. "backend developer", "client-side programmer vs. server-side programmer" and most recently user experience developer and cloud services software engineers. As a practitioner in the field, I have observed the gender distributions in these software developer roles, with high male participation in the design and development of software for operating systems and virtual machines, and a notable female presence in the areas of user interface development and user experience. Not surprisingly, the software development roles that are closer to the "virtual machines" are yielding higher salaries. More research is needed to understand whether we are seeing a modern replaying of the history of masculinity and machines in the modern Web computing era. This also raises questions of how the gendering of the *processes of developing* modern computing technology results in technologies that have a gendered nature. More research is needed to surface how elements of gender in the production of software can become embedded in the software itself, which requires asking questions such as: is it designed for particular gendered needs and desires, designed to protect of privacy, designed for safety, designed to prevent mis-information, or designed to promote different understandings of knowledge and justice?

One early inspiration for my undertaking this dissertation research was to explore a social perspective on the technology developed by communities operating outside of "traditional" structures of (e.g. corporate structures; formal institutions) such as open source communities that promote ideals of collaboration, sharing, and openness. As open source had moved from being a radical and revolutionary movement to becoming more mainstream and best practice in many organizations, women and other marginalized groups were still underrepresented in the development of open code, open standards, open data, and open knowledge resources. I note that there is still a limited amount of research on gender and peer production communities (e.g.,

both open source software, and knowledge communities such as Wikipedia). With the continuation of an extremely low percentages of women in open source development communities, there is more work to be done around issues of both bias and identity that must be further unpacked and analyzed. There is still much work to be done on the implications of the patterns of participation in such communities, what types of technologies are built, and why some groups (e.g., women, racial minorities) continue to make up only a small percentage of these communities. There are also questions such as how meritocracies might actually be discursive *performances of merit* (vs. actual merit?). If a meritocracy speaks a discourse of full participation and equality yet promotes a culture that discourages or obstructs certain types of people from effectively participating, this is not a pure meritocracy.

Related to this is the need to foster "pro-social" discourses about gender and technology in the building of software and technological systems, and this need is everywhere from Silicon Valley to knowledge organizations such as universities, research libraries, and cultural institutions. Issues of gender and computing intersects with the work of many scholars who collaborate in research areas focused on "knowledge infrastructures" (Edwards, Jackson, et al., 2013) and "values in design[168]." These are both interdisciplinary research areas that the National Science Foundation and others have funded and there continues to be many open questions that involve gender in the design and development of software, policy, and technical standards. Critical discourse analysis can be used alongside, or in conjunction with, critical data studies (boyd & Crawford, 2011, 2012; Gitelman, 2013; Kitchin, 2014), critical information studies (Vaidhyanathan, 2005, 2006), and infrastructure studies (Borgman, 2015; Paul N Edwards,

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[168] See the website of the Values in Design Council, http://www.nyu.edu/projects/nissenbaum/vid/index.

Bowker, Jackson, & Williams, 2009; Gillespie, 2018; Plantin, Lagoze, Edwards, & Sandvig, 2018). It is often not apparent that decisions made about the design of the technical standards and protocols at the core layers of the Internet, all the way up the technology stack to what is programmed into social platforms and applications, can have implications for civil liberties, privacy, and freedom (Brunton & Nissenbaum, 2015; DeNardis, 2009; Jackson, Gillespie, & Payette, 2014; Lessig, 2006; Mayer-Schönberger, 2009; Zittrain, 2008). If gender and power can be deeply imprinted in the design of technologies that are introduced to society, then there are questions about who was present and who was absent at their conception, as well as questions about what is built and what should not be built.

Following up on the work of this dissertation, there are still questions regarding the durability of discursive moments and how long specific interventions for diversity will last. Foucault would suggest that the discursive moments are durable, but they may be either manifest or hidden. This would suggest that the *visibility* of discursive moments is key for influencing durable social change. This would include the durability of moments such as daily micro-aggressions of bias, localized moments, and media moments (such as the viral spread of the Nadella incident). Near the end of my research, there was a significant national moment of discourse that emerged in the form of the #MeToo movement beginning in 2017[169]. This movement exposed issues of gender and power in the workplace more broadly and was an example of what may be considered a "mega moment." The multiplicity of discursive moments of the #MeToo movement were expressions by individual women who were victims of sexual harassment or assault that signaled a broad pattern of abuse of power by male leaders in a variety

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[169] See a summary of top news of 2018 about the #MeToo movement in the New York Times. The following series aggregates top articles on the topic (https://www.nytimes.com/series/metoo-moment).

of industries. The aggregate effect of the discursive moments was a loosely coordinated release

knowledge about what was in the realm of the "not said." This is the power of discourse.

More research is needed to identify the conditions that encourage and discourage pro-

social risk taking (beyond reducing risk assessment to profit-making arguments of the private

sector). There are inquiries that can be continued about the tech sector regarding obstacles to

normalizing of pro-social risk-taking, including understanding the risk of *not taking action* for

positive social change and social justice. When only a limited set of individuals and groups feels

comfortable taking pro-social risks, we need to examine the conditions that obstruct the sense of

agency and a deeper understanding of both actual or perceived obstructions to social action.

Examples presented in this dissertation included women taking collective action to surface

gender bias, male allies speaking up, and not-for-profit organizations positioning amid the forces

of commerce and industry. How do more individuals take action in daily work life without fear

of losing jobs or being labeled negatively and how do the structures of society adapt to current

conditions in tech sector?

My concerns about the underrepresentation of women in computing can be put in

conversation with other feminist studies of the gender and employment in social media and

independent entrepreneurship. For example, the gender "double bind" (Jamieson, 1995)

suggests that, from multiple directions, paradoxical obstacles can arise for women due to

gendered expectations. The double bind is also similar to the "self-defeating traps" of leadership

(Moss Kanter, 1993, 1977) or "the tightrope" where women are expected to behave in

"masculine" ways, but then are accused of not being feminine enough (J. C. Williams, 2015; J.

C. Williams & Dempsey, 2014). More recently, the notion of a "digital double bind" (Duffy &

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Pruchniewska, 2017) observed women who work in social media roles and how they felt compelled to adopt an online persona that aligns with female stereotypes and traditional perceptions of femininity. The fulfillment of these expectations can expose women to more risk and precarity in their independent work (p. 845). The topic of gender and entrepreneurship is a research area with many open questions such as and how women approach the balancing of issues of social justice and business performance; how gender bias influences the ability to secure startup funding or venture capital for women in tech; and what types of businesses female tech entrepreneurs pursue and why.

This dissertation brought together influences of critical discourse analysis, qualitative empirical study, and the socio-technical systems perspectives of STS. This approach has been valuable for reflecting critically on building technologies that are omni-present in our industries, educational institutions, our entertainment, and increasingly in our homes. At a time when we are just beginning to confront massive data platforms, the role of algorithms, and the prospect of an "Internet of Things," an interdisciplinary stance that brings gender into the analysis becomes essential for analyzing power in the face of increasingly distributed and complex socio-technical systems. Not-for-profit organizations such as ABI and NCWIT can be valued as the "keepers of the flame" for women in technology for the foreseeable future, but this also raises uncomfortable questions, such as whether the work on diversity is ever "done," and who will continue to put pressure on companies to reconcile tensions between business performance and social justice. Several themes in this dissertation continue to influence my thinking, especially critical theories on the relationship of discourse to power. Foucault and Butler both theorized power in terms of what it represses or censors; but they also observed that power can be viewed in both negative and positive terms, meaning we can focus both on what discourse takes away and on what it

produces. It is from this standpoint that we can think about how hegemonic forces can be

resisted, which can then suggest pathways for positive social change.

APPENDIX A
Missions of 501(c)3 organizations in WIT ecosystem

As seen below, each of the organization in the WIT ecosystem has a formal mission statement that reflects one or more aspects of the principles of its exempt purpose. In support of its mission, each has an array of programs that are designed to serve institutions or individuals to address systemic barriers and bias, to promote individual agency, and to influence and culture change in tech.   The mission statements of ABI and NCWIT are highlighted, followed by others.

Org Name	Mission Statement
ABI	**"The Anita Borg Institute connects, inspires, and guides women in computing and organizations that view technology innovations as a strategic imperative…. We believe technology innovation powers the global economy, and that women are crucial to building technology the world needs[170].** (IRS, Form 990, 2015) "Our mission is to increase the impact of women on all aspects of technology and to increase the positive impact of technology on the world's women" **(IRS Form 990, 2013-2014)**
NCWIT	"The mission of the National Center for Women and Information Technology is to ensure that women are fully represented in the influential world of information technology/computing. While other organizations are focused on the broader issues of science, math, and engineering, this effort is unique in its exclusive focus on information technology. (IRS Form 990, 2015, 2014, 2013)
Girl Develop It	"Provide affordable and accessible programs to women who want to learn software development through mentorship and hands-on instruction." (IRS Form 990, 2015)
Girls Who Code	"Girls Who Code programs work to inspire, educate, and equip girls with the computing skills to pursue 21st century opportunities."

[170] Guidestar, 2016, http://www.guidestar.org/profile/77-0480427, retrieved, March 20, 2016)

Code.org	"Code.org is a non-profit dedicated to expanding access to computer science and increasing participation by women and underrepresented students of color. Our vision is that every student in every school should have the opportunity to learn computer science. We believe computer science should be part of core curriculum alongside other courses such as biology, chemistry or algebra." (IRS Form 990, 2015)
Women Who Code	"Women Who Code exists to inspire women to pursue and excel in technology careers by encouraging women to engage in the broader tech community and lowering the barrier for that participation." (IRS Form 990, 2015)
Lean In	"Our mission is to empower women to achieve their ambitions. We do this in 3 ways: Lean In Circles, public awareness, and education." *(a private foundation, not a public charity)*
CEWIT	The mission of the Center of Excellence for Women in Technology (CEWiT) is to empower IU Bloomington women faculty, staff, students, and alumnae to be leaders in technology fields and to fully leverage technology in support of academic and professional excellence.[171] *(a center of excellence at Indiana University modeled after NCWIT)*

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[171] CEWIT mission, http://cewit.indiana.edu/about-us/mission-statement.shtml

How do the missions of ABI and NCWIT serve the public good? How have these missions evolved and what are the different strategies for achieving the organization's goals while continuing to operate for exempt purposes? What is the significance of the flagship programs of each organization and how do these organizations collaborate or compete with each other?

When unpacking the mission and purpose of each organization, I observe a lineage of statements that began with the words of the founder and evolved into a formal mission statement that is recorded in the public documents with the IRS.   While each organization reports a stable mission every year on IRS Form 990, there are many other statements of purpose that have an element of being *alive* as a dynamic discourse of organizational identity and that present different views of the organizations on their public websites.   To follow these trajectories of organizational identity and purpose, I examined both the history of public documents submitted to the IRS as well as the organizations' webpages over time using the Internet Archive's Wayback Machine. I corroborated the understanding of purpose through in in-depth interviews with the CEOs and senior staff.

There are two primary types of identities for each organization –first the *legal institutional identity* as reported to the IRS and that is stable over time. The other, what I call a *branded strategic identity*, is dynamic and responsive to the changing tide of the environment of tech and each organization's evolving understanding of its role and where it can have the most impact.   Ideally, these two identities maintain a consistent alignment for each organization over

time. However, depending on where we look, we see variations in the discourses that each organization disseminates, about itself and about the themes related to its mission. From a methodological standpoint, my thinking about this was influenced by the CDA perspective (Fairclough) which helps in the analysis of the relationship between discourses and social change over time.

Interestingly, both NCWIT and ABI have adopted expressions of their respective branded strategic identity based on keywords that reflect their respective legal institutional identity expressed in the mission statements.   These keywords form a 3-prong action-oriented "motto," or a branded byline, that actually encapsulates the "how" of the mission. In this sense, the embedding of these keywords reveals elements of the *strategy* each organization takes to achieve the broader "Mission WIT."

- *NCWIT motto – "convene, equip, unite"*
- *ABI motto – "connect, inspire, guide"*

These mottos constitute a triad of keywords found in communications such as the organizations webpages, media, graphics, impact reports and the publicly available documents of the 501(c)3. Based on my interview with CEO Lucy Sanders, I suspect that the use of the 3-prong motto approach was inspired by NCWIT:

> *"We used to say that we were a learning community.... I have every three prong strategy we've ever tried… But the one we have now is right – we convene, we equip, we unite a change leader network of over 650 organizations and we work to increase participation of girls and women in computing." (Lucy Sanders, CEO of NCWIT, 2015).*

Indeed, in 2015, ABI changed its formal mission statement reported to the IRS to *explicitly* include its own 3-prong motto of "connect, inspire, guide" (IRS Form 990, 2015). It is

also notable that the formal legal the mission statement was refined to specify a focus on "women in computing and organizations that view technology innovations as a strategic imperative."

The parallel structure of three keywords used by the ABI and NCWIT organizations communicate their public legal identities, which provided a ready-made analytical hook for evaluation of the two organizations side-by-side. The 3 prongs surface what each organization values and how their missions are pursued in practice through its programs..

NCWIT Mission ("Convene, Equip, Unite")

The legal organizational identity of NCWIT is expressed in the mission statement seen in the public document of IRS Form 990. (Figure 21) .

Part I **Summary**

1 Briefly describe the organization's mission or most significant activities
THE MISSION OF THE NATIONAL CENTER FOR WOMEN AND INFORMATION TECHNOLOGY IS TO ENSURE THAT WOMEN ARE FULLY REPRESENTED IN THE INFLUENTIAL WORLD OF INFORMATION TECHNOLOGY/COMPUTING WHILE OTHER ORGANIZATIONS ARE FOCUSED ON THE BROADER ISSUES OF SCIENCE, MATH, AND ENGINEERING, THIS EFFORT IS UNIQUE IN ITS EXCLUSIVE FOCUS ON INFORMATION TECHNOLOGY NCWIT'S WORK LEVERAGES THE EFFORTS OF ORGANIZATIONS ACROSS THE COUNTRY, AND CONNECTS EFFORTS TO INCREASE WOMEN'S PARTICIPATION IN IT ALONG THE ENTIRE PIPELINE, FROM K-12 AND HIGHER EDUCATION THROUGH INDUSTRY, ACADEMIC CAREERS, AFFINITY GROUPS, AND ENTREPRENEURIAL ENDEAVORS NCWIT ENCOURAGES ITS MEMBERS TO UNDERTAKE INSTITUTIONAL CHANGE WITHIN THEIR ORGANIZATIONS, AND OUR WORK PROVIDES THEM WITH THE TOOLS AND SUPPORT TO BE CHANGE AGENTS

Figure 21. NCWIT, IRS Form 990, 2013-2015

This formal mission statement has been stable over time. It is expansive and articulates a broad purpose that includes addressing the "*entire pipeline*" (from K-12, through secondary education, to employment and the workplace). Also it is focused on the representation in computing, with NCWIT working to "*ensure that women are fully represented in the influential world of information technology and computing.*" With this focus, NCWIT is distinguished from many other organizations that focus on women in STEM more broadly. Also, significant in the mission

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is the focus on encouraging and supporting organizations to undertake "*institutional change*" as well as providing tools to support the "*change agents*" in those organizations.

In contrast to the stable and durable mission expressed in the legal documents of the 501(c)3, NCWIT's branded strategic identity has changed over the years, ultimately evolving to being encapsulated in the 3-prong motto of "convene, equip, unite." This motto appears on the NCWIT website and throughout its other communications. The history of the branded strategic identity can be uncovered through snapshots of the NCWIT website over time. Using the Wayback Machine, we can look back in time to 2003 when the website had an early expression of the NCWIT mission. In these early years, NCWIT stated that "*parity*" was an overarching goal, with four reasons why this overarching goal mattered – innovation and competitiveness, jobs, social impact and equity. In this case, parity meant that there was equal representation of women and men as well as equal pay and opportunity.

> *"NCWIT's overarching goal is parity in the professional information technology (IT) workforce, and our fundamental strategy is to educate, disseminate, and advocate a national multi-year implementation plan that generates tangible progress within 20 years" (NCWIT website, October25, 2005, WayBack Machine)*

While the branded strategic identity has evolved towards the business and workplace narrative for diversity, this does not compromise NCWIT's public charity positioning since engaging the private sector is intended to serve the overall mission. Thus, the discourse of the branded strategic identity (i.e., appealing to the business narrative) is strategically useful for achieving the public mission since it catalyzes new opportunities for women in the workplace. Overall, NCWIT's interventions that engage the private sector, along with its many other initiatives, contribute to exempt purposes and serving the public good. NCWIT's full portfolio of programs

can be seen in the official legal documents (NCWIT IRS Form 990, 2013; 2014; 2015; 2016).

The top programs are summarized below in Table 3.

Table 3. Summary of NCWIT Programs, Selected

Program	Purpose	Audience
NCWIT Resources	Provide evidence-based research on issues of gender, bias, diversity, leadership. Provide practical tools for taking action based on evidence.	change agents within academic/commercial sectors, and the general public
NCWIT Alliances	Groups of leaders from NCWIT members organized into affinity groups. NCWIT enables networking, issue discussion, development of solutions, special projects, and a forum at the annual Summit	- Workforce - Academic - K-12 - Entrepreneurs
NCWIT Summit	Annual meeting to convene all Alliances to engage with latest knowledge, deliberate, strategize, network, plan for action	Alliance members and invited guests
Aspirations in Computing	Aspirations is building a community of technical girls and women that begins with outreach to girls at the K-12 levels. The programs works to inspire and empower girls with technical interests at an early age, reward them, and help them build a durable network for the future.	K-12 girls
Sit with Me	A national advocacy campaign to bring support women in technology. An iconic red chair is the centerpiece for events that feature testimonials and stories around the chair. Videos and celebrity advocates are often featured on YouTube and Vimeo channels.	- the public - organizations - individuals

ABI Mission ("Connect, Inspire, Guide")

The lineage of ABI's organizational statement of purpose begins with words of Anita

Borg, the founder of ABI.

"Around the world, women are not full partners in driving the creation of new technology that will define their lives. This is not good for women and not good for the

world…. Women need to assume their rightful place at the table creating the technology of the future." (Anita Borg, Founder ABI[172])

When founding the not-for-profit organization, the passion of Anita Borg was translated into a simple, yet powerful, mission statement that stood stable throughout most of the years of ABI's existence in its public documents. The stated mission was *"to increase impact of women on all aspects of technology and increase the positive impact of technology on the world's women."*

Part I   Summary
1   Briefly describe the organization's mission or most significant activities
    Our mission is to increase the impact of women on all aspects of technology and to increase the positive impact of technology on the world's women

Figure 22. ABI IRS Form 990, 2013-2014

In 2015, ABI's legal mission statement was changed for the first time. Figure 23 shows that ABI transitioned to using it's 3-prong motto of "connect, inspire, guide" directly within its formal mission statement on IRS Form 990. Also notable was a new rhetoric of urgency, as seen in the phrase about the types of organizations ABI serves, notably those that view technology innovation is a "*strategic imperative*."

Part I   Summary
1 Briefly describe the organization's mission or most significant activities
  We connect, inspire and guide women in computing and organizations that view technology innovation as a strategic imperative

Figure 23. ABI IRS Form 990, 2015

In contrast to this laconic mission statement, the strategic branded identity of ABI is rich with words of empowerment and inspiration. Throughout its history, ABI described itself as a social enterprise that was founded upon a belief – "women are vital to building technology that the

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[172] ABI Founder statement, **https://anitaborg.org/about-us/mission-and-history/**

world needs" (cite). The founding focus was on inspiring women in computing, addressing the

formation of positive professional identity in computing and paving pathways for individual

agency. At the same time, empowering women would also have the positive effect of helping

the world. In the early years, the ABI discourse was primarily focused on empowering women

and building networks of women. As ABI matured, the discourse gravitated towards serving

organizations in the private sector with ABI being a catalyzing force for innovation – serving the

strategic imperative of organizations.

> *"... if you look at our programs, our programs are focused in a very mainstream way… women in professional life. And a lot of women in professional life are working for companies [that] involve information technology like finance, and companies that are in information technology…. [W]omen in technology careers are a really important constituency and really have a lot to do with the success of women in technology at large. And so ABI has really focused on the private sector in a really important way (0020, 0:03:00)*

Like NCWIT, the business case for diversity has come to the forefront, and since ABI

continues to be uphold its mission in serving both individual women and organizations, it is

appropriate to invoke Giddens' "duality of structure" and the dual forces on agency and

structure. This dual purpose is in statements on the most recent ABI website, as well as personal

statements from ABI leadership.

> *"ABI is a social enterprise founded on the belief that women are vital to building technology that the world needs. Women in technology are at the heart of ABI's mission. We are on a quest to accelerate the pace of global innovation by working to ensure that the creators of technology mirror the people and societies who use it." (ABI About, 2017, https://anitaborg.org/about-us/, retrieved on 09-11-17)*

> *"We believe technology innovation powers the global economy, and that women are crucial to building technology the world needs. As a social enterprise, we recognize women making positive contributions, and advise organizations on how to improve performance by building more inclusive teams." (ABI Guidestar profile, 2017)*

Several notable keywords in these statements speak to the essence of ABI is today - "social enterprise," "innovation," and "global economy." While the fusion of social enterprise and global economy may appear paradoxical, this fusion can bee seen most clearly in ABI's flagship program, the Grace Hopper Celebration (GHC), discussed in the next chapter. NCWIT's full portfolio of programs can be seen in the official legal documents (ABI IRS Form 990, 2013; 2014; 2015; 2016). The top programs are summarized below in Table 2.

Table 4. Summary of ABI Programs

Program	Purpose	Audience
Grace Hopper Celebration for Women in Computing (GHC)	GHC is ABI's flagship program. It is the largest gathering of women in computing in the world. It caters to *both* individual empowerment and organizational strategies.	- Students - Professionals - Academics Serves private, not-for-profit, and government sectors
Systers	The original ABI program which is an online community and email list exclusively for women in computing	Professional women Female students
Partner Program	Provides opportunities for corporate partners to speak with experts and to network. The partner council has regular calls, 3 in-person meetings/yr	Corporate partners
Top Companies	Work with companies to have a model and process for collecting diversity data. Provide cross-company comparative analysis of data.	Corporate partners
Executive Forum	Senior technical executives have opportunity to connect and deliberate, share ideas.	56 organizations 104 executives-43% men
ABI.local	Local hubs of ABI activity that form a global network of communities that connect women technologies at the local level. ABI.Local offers meetups, codeathons, peripheral GHC activities and other events for technical women.	Women technologists; women and men in tech and academia; students

APPENDIX C
Timeline of Research Process

2014   CDA Stage 1:   Identify and focus on social problem (use WIT Ecosystem as lens)

2014   CDA Stage 1:   Discourse artifact selection (texts)

2014   CDA Stage 2-3: Discourse artifact review and preliminary analyze (texts)

2014   CDA Stage 2-3: Virtual observation (GHC and NCWIT Summit)

2015   CDA Stage 4:   Participant observation of GHC15 (on site in October)

2015   CDA Stage 4:   Participant observation of NCWIT Summit (on site in May)

2015   CDA Stage 4:   Observation of NCWIT Strategic Planning (on site in July-Aug)

2015   CDA Stage 5:   NCWIT leadership interviews (July – Sept)

2016   CDA Stage 5:   ABI leadership interviews (Mar – May)

2016   CDA Stage 5:   Critical Analysis of Discursive Moments of Crisis

APPENDIX D
IRB Consent Narratives

IRB Consent Narratives
Sandy Payette
Updated 5-14-15

Oral Consent Script

Thank you for your time and willingness to participate in this research.   The questions I will ask are part of my dissertation research on how not-for-profit organizations are working to address the under-representation of women in computing. I am interested in the history, motivations and goals of your organization/institution/company in improving the state of women in computing as well as your role and perspectives on it.

#1) First, I would like to start by making sure that I have your consent to participate in this interview. Your participation today is completely voluntary, and you can decline to answer any question I ask or end the interview at any time. Is this ok?

OBTAIN → interviewee's verbal consent response to participate

#2) I would like to be able to quote you in our academic publications. To protect your identity, I do not use personal names when I quote. However, in your professional capacity, it may be important to indicate your role or the organization/company you work for.   I will be mindful of situations where the combination of the role and company name would enable a reader to easily infer your personal name and you can request that I don't use your role+company in quotes. Is this ok? (if not ok, see alternative #2 below)

OBTAIN → interviewee's verbal consent response to identity and quoting request

#3) Finally, I would like your permission to record our conversation. There is really no substitute for hearing the perspective of participants in their own words. To that end, I'd like to record the conversation so I don't need to ask you to pause while I take notes, or miss something important in what you said.

These recordings are meant only for us as researchers; they will be guarded as confidential, and would never under any circumstances be made available to anyone else. Do I have your permission to record our conversation? All transcripts and audio files will be stored on a secure, password protected storage system with highly secure passwords that are under my control only.

OBTAIN → interviewee ' s verbal consent response on audio recording request

Cornell University
Institutional Review Board
Approved: May 17, 2015

1

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IRB Consent Narratives
Sandy Payette
Updated 5-14-15

****************** ALT #2 **********************
Alternative request #2): For interviewees who request strict confidentiality:

I would like to be able to quote you in our academic publications, with the
understanding that any quote I use in a publication will be anonymous, meaning
that it will not be attributed to you by your name, role, or organization/company.
Whether I directly quote you, refer to this conversation in my own words, or just
learn from it as background, your identity will be kept in strict confidence. Do I have
your consent?

OBTAIN → interviewee's verbal consent response for strict confidentiality

****************** ALT #2 **********************

Contact information ~~to be~~ provided to research subjects

The main researcher conducting this study is Sandy Payette, a PhD Candidate at
Cornell University. Sandy may contact you again for follow-up interviews. If you
have any questions before, during, or after your participation in this research, you
may contact Sandy at sdp6@cornell.edu.

If you have any questions or concerns regarding your rights as a subject in this
study, you may contact the Institutional Review Board (IRB) for Human Participants
at 607-255-6182 or access their website at http://www.irb.cornell.edu.

You may also report your concerns or complaints anonymously through EthicsPoint
online at www.hotline.cornell.edu or by calling toll free at 1-866-293-3077.
EthicsPoint is an independent organization that serves as a liaison between the
University and the person bringing the complaint so that anonymity can be ensured

Cornell University
Institutional Review Board
Approved: May 17, 2015

APPENDIX E
Interview Guide: Not-for-Profit Founders and Leaders

Topic 1: Organization history, founding, mission

1. To begin, can you describe your role in the not-for-profit organization?

2. How would you describe this organization and its goals to someone who is unfamiliar with it?

3. [FOR FOUNDERS] How did you come to establish this organization?   What were your original motivations?

Topic 2: Role played by the not-for-profit organization re: women in computing

1. What are the unique contributions that your organization can make to improve conditions for women in computing?
    [PROBES: careers in computing? under-representation; computing pipeline? identity issues? equity issues? gender bias?]

2. Who do you think benefits the most from your work?

3. What do you think corporations see as the role of your organization and the benefits of working with an organization like yours?] *[PROBES: how is it a different role from a corporation or university?]*

4. How do you understand what the needs are? For individuals? For tech companies?

5. How do you interact with other organizations working in this space? Other not-for-profit orgs? Corporations? Universities? *[SDP NOTE: I'm interested in similarities/differences among orgs. Collaborate or compete? Partnerships? Synergies? Tensions?]*

6. How has your organization changed since it inception? How has the strategy for fulfilling the mission changed over time?

Topic 3: Challenges re: women in computing

1. What is the biggest obstacle that women face in the computer tech industry?
    [PROBES: ... the most stubborn/frustrating challenge or problem]

2. What is the most significant challenge that a corporation in the computer tech industry faces regarding gender? *[PROBES: ... the most stubborn/frustrating challenge or problem]*

3. Some say we just need to teach young girls to code. What do you think about that?

4. Let's reflect on the culture of women in computing in the 1980s compared with today. What changes have you observed? *[PROBES: changes in attitudes? beliefs? behaviors?]*

Topic 4: Organizational communication re: women in computing

1. How is your organization trying to change the way women and men *think* about gender? How about the way they *talk* about gender?

2. How does your type of organization and its structure influence the communication strategies that are used/implemented to address issues of gender and computing? *[PROBES: in the context of events, programs, reports, media and social media?]*

3. How does the work of your organizations influence perceptions about women in computing? *[PROBES: notions of gendered identities of the computer programmer?]*

Topic 5: Structure /Agency

1. *What role do individuals versus tech companies have in improving the status of women in computing? Who's responsible for the problem? Who's responsible for the solution?*

2. Who does your organization need to work with to enact the changes you envision? How do you identify the kinds of organizations, institutions, companies, & individuals to collaborate with or partner with?

3. Are there particular issues related to women in computing that your organization *does not* work on, or does not choose to address? Who should address these areas? Why and how?

4. Have you had personal experiences of gender bias or inequality as a women working in the domain of computing? If so, how has this influenced your career and your work with the not-for-profit organization?

Topic 6: Determining impact

1. How do you determine if you are succeeding in fulfilling your organization's mission re: women in computing? *[PROBES: More broadly, how would you describe what makes a more successful vs. less successful intervention or program? What's different about them?]*

2. How does your organization think about "impact" with regard to gender diversity? How does your organization evaluate or measure such impact? What have you learned from this?

3. What do you think is the most significant *contribution* your organization has made to women in computing?

4. What do you think is the most significant *challenge* that remains for your organization in its work on women in computing?

5. Given what you have achieved so far, can you tell me about your organization's short-term and long-term goals re: women in computing?

ATLAS.ti Report

Merged Projects - Selected Code groups

◎ CDA

Members:
○ cda: anecdote ○ cda: conversation ● cda: dilemma ○ cda: hegemony ○ cda: power ○ cda: rhetoric ○ cda: stories ○ change: cultural change ○ change: individual ○ change: organizational ○ change: structural ○ change: systemic ● tension: challenge ● tension: competition ○ tension: complementary ● tension: unintended-consequences ● tension; conflict

---

◎ theme

Members:
○ >ABI: GHC ○ change: cultural change ○ change: structural ○ change: systemic ○ corporate: engagement ○ corporate: hiring-recruiting-retention ○ cultural: agency ○ cultural: community ● tension: unintended-consequences ○ theme: action-oriented ○ theme: awareness ○ theme: evidence-based ○ theme: fix the women ● theme: glass slipper ○ theme: innovation ○ theme: k-12 girls ○ theme: male allies ○ theme: meaningful participation ○ theme: media attention ○ theme: mentoring ○ theme: network ○ theme: pipeline ○ theme: research-based ● theme: unconscious

---

◎ change

Members:
○ cda: stories ○ change: adaptation ○ change: change leader network ○ change: cultural change ○ change: individual ○ change: organizational ○ change: structural ○ change: systemic

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◎ data

Members:
○ data: diversity ○ data: metrics ○ data: patents ○ data: qualitative

INTERNET ARCHIVE
WayBackMachine

25 captures
25 Oct 05 – 4 Apr 15

http://www.ncwit.org/what.mission.html

Go

AUG **OCT** DEC
◀ **20** ▶
2005 **2006** 2007

Home :

Who We Are   What We Do   Resources   Practices   Connect   Contact Us   Extension Services

What We Do : Mission

The mission of the National Center for Women & Information Technology is to ensure that women are fully represented in the influential world of information technology and computing.

NCWIT's overarching goal is parity in the professional information technology (IT) workforce, and our fundamental strategy is to educate, disseminate, and advocate a national, multi-year implementation plan that generates tangible progress within 20 years.

Why this issue is important:

● **Innovation and competitiveness.**
  Innovation thrives with a diversity of ideas and input. As IT becomes a commodity in an increasingly global society, what will distinguish U.S. performance? Women can, and must, play an important role in IT innovation if the U.S. is to remain competitive.

● **Jobs.**
  U.S. Department of Labor projections forecast that our economy will add 1 million professional IT jobs by 2014. In the aftermath of the dot-com bust, however, the perception of a job shortage has caused a sharp decline in enrollment at computer science programs. With the female labor force growing at a faster rate than the male, we must capitalize on women's value in our IT workforce.

● **Social impact.**
  From airbags to voicemail to medical advances, we've seen the negative consequences of products and services designed without women's participation. As technology becomes exponentially more pervasive in our lives, we need to ensure that it is created by as broad and diverse a population as the one it serves.

"Underlying much of the work on the culture of computing is a theoretical perspective that ties computing to the masculine culture dominating modern society. From this perspective, women are not present in computing either because they feel out of place or unwelcome in that culture, or because women outright reject the culture."

–Joanne Cohoon and Bill Aspray, A Critical Review of the Research on Women's Participation in Postsecondary Computing Education

national center for
women&

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APPENDIX H
Discourse Artifacts Selected and Analyzed

Gov't documents	IRS Form 990 for ABI (2012, 2013, 2014, 2015, 2016))
Gov't documents	IRS Form 990 for NCWIT and ABI (2012, 2013, 2014, 2015, 2016) IRS Form 990 for all in WIT Ecosystem
Reports	ABI and NCWIT Annual Impact Reports (2013-2016)
NCWIT Resources	Resources selected as discourse artifacts included: (1) Male Advocate and Allies; (2) Scorecard on Women in Computing; (3) Releasing Diversity Data; (4) Impact of Gender Diversity on Technology Business Performance
Websites	ABI website 2014-1018: https://anitab.org/ NCWIT website 2014-1018: https://www.ncwit.org/
Wayback Machine	NCWIT & ABI Website snapshots Internet Archive: October 2003, October 2005 ,October 2006, March 30, 2008, April 13, 2008, January 2012, January 2013
Videos	Nadella plenary at GHC14 and Klawee reaction to Nadella plenary
News	Articles from mainstream newspapers, and tech, business magazines
Twitter	Tweets of individuals about GHC events (#GHC14 and #GHC15) Tweets of the Union of Concerned Feminists, @concernedfems (2014-2015) Tweets related to GHC Allies Bingo, #ghcmanwatch (2014-2015)
Blogs	Transcript of Nadella/Klawe at GHC14 http://juliepagano.com/blog/2014/12/02/male-allies-panel-transcript/ Ally Bingo Card, https://hypatia.ca/2015/09/23/bingo-and-beyond/

APPENDIX I
Attendance at Grace Hopper Celebration

Year	Location	# Attendees	Website for GHC event
2017	Orlando, Florida	18,000+	[ABI website](#)
2016	Houston, Texas	15,000	[ABI website](#)
2015	Houston, Texas	11,702	[ABI website](#)
2014	Phoenix, Arizona	7,830	[ABI website](#)
2013	Minneapolis, Minnesota	4,758	[ABI website](#)
2012	Baltimore, Maryland	3,592	https://web.archive.org/web/*/www.gracehopper.org/2012
2011	Portland, Oregon	2,784	https://web.archive.org/web/*/www.gracehopper.org/2011
2010	Atlanta, Georgia	2,070	https://web.archive.org/web/*/www.gracehopper.org/2010
2009	Tucson, Arizona	1,571	https://web.archive.org/web/*/www.gracehopper.org/2009
2008	Keystone, Colorado	1,446	https://web.archive.org/web/*/www.gracehopper.org/2008

2007	Orlando, Florida	1,430	https://web.archive.org/web/*/www.gracehopper.org/2007
2006	San Diego, California	1,347	https://web.archive.org/web/*/www.gracehopper.org/2006
2004	Chicago, Illinois	899	https://web.archive.org/web/*/www.gracehopper.org/2004
2002	Vancouver, Canada	630	https://web.archive.org/web/*/www.gracehopper.org/2003
2000	Hyannis, Massachusetts	550	https://web.archive.org/web/*/www.gracehopper.org/2000
1997	San Jose, California	600	
1994	Washington, D.C.	500	

In 2017, ABI did a complete redesign of its website, which made it more difficult to located the organization's archive of materials of earlier GHC events. The current ABI "archive" page only has the most recent conferences (2013-2018, https://ghc.anitab.org/archives/.) To see earlier renditions of the content available on the website, go to the Wayback Machine[173] for snapshots under the previous domain name http://anitaborg.org/.

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[173] Here is the URL to the Wayback Machine to search for ABI website history: https://web.archive.org/web/*/anitaborg.org

APPENDIX J
Reactions in the Press to the Nadella Incident

2017: Recent interview of Nadella three years later

1. PBS Newshour: https://www.pbs.org/newshour/show/how-microsofts-ceo-has-hit-refresh-in-business-and-in-life

2014: Tech News

1. Recode: https://www.recode.net/2014/10/9/11631778/microsoft-ceo-satya-nadella-on-women-gaffe-i-answered-that-question
2. New York Times: https://bits.blogs.nytimes.com/2014/10/09/microsofts-nadella-backtracks-from-comment-about-women/
3. ReadWrite: https://readwrite.com/2014/10/09/nadella-women-dont-ask-for-raise/

2014: US National News

1. USA Today: https://www.usatoday.com/story/tech/2014/10/10/microsoft-ceo-nadella-comments-social-media/17031569/
2. National Public Radio: https://www.npr.org/sections/alltechconsidered/2014/10/10/355100973/microsoft-ceo-nadellas-remarks-add-to-techs-sexism-problem
3. Los Angeles Times: http://www.latimes.com/local/abcarian/la-me-ra-microsoft-ceos-awful-advice-to-women-20141010-htmlstory.html
4. New Yorker: https://www.newyorker.com/business/currency/corporations-like-idea-karma
5. Washington Post: https://www.washingtonpost.com/news/morning-mix/wp/2014/10/10/walkback-microsoft-ceo-saying-women-should-rely-on-karma-for-raises/?utm_term=.253655e1c70d
6. Time: http://time.com/3486673/microsofts-ceo-satya-nadella-women-work-gender-pay-gap/
7. Forbes: https://www.forbes.com/forbes/welcome/?toURL=https://www.forbes.com/sites/amitchowdhry/2014/10/10/microsoft-ceo-satya-nadella-apologizes-for-comments-on-womens-pay/&refURL=https://www.google.com/&referrer=https://www.google.com/
8. CrossCut: http://crosscut.com/2014/10/microsoft-ceo-satya-nadella-women-raises/
9. CNN Money: http://money.cnn.com/2014/10/09/technology/microsoft-ceo/index.html

10. Fox Business: http://www.foxbusiness.com/features/2014/10/10/is-this-good-karma-women-in-tech-finance-face-biggest-pay-gap-less-likely-to.html
11. NBC News: https://www.nbcnews.com/tech/tech-news/microsoft-ceo-nadellas-comments-hit-raw-nerve-silicon-valley-n223126

2014: International News

1. BBC: http://www.bbc.com/news/blogs-echochambers-29578265
2. The Guardian: https://www.theguardian.com/technology/2014/oct/10/microsoft-ceo-satya-nadella-women-dont-ask-for-a-raise
3. Independent: http://www.independent.co.uk/news/business/news/microsoft-ceo-satya-nadella-apologises-after-saying-women-should-not-ask-for-pay-raise-because-its-9786352.html

APPENDIX K
Google EEO-1 Report

We prepare our EEO-1 report according to the guidelines issued by the US government. We realize it's useful for the government to collect job information across all companies using a standard format with uniform job definitions.

But these categories differ from how we and many companies think about our workforce when it comes to organizing and recruiting people. For example, in the EEO-1 report, sociologists, actors, financial analysts, and computer software engineers are categorized as "professionals", while "technicians" includes dental hygienists, surveyors, and sound engineers.

We find it useful to also divide our workforce into "technical" (e.g., software engineers, product managers) and "non-technical" workers (e.g., those in sales, marketing and finance). A third category, "leadership," cuts across technical and non-technical areas to reflect the diversity at the more senior levels. These segments provide us with greater insights into our workforce, so that we can to take action and improve.

EQUAL EMPLOYMENT OPPORTUNITY
2013 EMPLOYER INFORMATION REPORT
CONSOLIDATED REPORT - TYPE 2

SECTION B – COMPANY IDENTIFICATION

1. GOOGLE INC.
   1600 AMPHITHEATRE PARKWAY
   MOUNTAIN VIEW, CA 94043

SECTION C – TEST FOR FILING REQUIREMENT

1-Y 2-N 3-Y DUNS NO.:060902413

2.a. GOOGLE INC.
      1600 AMPHITHEATRE PARKWAY
      MOUNTAIN VIEW, CA 94043

c. Y

SECTION E - ESTABLISHMENT INFORMATION

NAICS:

SECTION D - EMPLOYMENT DATA

JOB CATEGORIES	HISPANIC OR LATINO		NOT-HISPANIC OR LATINO															OVERALL TOTALS
			************ MALE ************						************ FEMALE ************									
	MALE	FEMALE	WHITE	BLACK OR AFRICAN AMERICAN	NATIVE HAWAIIAN OR PACIFIC ISLANDER	ASIAN	AMERICAN INDIAN OR ALASKAN NATIVE	TWO OR MORE RACES	WHITE	BLACK OR AFRICAN AMERICAN	NATIVE HAWAIIAN OR PACIFIC ISLANDER	ASIAN	AMERICAN INDIAN OR ALASKAN NATIVE	TWO OR MORE RACES				
EXECUTIVE/SR OFFICIALS & MGRS	0	0	21	1	0	10	0	1	3	0	0	0	0	0				36
FIRST/MID OFFICIALS & MGRS	53	27	1791	28	3	632	7	53	744	21	5	332	2	15				3713
PROFESSIONALS	369	141	8932	174	29	4469	18	352	2205	115	18	1737	8	150				18717
TECHNICIANS	16	1	287	14	0	31	4	7	25	4	0	10	1	0				400
SALES WORKERS	65	62	1005	36	1	251	3	49	1050	43	1	275	4	62				2907
ADMINISTRATIVE SUPPORT	24	39	106	13	3	34	1	15	299	31	3	106	0	45				719
CRAFT WORKERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0
OPERATIVES	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0
LABORERS & HELPERS	0	0	0	0	0	0	0	0	0	0	0	0	0	0				0
SERVICE WORKERS	1	0	18	2	0	1	0	0	38	1	1	3	0	2				67
TOTAL	528	270	12160	268	36	5428	33	477	4364	215	28	2463	15	274				26559
PREVIOUS REPORT TOTAL	443	219	10086	188	30	4415	35	352	3745	176	28	2077	13	200				22007

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A poster I made for the programming team to attend an Ingres database conference.

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