

Cracking the Code: Navigating and Subverting Dominant Class Rule
in Computer Science and Engineering

Coleen Carrigan

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Reading Committee:
Dr. Rachel Chapman, Chair
Dr. Devon Peña
Dr. Alison Wylie
Dr. Joyce Yen

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Abstract

Cracking the Code: Navigating and Subverting Dominant Class Rule
in Computer Science and Engineering

Coleen M. Carrigan

Chair of the Supervisory Committee:
Associate Professor Rachel R. Chapman
Anthropology

My dissertation investigates the reproduction of gender-differentiated outcomes in sites of technology production and why Computer Science and Engineering (CSE) remains highly segregated. Computer technology both reflects and manufactures social values and the reproduction of systems of power in the US. I use ethnographic methods and media analysis to explore the social construction of gender, race and technology and their co-constitution of cultural norms governing labor segregation in CSE. I rely on and contribute to feminist theory from a variety of orientations - anthropology, Marxism, science and technology studies and critical race studies - to argue the overrepresentation of white males in CSE is a matter of reproductive and economic justice. My cross-sectional method illuminates barriers women face at three different stages of a CSE career. At the heart of this research are the stories of women who persist in CSE, the barriers to desegregating the field and their ideological justifications and the broad

cultural domains that shape and are shaped by the product, practices and applications of computer technology.

In my dissertation, I advance five related arguments. First, women who navigate, resist, and subvert male hegemony to persist as workers in CSE have a unique standpoint in US society and have the potential to transform, institutionally and interpersonally, unjust social relations. Second, rites of passage (Davis Floyd 1992) in CSE, for example, interviews, long hours, precision questioning, combative work styles and the valorization of logical and abstract approaches to knowledge production over creative, material ones reproduce the ideological union between masculine ideals and competency in the field. These rituals also serve to indoctrinate CSE workers' to the core values in computing commodity production, including constant observation, intense evaluations of others, and the devaluation of sociality. Third, participants' emotions allowed me to locate and interpret the conflicts and contradictions of women CSE professionals. Many of these contradictions signal a rupture, women's struggle to navigate the bifurcated nature of their workplace role – participants privileged to be agents in a powerful field and marginalized members of this field (Smith 1990). These sites of rupture are areas ripe for social change activism. Fourth, the majority of my participants have social change aspirations. They want to use their CSE skills to make the world a better place. These aspirations correlate with a commitment to support other women in CSE. Navigating the experience of rupture, combined with a yearning for social justice, may ignite feminist consciousness in women CSE workers, which can lead to collective action in pursuit not only of equality in CSE but also in broader cultural domains. Finally, I argue that social change aspirations are a collective form of reproductive aspirations and CSE workers can

effectively organize around the shared yearning to contribute to the reproduction of the collective well being of society.

These findings elucidate the causes of women's underrepresentation in CSE and the consequences of denying women of all ethnicities the opportunity to influence the design and application of technology. My research is meant to inform strategies that eradicate the barriers excluding women from Computer Science and Engineering and transform the powers of technology to advance social justice.

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Chapter One: Intimate Narratives and Cultural Domains of Computer Science and Engineering

INTRODUCTION: A Visit to the Versailles of Silicon Valley

The shuttle drops me off in a large courtyard. Dotted the walkways are nine sculptures; three are busts of women. I take a moment to walk through a beautiful garden with flowers and edible plants. Next to the garden is a brightly lit cafeteria offering a smorgasbord of fruits, vegetables, and grains. I stop in my tracks at the sight of a life-sized Tyrannosaurus rex sculpture with flamingos “attacking it.” Dozens of bikes painted in primary colors are lined up outside the building. Upon entering building No. 43, I note the assignation of numbers instead of names for buildings, much like MIT. I am greeted by a troupe of corporate representatives in bright blue golf shirts. They check my identification, ask me to wear me a badge, and direct me upstairs. Looming above the stairs hangs a huge replica of a space shuttle with Paul Allen’s name inscribed on it. Colorful comfy couches are around every corner. There are outdoor patios with plants and more sculptures, kitchens with espresso machines, fruit, and candy. Individuals are hard at work on their laptops.

Everywhere I turn there is a “No Visitors” sign in bright red. Security guards in the same bright blue shirts are positioned closely, in a wide-legged stance. They surround the room in which the conference is held, so that I cannot walk more than ten feet without being asked: “Can I help you find something?” At first, I feel conspicuous as an outsider and disconcerted at being watched and observed. But then I realize I am here to do the same thing. I ask one of the guards, Terrance, what he and the other guards are doing. He says their job is to help to guide visitors and treat medical accidents. Apparently, lots of people fall off the communal bikes that the employer provides to help

expedite employee trips across the large headquarters. I smile knowingly, and say “Okay,” with disbelief. He shrugs and says “I’m just doing this gig until I graduate from school and enter law enforcement.” Men roam the halls in packs. They remind me of the jocks in high school but instead of letter jackets, these guys wear jeans and t-shirts and carry Mac laptops. During this long, first day of the conference, I see more male security guards than women employees. I speak with two of the women I see working here, both in Human Resources. Through closed glass doors, I see three meetings with over fifteen people in each one and not a single woman! At the end of the day, on a different floor, I search for a bathroom and observe a fourth meeting. One woman is present among nine men.

I see a female employee running frantically through a hallway. She looks at me anxiously. Here is another woman ... I smile. She replies by mumbling, while shaking her head: “Meetings, meetings, meetings ...”. Then, I take a wrong turn into a “hive.” The air has shifted. It buzzes with energy. People are working closely in groups and individually. Whiteboards are covered in a programming language foreign to me. A poster of Napoleon Dynamite is trimmed in red tinsel. Cubicles are densely packed and the conference rooms and offices are small and transparent. The space is dense with people and offers little privacy. I am out of my element and getting more lost, so I retrace my steps. Once more on secure footing, I realize I have accidentally wandered past the “No Visitors” sign.

I discover a few private phone rooms within the Visitors area and use them for some moments unobserved (or so I thought) to check in with colleagues at my university. In the bathroom, the toilet seats are heated and the tampons are free. In every stall, there

is a laminated poster with tips on how to code more efficiently. There are different tips in each stall. Apparently, this place wants every moment of your “free” time.

As I wait for my hotel shuttle, I peer inside a building that has a huge screen as a floor. The floor plan is at least 2000 square feet and lit with the corporation’s name bouncing across the room – a screen saver to fill a room. The stairwell that I climb is also lit with screens. On the vertical part of stairs, in different primary colors, are the names of cities with the corporation’s offices. My shuttle arrives to take me back to my hotel and I climb on in a daze, overwhelmed by the opulent, intense culture at the Versailles of Silicon Valley.

This is a study of women knowledge workers in sites of Computer Science and Engineering (CSE). I do not claim that this sketch is a thorough representation of all of CSE, nor does it epitomize all CSE corporations. However, in this investigation into why men from dominant groups have preferential access to lucrative, prestigious CSE jobs in the U.S., I detail the structural conditions under which CSE knowledge is produced and the social relations of power within which these sites of production elucidate the broader cultural domains that co-construct ideologies of gender, race, and technology. My story elaborates on some themes highly significant to my data analysis, including gender, surveillance, privacy, labor practices, misinformation, and decadence. Technological acumen in this cyber era is a form of social power that shapes our social, political, and economic environments. Yet, a highly segregated workforce produces CSE knowledge.

My cultural anthropological study of CSE fields makes visible the values and social conditions necessary to acquire and maintain CSE knowledge. Ethnographies of CSE workers tell us a lot about our thoroughly computerized society, awash in a sea of

technological artifacts and applications. The commodities dreamed, designed, and developed in workplaces such as the one described above mediate our digitally enhanced environments, and influence both interpersonal and structural relations of power. My two days as an observer behind the palace doors of the Versailles of Silicon Valley, my four years as an executive at a high-tech corporation, and my two years ethnographically researching the cultural dynamics of CSE through the life histories of women CSE workers has helped me map the material, ideological, and political systems that reproduce dominant class rule in CSE and the domains on which it impinges.

IN SEARCH OF HIDDEN ABODES

This is an autonomous Marxist feminist account of CSE workers. Autonomous Marxists seek to include cognitive labor in efforts to recompose working class action and consciousness (Beradi 2009). Inspired by Marx (1976/1990), I am in search of “hidden abodes.” Halfway through *Capital Volume I*, Marx’s critical analysis moves from the sphere of exchange, “this noisy sphere, where everything takes place on the surface and in full view of everyone,” (p. 279) to an examination of the “hidden abodes of production” (Marx 1976/1990, 279). For Marx, this means the creation, extraction, and accumulation of surplus labor within the workplace. My research focuses on the CSE workplace and the women who persist in the CSE field. I too want to move beyond the noisy rhetoric on the promise of CSE technology to seek and examine the hidden abodes of power and exploitation in an analysis of women’s marginalized standpoint in sites of CSE production. “The secret of profit making,” or the creation surplus labor, cannot be fully understood within the exchange process of commodities alone (Marx 1976/1990, 280). Instead of exploring the realm of reproduction, Marx sought to uncover hidden

abodes within the means of production alone. Marxist feminists Dalla Costa and James (1980) correct Marx's myopia to argue that social reproduction is a primary, fundamental terrain for accumulating profit in this new phase of capitalism.

I add to existing feminist theory by analyzing my ethnographic data using critical methodologies aimed at exposing and transforming social injustice in order to develop a fuller understanding of social reproduction and how it is specifically implicated in the exclusion of women from CSE. Drawing upon the works of Nakano Glen (1992), Katz (2001), and Duffy (2007), I define social reproduction as work attending to sustenance needs like food production, provision and preparation; providing care for others' physical, mental, and emotional well-being; maintaining kin and community ties; and reproducing the labor force, both on a day-to-day basis and generationally. I theorize that the principles of CSE production reflect and reproduce broader cultural norms governing gender politics that result in women's low participation in positions of power in CSE and public politics and women's primary care responsibility for social and biological reproduction.

The modes of reproduction, the means by which people secure their material needs and reproduce themselves daily and generationally, are caches of surplus labor value which are currently commodified through the process of neoliberalism. Social networks of reproduction are eliminated, intensifying unpaid work in homes and communities, a burden that women disproportionately shoulder as they struggle to fill in the gaps emerging between the state and the market (Benería 1999; Katz 2001; Bakker and Gill 2003; Ehrenreich and Hirschchild 2004). Capital has always needed a new frontier, a "non-capitalist milieu and strata' ... for the extension of market" (Mies

1986, 34). The tendency for profits to fall requires that the owners of production “create ever more surplus labor” (Marx 1976/1990, 408). Dalla Costa (1981) and Fanon (1975) identified the hidden strata of profit–communities – households and families – as colonies of the neoliberal state (Mies 1986). The owners of the means of production draw on colonies-in-reserves (by which I mean previously non-industrialized lands, relationships, economies, and cultures) and exploit sexism and racism to gain access to women’s labor in the paid workforce while ensuring that the costs of social reproduction remain externalized to individuals. The burden of unpaid reproductive labor, which, between 1974 – 1992, grew twice as fast as market labor, already represents “between a quarter and a half of economic activity, depending on the country” (Benería 1999, 299).

Men’s labor in the home has increased with women’s increasing participation in the US labor market, but women with full-time jobs still do twice the housework and twice the childcare as do their male partners (Pew Research Center 2013). Inequitable division of labor in the reproductive sphere works in tandem with structural adjustment policies, which force countries in the South to transfer public wealth to multinational corporations in the North, and results in drastic cuts to social services. Harding (2008) uses the terms North and South to distinguish between those countries that have benefited from European and North American imperialism and those countries that have suffered from their material, cultural, and ideological violence. Harding describes how scientific knowledge follows economic power relations. Non-western epistemologies have been subsumed and assimilated into western sciences and then delegitimized. These patterns of violence continue today. Concurrently, the “west is best” mentality imposes the western ethnoscientific worldview as monolithic, with consequences that result in both globally

reproducing male hegemony in CSE production and also limiting the possibilities for multiple forms of computing knowledge to thrive.

The expanding reach of commodification, which I argue is dependent on advances in CSE knowledge aimed at increasing profit and social control, contradicts capital's inability to meet social reproduction needs, with grave implications for the global political economy. This contradiction reflects the root of all crises in capitalism: capitalists' concurrent dependence on labor power and the need to denigrate labor power for profit (Federici 2004). Therefore, I prioritize the devaluation of women's labor in the CSE field to understand the construction of labor value in the technocratic model of capitalist production in the US. I document that labor hierarchies and organizational norms common in sites of CSE technology reflect and reproduce values that devalue women's labor and modes of reproduction in the US and have implications for broader cultural norms governing socioeconomic politics.

THE BROADER CULTURAL DOMAINS OF CSE

Background and Significance

When the status of a scientific field rises to prominence, the value of women's labor in the field inversely diminishes (Ettzkowitz et al. 2008). Computer programming is a prime example of this. The first functional computer, the ENIAC machine, was built during World War II and women were its first programmers. Once the level of intellectual demand and skill required for this labor were recognized, software programming was no longer considered women's work (Kraft 1979). In seeking to understand the values governing cultures within CSE, I engage work from feminist science and technology studies scholars that asks how some technology becomes socially

constructed as masculine (Lerman et al 2003). I decenter the texts and artifacts of technology and interrogate instead the social architecture of labor value. While there has been a proliferation of scholarship on the artifacts and consumption of technology in our digital era, my study focuses on the production and design of CSE technology and the subjectivities of CSE workers. I prioritize producers of CSE technology over consumers because the institutional and embodied conditions of computing commodity production can tell us much about the material, cultural, and ideological dimensions of gender and technology in US society. I also argue that women who navigate, resist, and subvert male hegemony to persist in as knowledge workers in CSE have a unique standpoint in US society and have the potential to transform, institutionally and interpersonally, traditional power relations.

Feminist researchers have established that men from dominant groups hold cultural power that enables them to define social relationships, economic values, and the meaning and purpose of science and technology (Rosaldo 1974; Collins 2000; Lohan 2000). They have also challenged claims of universality and objectivity in scientific knowledge production, leaving the norms of dominant groups open to scrutiny and challenge (Haraway 1988; Harding 1991). I join feminist science and technology studies (FSTS) with feminist anthropology to build a theoretical model that can sufficiently address the social matrix generating labor norms in the United States. Feminist anthropologists have done groundbreaking scholarship on reproduction and reproductive technologies when theorizing on the social dynamics of gender (Chapman 2003; Ginsburg and Rapp 1995; Martin 1992; Maternowska 2006; Taylor 1999). Feminist anthropologists, especially those scholars who study the sociality of science, view the

body from three perspectives: (1) as an individual *body-self*; (2) as a *social body*, a symbol for the relationships among nature, society, and culture; and (3) as a *body politic*, a target and tool of control (Scheper-Hughes and Lock 1987). I have organized my findings around multi-layered conceptualization of the body in order to elucidate lived experiences, relations of power, and the purpose and implications of gendering CSE labor.

The contributions made by feminist anthropologists, and especially the insistence that reproduction be made central in cultural and political economic analyses, augment the analytical frameworks in FSTS, including gender schemas, chilly climate, and the historical, interpersonal dimensions of sexism in science. I keep reproduction central in my research on the causes and implications of limiting women's labor options. Using Davis Floyd's (1992) theoretical framework of the technocratic model of society, I broaden the scope of inquiry regarding CSE technology beyond physical reproduction to investigate how the processes and production of CSE technological labor regenerate historical patterns of labor segregation. I take seriously Davis Floyd's claim that US society is a technocracy, where technological progress is equated with social advancement, and this reigning ideology is a source of power for the ruling class (Davis Floyd 1992). Her ethnography illustrates how technocratic interventions in women's birth processes are driven by a pervasive fear of natural processes and women's power in reproduction. I expand her theoretical construct to explore gendered ideologies shaping technocracy in the US and the opportunities and constraints of women's power in the production of CSE knowledge.

While the number of women attending institutions of higher education equals or exceeds men, CSE has seen over a thirty percent *decrease* in female students while other science and engineering fields have increased the number of women earning bachelor degrees (Snyder and Dillow 2009). In 2008, women earned only 18% of CSE bachelor degrees in the US compared to 37% in 1985 (Tahmincioglu 2010). Women make up 15% of the information technology (IT) workforce (Bateman 2013). Three percent of these women are African American and only one percent are Hispanic (National Center for Women in Information Technology (NCWIT) 2010). 64% of women that have persisted in CSE have felt discriminated against in their job because of their gender (Bateman 2013). These dismal trends are especially disturbing in light of the fact that CSE is one of the highest earning degrees (Money Magazine 2009) and thus a site in which to accumulate cultural capital. Due to its prominence and impact as an academic and professional field, understanding how gender inequities in CSE are maintained and reproduced stands to contribute to all the domains on which it impinges. I surmise that creating the conditions necessary to include women from diverse racial, ethnic, and socio-economic backgrounds in the CSE workforce would pose a grave risk for the powerful elite in the US.

Women's perspectives are missing from this lucrative field with enormous influence (Margolis and Fisher 2002) to the detriment of many. For example, the all-male teams who designed the first automobile air bags did not consider a variety of body types, including those of women and children. Consequently, dozens of women and children were killed by improperly designed airbags until technological innovations were recalled and redesigned for the majority of users (Margolis and Fisher 2003). Suzanne, a white,

mid-career CSE professional and executive at Facebook who spoke at the 2011 Celebration of Women in Computing conference, was the only woman on a design team tasked with developing a tracking device for a mobile phone application that would enable users to meet up with friends in real-time while out on the town. In her words, the men on her team were all extremely enthusiastic about the potential of this feature, without reservation. She finally interjected and asked the men: “Have you ever been stalked, harassed, or afraid for your life? Women deal with fear of male violence everyday and we need to give our users a sense of security. We must make privacy paramount.” If she had not been in that planning meeting, millions of women worldwide who participate in Facebook would have been put at significant risk. Gender segregation in technology is not only a matter of justice for women in CSE fields, but also a matter of life and death for women who consume technology. Furthermore, the gendered consequences of the forms of surveillance enabled by social media technology invite further scrutiny of these artifacts and their threat to all users’ privacy and liberties. Attracting and retaining women in CSE is critical to ensuring a fair and just society, one in which women of all classes and races have the opportunity to influence the design and application of technology and use it towards ends that benefit many.

With this urgency, I seek to answer Tom Boellstorff’s recent entreaty that “we desperately need a better anthropological understanding of the broader cultural domains in which S[cience] T[echonology] E[ngineering and] M[ath] work takes place” (Boellstorff 2012, 1). I aim to illuminate these domains and advance knowledge on gender segregation in CSE by placing women’s labor value at the center of my analytic framework. Gender biases, hostile cultures, and the meaning and impact of technological

work and women's socially scripted roles bearing primary responsibility for social reproduction operate systematically and synergistically to reproduce inequitable systems of power. Toward this end, my dissertation study addresses the following overarching research questions: 1) Do gendered labor norms in sites of CSE training and employment combine with practitioners' career and reproductive aspirations to influence gendered biases and outcomes in the practice, production, and application of computer technology, and if so, how?; 2) How can analysis of the underrepresentation of women in CSE serve to illuminate the social constructions of gender, race, and technology as they co-constitute cultural norms that govern labor segregation in the US?; and 3) What happens when there is meaningful participation by women in CSE, what happens when there is not, and what factors influence changes in participation, values, discoveries, and innovations?

My ethnography focuses on the gender politics of women's participation in CSE in order to open inquiry into four main research areas. First, I seek to understand more about values in CSE that serve to either exclude or welcome underrepresented practitioners and to discern patterns. Second, I examine attitudes regarding gender in CSE organizations and determine how these relate to broader cultural values governing labor norms. Third, I aim to understand women's differential experiences in access, persistence, and achievement in CSE environments in order to discover the policies, practices, behaviors, values, and norms that reproduce these exclusionary environments and the ways in which people on the margins of the CSE labor force articulate their individual values, resources, and agency within sites of technical knowledge production and political economic structures. Finally, I ask, What transformations are needed for

marginalized CSE community members' values to take root in the CSE culture and how would this impact society at large? Can women's differential experiences in access, persistence, and achievement in environments of technological training and production illuminate broader issues of power inequalities in U.S. society?

CRITICAL METHODOLOGIES

The Power of Making Culture

My conceptualization of culture is critical of power. For this research to effectively address the problem of culture in CSE, a problem that diversity scientists often refer to as a "chilly climate" (Ginorio 1995), I define culture as ways of life structured by power and representations (Jolly 2002). These relations of power are a product of ideology and manufactured to reproduce existing power relations (Smith 1987). I ask how CSE technology serves to reproduce historical, inequitable relations of power. I further operationalize culture as "the collective behavior patterns, communication styles, language, beliefs, concepts, values, institutions, standards, symbols, and other factors unique to a community that are socially transmitted to individuals and to which individuals are expected to conform" (SGISA 2003). Culture serves as a mechanism that manufactures social values and reproduces systems of power favoring the dominant class (Smith 1987; Bourdieu 1991).

I seek to interpret the meaning of cultural values in sites of CSE production and their role in shaping social priorities and practices (Madison 2005). In my analysis, I rely on Londa Schiebinger's (2008) three-tiered analysis of cultural change in science, technology, engineering, and math (STEM) fields. Schiebinger argues that efforts to remove gender bias at all levels of STEM fields will result in transformational changes in the following areas: 1) who participates; 2) what is culturally valued; and 3) what

knowledge is produced in STEM fields. Too often diversity programs in STEM focus on helping women assimilate to cultures formed by predominantly white male practitioners. Similar to the goals of the National Science Foundation's ADVANCE grants, Schiebinger asserts that we must seek to understand the culture of STEM fields - the "daily day-to-day conformity, codes governing language, styles of interactions, modes of dress, hierarchies of values and practices" - in order to transform them (Schiebinger 2008, 5). Connecting cultures of CSE production to broader social, economic, and political values is critical to our goal of creating welcoming and inclusive environments in a profession that serves the interests of the owners of the means of production and other powerful agencies of social control in the US.

In this project, I interpret power from a Marxist perspective: power is a manifestation of cultural, material, and historical social relations of inequality. I interpret the relations of power in sites of CSE knowledge production as applying differently among workers based on gendered aspects of labor values and controls (Bakker and Gill 2003). I purposely eschew Foucault's theory of biopower, which mystifies both its historical origins and the centrality of women as its subjects. Unlike Marx, Foucault's account of institutionalized power obfuscates the specific machinations of exploitative social relations. Foucault's theoretical framework is inept for feminist analyses of capitalist patriarchy because, by ignoring the systematic nature of sexual oppression and emphasizing only the "top-down" operationalization of power, it does not allow for the possibilities of collective resistance and social change.

Like DiMaggio (2004), I place inequalities in CSE within a broader social context of power relations. However, rather than examining access to technology with a top-

down perspective of how structures impact individuals (DiMaggio 1991; DiMaggio 2004), I study CSE production from “microperspectives on culture” gathered from individual actors embedded in CSE networks using critical ethnographic methods (DiMaggio 1997, 282).

In the tradition of feminist anthropologists, I pay close attention to subjects’ “kinscripts,” the interplay between ideologies and norms governing family role allocations in discourses on women’s labor value (Stack and Burton 1993). Collecting data on the kinscripts of life history participants enables me to analyze how women’s private lives influence their experiences in cultures of technology. The kinship framework is ideal for this study because it allows me to situate CSE practitioners’ reproductive aspirations and practices within broader socioeconomic forces. Additionally, kinscripts allow me to compare research participants whose life courses conform to the expectations of their gender, ethnic, and socioeconomic groups with research participants whose life courses resist these socialized norms. This comparison helps me to identify factors that help embolden women in CSE to become and persist as outliers and change agents who take action on sexism in their workplaces and the discipline as a whole. In my analysis, I make women central and insist not only that women’s voices matter but also that their emotions and stories of embodied experience matter. I adopt Hartsock’s (1999) prioritization of studying change as a process rather than an individual or social phenomenon. I locate transformational processes at the nexus between the production of CSE commodities (both material and intellectual) and the reproduction of the social body as accessed through the stories, lived experiences, and emotions of CSE knowledge workers.

My inquiry into power and ideology, with its implicit action-oriented approach, requires an alternative methodology. “Methodology is a theory of research” (Denzin et al. 2008, 22). Critical methodologies aim to make the lives of the dispossessed visible as well as uncover systems of disempowerment and injustice (Kemmis and McTaggart 2000; Denzin et al. 2008). The aim of my dissertation project is to make visible how power operates in our computerized society, make suggestions on how to desegregate the production of CSE technology, and ask if it is possible for computers to facilitate social justice movements, and if so, how? Toward this end, I have designed my research to highlight the lived experiences of CSE professionals who are marginalized because of their social identities. The traditional scientific method is purportedly apolitical and impersonal, created by scholars, largely male, who have distanced themselves from the material aspects of life (Hesse-Biber and Yaiser 2004). This method begins from the principle that external reality awaits discovery through a series of approximations of “the truth” and was established in Europe during the emergence of capitalist industrial growth (Bernard 2006). Critical methodologists are not only cognizant of the historical collaboration between western scientific and industrial enterprises but defiant of it as well. They recognize “race, class, gender and sexuality as the fault lines of inequality [and link] the lived experience of theorizing to the processes of social transformation” (Grande 2008, 236).

Feminist and participatory action research are forms of decolonizing methodologies committed to social justice. These methodologies complicate the relationship between the researcher and the researched, the locations of research, and the end toward which research is applied. Additionally, this scholarship emphasizes the

intersectionality of race, class, and gender to build politics of resistance that encompasses the aspirations of women from different locations and histories. These developments move feminist methodologies from reactive to active formations of critical epistemologies, resulting in the disappearance of the “universalized woman” (Olesen 2005, 220). Once this remnant of positivist tendencies is dislodged from feminist qualitative research, the liberational promise of feminist methodologies can begin to manifest. Researchers committed to emancipatory scholarship can combat the silencing of underrepresented groups and produce counter-hegemonic discourses in collaboration with research participants. In this way, feminist and participatory action research speaks back to dominant groups and the hegemonic institutions that serve their interests.

Studying Up

I chose to study CSE students, faculty, and professionals because they are powerful contributors to their field who reproduce cultures in CSE as teachers, mentors, scholars, and knowledge producers and also, by extension of computing’s ubiquity and cultural power, the US. My relationship with participants was complicated by the fact that they are members of an elite community. I was a social science graduate student interviewing people with highly prestigious, highly specialized, and lucrative positions, many of whom, including the students in this study, were from class backgrounds more affluent than me. Nader (1972) argued that anthropology undervalues fieldwork in the US and more anthropologists should study powerful elites rather than the disempowered. Many years later, anthropologists from a FSTS orientation are leading the way in carrying out Nader’s call to action (Traweek 1988; Gusterson 2004; Gusterson 1997). However, Gusterson (1997) argues that even though science and technology studies

(STS) anthropologists are conducting research in the US, their work often “involves studying across or studying down more than studying up” (p. 114). This is due to the problem of access that ethnographers face when studying up. Finding access to those with significant cultural capital often requires navigating around armed guards and locked doors and talking with extremely busy people with careers at stake. The traditional ethnographic methods must be adapted when studying up. STS ethnographies therefore often rely on a multi-sited approach (Franklin 1995).

Daly (1984), Frankenberg (1993), Peña (1997), and Bonilla-Silva (2000) all exemplify a studying-up technique method I call “reading against the grain,” whereby the interview transcripts of participants are excavated for evidence regarding structural domination embedded within individuals and reproduced in daily life. These counter-hegemonic narrative interpretations demonstrate both the material and ideological dimensions of the “relations of ruling” that occur in subtle, taken-for-granted ways (Smith 1989). They focus on the personal to examine and demystify discursive power relationships and disclose efforts to protect dominant group identities as a method to maintain unearned social privilege. Using this method, I excavate the standpoint of dominant group members in the CSE workforce from the narratives of marginalized members of CSE communities.

The tenor of my feminist ethnography resounds with chords of feminist epistemologists who ground social identities (for example, race, class, and sexuality) in historical periods and structures generally and white supremacy, heterosexist patriarchy, colonialism, industrial science, and neoliberalism specifically (Collins 2004; Madison 2005; Sandoval 2000; Sanger 2003; Mohanty 2003; Hartsock 1997; Collins 2000;

Harding 1991; Smith 1987). These micro- and macro- dimensions of social relations shape women's lives. My multi-sited design of this STS research is not unique, but like Martin (1994), I have unmoored this research from the research lab and prioritized disciplinary norms over local organizational politics. Anthropology fetishizes locality (Boellstroff 2012), and studying technology in an era when large-scale capital and its owners are hyper-mobile can require multi-sited ethnography. I use life history methods, autoethnography, and media analysis to cement connections between places, identities, and ideologies. Life history interviews, a methodology pioneered in feminist anthropology, makes political economic relations central in cultural evaluations of sexuality, marriage, and interpersonal relations (Rapp 1979). The technique documents a person's life events, stories, and perspective across time and social settings, thereby enabling an analysis that spans phenomena across the spheres of production and reproduction. By combining life history interviews with cross-sectional methods, women's stories of their lives as CSE professionals illuminate their stages of development, lived experiences, and social milieu. This elucidates women's individual strategies for succeeding in CSE, the organizational culture of CSE institutions, and the broader cultural norms in which technical labor occurs.

In my analysis of these life history interviews, I also adopt a method from medical anthropologists, who have developed a new epistemology of the body that informs the methodological orientations of this project. Scheper-Hughes and Lock (1987) argue that paying special attention to emotion both destabilizes positivist assumptions embedded in scientific knowledge production and offer the liberating potential of bridging the Cartesian dualisms between reason and body, individual, society, and body

politics. Emotions are socially mediated but are difficult to compartmentalize (unlike the machines that CSE workers interact with), thereby offering a holistic expression of each participant's experience of the individual, social, and political body across the false binary of the reproductive and productive spheres. In this study, my attention to participants' emotions has illuminated connections between the social relations of power central to the organization of CSE production and the reproduction of social life in this era of advanced technological artifacts.

STANDPOINT THEORY

Standpoint theories are feminist investigations into the relations between material experience, power, and epistemology and the effects of power relations on the production of knowledge. Standpoint theorists challenge the social construction of knowledge and the values which determine who is a "competent" knowledge producer within institutions. They make important connections between women's labor value, gender politics in the sciences, and the political and philosophical stakes in diversifying technology production (Wylie 2003). Because standpoint theory seeks to destabilize dominant ideologies and incorporates a multiplicity of social identities, it is a critical means by which to critique the social construction and impact of technology (Wacjman 1991).

Feminism has shown tendencies toward universalization, a legacy inherited from western rational thought. White feminists, even when they are cognizant of race, rarely position themselves as inhabiting racialized bodies, making them complicit with white privilege (Moreton Robertson 2009). Audrey Lorde (2003) also challenges white feminists who call for "unity," which she argues is misnomer for a "need for

homogeneity” (Lorde 2003, 79). Like Sandoval (2000) and Katz (2001), Lorde wants to chart topographies of oppositional consciousness and the conditions that incubate and ferment a resistance which compels people to subvert dominant class rule. In the US, a society of vast social inequalities and violent histories of oppression, underrepresented scholars must convince a community controlled by elite, white, and purportedly straight men that their claims are valid (Collins 2000). Du Bois (1994) refers to as a “second-sight in this American world a double-consciousness” (p. 2) that requires one to move between two selves in order to both resist and survive everyday injustices. Collins (2004) recognizes that this “outsider within status” generates tension as well as important insights into social patterns that dominant group members cannot see. Our intellectual practice can make power visible from marginalized sites of lived experiences to link the knowledge of “our own existence into a larger knowledge of a historical process in which we are active and to which we are captive” (Collins 2004, 213-23). I take to heart Beradi’s claim (2009) that intellectual laborers have the potential to contribute uniquely to the class fight against the imposition of the commodity-form. Cognitive laborers who produce CSE commodities have a specific form of knowledge that allows them to perceive the framework underlying social relations in US technocracy in ways that non-computer experts cannot. This potentially liberating perspective can be further augmented by the insights of marginalized CSE professionals who persist in the field. Toward this end, I aim to understand how CSE professionals from non-dominant groups develop an oppositional stance against forces that reproduce male domination in CSE sites of knowledge production.

My study of CSE workers prioritizes modes of reproduction because the CSE field epitomizes the efforts of scientific and religious institutions in western culture to try to transcend the material world and valorize the supra-natural (Ortner 1996). Most male members of dominant groups in western culture refuse to be responsible for daily life - their own or other people's – and women are socialized to bear responsibility for material life (Harding 1991; Smith 1987; Hartsock 1995). This standpoint has the potential to pose alternatives to male and myopic sciences, technologies, philosophies, and epistemologies. Recognizing the range of women's material experiences, constraints, opportunities, and manufactured identities is central to the struggle against gendered labor segregation and women's exclusion from public positions of influence.

Patricia Hill Collins (2000) and Nancy Hartsock (1999) argue that community-based vision of power can emerge from a feminist standpoint. Collins' conceptualization of Black feminist standpoint theory affirms the importance of "women-centric networks" in Black diasporic communities (Collins 2000, 319-20). She relies on Gwaltney (1981) and Hurston (1979) for ethnographic data of African American women's lives, linking this data with critical analysis to reveal the theoretical and empirical limitations of positivist sciences born of western modes of rationality (Collins 2000). The process of making knowledge claims from the margins of a culture germinates distinctive ways of knowing. Personal experience counts as evidence (Collins 2000). African American women not only have developed a distinctive Black women's standpoint, but also have done so by using alternative ways of producing and validating knowledge (Collins 2000). In my project, I analyze women's stories keeping in mind their racialized standpoint. For example, I connect some white women participants' expressions of low self-efficacy to

their gendered, racialized relation to white male co-workers. Also, the narratives of African American CSE workers bring a privileged perspective on networks of access and influences and the challenges of integrating multiple social identities. These women's lives help specify the constraints of dominant class rule in CSE and their yearnings for a technical occupation offer liberating potentials for the production and application of CSE technology.

Some standpoint theorists hypothesize that the social order is arranged by elite white men to "free" them from the labor required to maintain and reproduce the daily material conditions necessary for them to spend their days contemplating abstractions (Harding 1991; Hartsock 1997). Paraphrasing Virginia Woolf, Harding valorizes the labor women perform to provide the social foundation for men's "great achievements" which, she mockingly notes, they "imagine they bring off all by themselves ... dominant groups have always insisted on maintaining different material conditions for themselves and those whose labor makes possible their dominance" (p. 26-7). Furthermore, they profess it impossible that those they subjugate "could ever achieve their own exalted level of consciousness" (p. 7). In CSE sites, this myopia is not only tolerated, but also buttressed and reproduced by the myth of meritocracy, whereby dominant groups in high-tech institutions defend the homogeneity of their workforce, claiming those who deserve to be there are and those who are missing from their ranks are incompetent. I expand on this ideological constraint in Chapter 4.

Because women and men occupy different standpoints, organizational practices affect them differentially (Acker 1990). Men have a standpoint that rewards them for breadwinner activities. These rewards may make up for having to spend long hours at

work and tolerate oppressive or hostile managers. Women are rewarded for performing traditional gender roles, which can help explain why privileged women with advanced degrees still put their careers on hold or consider their careers a lower priority than their husbands' (Hirshman 2006). Inspired by Faulkner (2000; 2007) and my own experience working with senior executives and CSE professionals, I am very interested in the standpoint of white heterosexual technologists and their relationships with the owners of the means of production. Male CSE workers are aware that their companies depend on their specialized knowledge while, at the same time, current economic ideology requires that the owners of the means of production minimize labor expenditures. This produces a tension in the high-tech workplace, which, as I argue in Chapter 5, contributes to the hostility reported by my research participants.

Institutions of knowledge production are predicated on the historical exclusion of women of all ethnicities from avenues of power, knowledge production, and public leadership (Smith 1987; Harding 1991). For example, women are often socialized to perform care-giving work and steered away from math, science, and technology (Harding 1991). The massive volume of documentation of discrimination against women in STEM disciplines stands in contradiction to the broad claim of objectivity in these fields (Harding 1991). Women in STEM fields must contend with issues that their white male peers do not: unexamined bias, competing in the workplace with men with stay-at-home wives, gender and sexual harassment, and structural policies and institutional norms that favor men's standpoint.

My dissertation is designed to focus on and amplify women's unique standpoint in CSE production. I analyze my participants' descriptions of their experiences of being

female in sites of CSE production using standpoint theorist Dorothy's (1990) theory of "rupture." Rupture occurs in women's lives when they experience the tension between being both ruled by dominant group members and being part of the ruling class. This theoretical concept helps me explore expressions of power relations at multiple levels in CSE and helps tease these relations apart from the ideological discourses promoting technocratic idealism. Contradictions between experiences of privilege in CSE work and the disadvantage of gender in CSE workplaces offer valuable insights into gender relations in a technologic capitalist economy and potential sites of resistance.

Not only do women live differently than men because they occupy different positions in social hierarchies, but their exclusion from sites of CSE production has serious and far-reaching epistemological outcomes for our society as well (Hartsock 1999). Resisting and subverting male domination in CSE and the inclusion of a critical mass of CSE workers from non-dominant groups would not only produce different kinds of computing artifacts, but also shift the purposes and applications of computer technology. If women of all ethnicities in the US were to have equal control of the technical tools that hold such a powerful sway over our society, what would be gained and how would social relations of power be transformed?

ETHNOGRAPHIC METHODS

I conducted seventeen months of ethnographic fieldwork with a cross-sectional sample of participants (Cohen et al. 2000) across a range of sites including conferences, workplaces, and university campuses. I designed my research as a cross-sectional study of gender norms to investigate the personal and professional aspirations of CSE knowledge workers at different points along a life course, including training initiation,

labor market participation, and career advancement. This design evocates similarities and differences across ages and stages of a CSE career. As a result, age and career stage emerge as important categories by which to analyze cultural norms and values in CSE sites. My research design provides a synchronic snapshot of different samples at various points of time in a CSE career, allowing for a systems-level analysis without the constraints of a longitudinal study. It enables me to compare different groups at various stages of a CSE career, thereby providing data for a macro-level analysis of the problem of women's underrepresentation in CSE.

Intimate narratives can bring into sharp relief broader cultural forces operating in society (Forsythe 2007). Ethnography examines real-world social processes and involves “*training oneself not to take anything for granted*” (Forsythe 2001, 148; my emphasis). Anthropologists spend time in communities to get to know them in depth but do not simply replicate the “insider’s” perspective. Feminist ethnography in particular involves putting oneself on the same plane as one’s participants, participating and observing informal situations to make the familiar strange (Forsythe 2001). Because I once was an insider in high-tech and have since stepped out and trained as a social scientist, I bring to this study both my “insider” experiences in CSE production and a structural analysis made possible from an outsider’s perspective.

Feminist anthropological research provides methods ideal for conducting this interdisciplinary research because of its ability to analyze women’s lives across the artificial binary of “public/private” and contextualize them within cultural norms and structural ideologies. Moreover, the anthropology of STS can open up new lines of inquiry when applied to social change movements (Hess 2007). This project embraces an

interdisciplinary framework, blending anthropology and STS with diversity in STEM scholarship and feminist theory in order to advance social change and critical epistemologies of knowledge production, gender, reproduction, and technology.

My project is multi-sited and involves “interacting with informants across a number of dispersed sites, not just in local communities, and sometimes in virtual form” (Gusterson 1997, 116) because I am studying disciplinary culture and the dynamics women must navigate in several formative stages of a CSE career. Women are so outnumbered by men in CSE that participating in research on gender could put their anonymity at risk. My multi-sited research design seeks to minimize this risk. Confidentiality is paramount to my participants. Henceforth, I use pseudonyms when quoting them. I also change the name of the organization they train or work at if I feel this information will jeopardize their anonymity. Conferences were a great opportunity for these interviews. I found my networking opportunities arose at panels, luncheons, social events, and poster sessions. Remote access tools were very effective for interviews as well.

Interviews: Mapping Participants’ Shifting Standpoints

This study relies on lived experiences as told to me by 42 people who work as CSE professionals in elite corporations and universities. The women and men who shared their stories with me are sharp-witted and dynamic. In general, they were quick to respond, not afraid to challenge me, and had strong opinions. I feel so lucky for these stories. To open up about one’s accomplishments, one’s fears and failures, one’s life course and the web of relations that keep us alive and sometimes even allow us to thrive - this is intimacy. This intimacy is a gift that enables me to tell these stories with gratitude.

Participants also had many interests outside of CSE. I spoke with a marathon runner, a trapeze artist, many women committed to strict exercise regimes, a weightlifter, two poets, and two race car drivers.

My participants were also extremely accomplished CSE professionals. When I decided to “study up” I decided to really go for it. Most of my academic participants were either trained or work in computer science departments that US News and World Report deems the “most competitive” in the US, like the Massachusetts Institute of Technology, the University of Wisconsin at Madison, Carnegie Mellon, the University of Washington, Stanford, and the Georgia Institute of Technology, to name a few. Participants in industry work for companies that most Americans recognize and solicit services from, including Intel, Microsoft, Amazon.com, Hewlett Packard, Google, Cisco, Inc., and Facebook. My sampling strategy is in no way aimed at reifying and reproducing the elitism that these institutions represent. Rather, I seek to critically examine the prestige and influence of these high-tech institutions:

The ‘high-IT core’ workforce includes computer programmers, computer scientists, computer engineers and systems analysts whose jobs are directly involved in the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware.

(Tam and Bassett in Byst and Bird 2006, 108).

When I use the term “high-tech” in this dissertation, I am referring to these types of jobs. The high-tech workforce has seen the greatest increases in employment and wages of any occupation. Demand for CSE jobs has tripled since 1999 (Tam and Bassett 2006). My focus on women working in elite institutions of the high-tech workforce offers

both opportunities and constraints. On the one hand, inquiry into the working conditions and lived experiences of these highly-educated and very privileged women can provide insights into the institutions that shape the co-constitution of gender, race, and technology in the US and how particular kinds of laborers are reproduced in a range of elite sites. On the other hand, it may limit the imaginative possibilities of transforming CSE technology because participants are embedded in structures erected to maintain status quo relations of power. Nevertheless, the moments of rupture women CSE workers experience between the constraints of their positions and the contributions they want to make using their technical skills can tell us much about this workforce and broader social domains.

Harding (1986) identifies three kinds of workers in US post-World War II scientific knowledge production: 1) managers and distributors; 2) technical workers; and 3) domestic staff. Harding (1986) explicitly frames the production of science in the last 60 years to factory assembly lines rather than in terms of the mythical “lone genius.” My study focuses on the first two categories of laborers, including those who conceptualize and control research (academic leaders, corporate managers, government policy advisors, and investigators on research teams in academia, industry, and government labs) and those who perform all the labor required to reproduce CSE knowledge, commodities, and technologic ideologies (technicians in computer labs, hardware systems manufacturers, computer programmers, data analysts, and research assistants).

I interviewed participants who were managers, distributors, and technical workers in CSE using semi-structured interview techniques. Keeping in mind the disparity in social power between CSE managers and technical workers, I am careful in this research

to categorize my participants as laborers. The separation between cognitive activities and the labor process “has no further grounding when we discuss the mental forms of social labor since when each intellectualized operator is the vehicle of a specific form of knowledge, s/he perceives ... the social system of knowledge underlying the ... productive” (Beradi 2009, 70). In other words, technical intelligence and skill gives the CSE worker a unique viewpoint into the cyber-optic infrastructure of institutions of power in the US. Therefore, CSE workers can be powerful allies to both the dominant class and those who challenge dominant class rule. What potential social changes can happen when a marginalized member of CSE offers her intellectual labor to workers’ movements to challenge technologic conditions of profit and social control? Possible answers to this question emerged in my participants’ stories and help explain why the contradiction between the social power of CSE knowledge and the social constraints of this highly rational field organized along industrial lines emerged significantly in my study.

I performed participant observation in classrooms, computing workplaces, and technology conferences and performed focus group interviews and life history case studies. I interviewed both women and men, with multiple racial/ethnic identities, and especially members of historically underrepresented groups in CSE. I oversampled women - 93% of participants identified as female. I interviewed three African Americans, four Latinas, six Asian Americans, five foreign nationals from three continents, twenty-two white Americans, and two participants whose racial/ethnic identities I did not confirm. Four participants were out members of the LGBT community. I chose this sampling strategy in order to solicit insights into CSE technology from people who must

navigate both privilege and marginalization to persist in their field of choice. I believe these “outside within” standpoints (Collins 2004) give my participants a dual consciousness within CSE production that generates a unique perspective on social arrangements that a dominant group member or entirely dispossessed member of society could not perceive.

I also used data from the Anita Borg Institute (ABI) for Women and Technology, an organization that works to increase the impact of women on all aspects of technology and increase the positive impact of technology on the world’s women. Every month, ABI puts out a newsletter and each one features an interview with a senior technical woman. I collected 20 of these interviews with senior technical women. When I quote a participant and use her full names in capital letters, I do so to clearly indicate I am referencing a senior technical woman from these ABI newsletters and not breaching my interview participants’ confidentiality. I am sharing these senior women’s stories from ABI newsletters only when their names have already been published.

I use multiple qualitative methods to triangulate data sources and methodologies to reduce biases inherent in relying on a single source or data gathering technique (Cohen et al. 2000). Audio recordings and notes were transcribed and general themes identified for participant verification. Because current research on gendered dynamics in cultures of technology does not share a common conceptual framework, I analyze my data using grounded theory techniques (Cohen et al. 2000). Grounded theory allows me to prioritize emerging themes and ideas rather than merely verify existing claims. I also challenge existing scholarship that analyzes gender hierarchies and disciplinary cultures as barriers. My research is interdisciplinary in nature and grounded theory enables a comprehensive

assessment of causes and consequences of women's underrepresentation in CSE. Using meta-coding techniques, I am able to question the relevancy of variables and identify and code new themes. To avoid limiting the textual analysis with my preconceptions and biases, I use participants' own terms in constructing codes and identifying themes.

Media Content Analysis

In order to understand CSE at the level of the *body politic* (Scheper-Hughes and Lock 1987), I use archival methods. From May 2011 until April 2013, I collected and analyzed the content of newspaper and magazine articles and web logs (blogs) I found online and in print. These archival materials all relate to processes of technological labor in the US and related political processes and discourses. This analysis is necessary to interpret my research data within the context of the social development of computing technology and its applications. It allows me to present a fuller picture of the “emotional, ideological and linguistic domains that condition social productivity” in US technocracy (Beradi 2009, 68). Some of this material supports data that emerged from my interviews, particularly the level of sexist violence that is rife in CSE communities. The combination of my ethnographic and archival data enables me to address a lacuna in current academic literature on women workers in STEM fields, which, unlike its chilly climate predecessors, focuses on implicit bias as the driving force behind women's exclusion from these fields to the neglect of explicit violence and harassment. I rely on this archival research to make recommendations in the Conclusion Chapter for broader social transformations needed to augment women's efforts to desegregate educational and industrial institutions of CSE production.

Every day while writing this dissertation, a new story of gender, race, or neoliberal politics crossed my path and I chose to include some of these late-breaking stories, including Sheryl Sandberg's (2013) book *Lean In*, and Adria Richards' act of defiance against everyday sexism in high-tech environments and the violence she faced in response. My dissertation was already completed by the time Edward Snowden released evidence demonstrating the scope of the US government's collusion with high-tech corporations to collect and store citizens' private on-line data and phone messages. My future work will incorporate these revelations with my analysis of my data findings.

I also use field notes from lectures and panels at national conferences, including the Grace Hopper Celebration of Women in Computing (Portland 2011), the National Center on Women in IT (NCWIT) (New York City May 2011; Chicago May 2012), the IEEE Women in Engineering and Google joint conference Enhancing the Sustainability of Women in Technology (Mountain View 2013), and the American Anthropological Association (San Francisco 2012).

A Luddite Among Technophiles

My motivation for this study is both personal and political. After interning full-time at the US Department of Labor Women's Bureau during my undergraduate years, I grew passionate about women's labor value and experiences in non-traditional, male-dominated fields. In my adult life, I have always been financially independent and plan to remain so. Therefore, I must grapple with labor segregation, the wage gap, and sexist discrimination in the workplace in order to support myself – to live – and I engage these issues in my scholarship in the hope of combatting the reproduction of inequitable relations of gender in the US. I base my arguments in this project on my four years of

experience as an executive in a high-tech corporation, seven years of working as a diversity advocate in engineering, two years of preliminary and formal ethnographic research with CSE professionals, and a content analysis of public discourse regarding women workers in high-tech fields.

In this study, I represent myself in two ways: 1) as a narrator who interprets participants' experiences through a prism refracting my lived experiences as a woman worker and a feminist scholar; and 2) as a woman worker who has experienced and resisted gender and sexual harassment and wage exploitation in high-tech production. I use legal documents and journal entries I wrote while employed as a project manager at a well-known high-tech corporation to demonstrate how interpersonal and structural sexism operates to contribute to and reproduce male dominance in CSE.

It is also worth noting that I am not a technophile. I distrust computer technology and engage with it hesitantly and with reservations. I see the advantages of the internet, lap tops, and cell phones but also believe them to be tools of extraction and distraction that generally serve the best interests of powerful institutions like global multinational corporations and the US military. I was a late adopter of cell phones and still refuse to buy a phone with a GPS monitor that can track my every move. This often caused me to feel like a Luddite while doing participant observation at technology conferences, where attendees were constantly checking their smart phones and tapping on their computer tablets. Participants in this study have taught me much about what computers can do and the emotional satisfaction that CSE knowledge and practices can offer. I see now that as a consumer, my wariness of computer technology may be justified, especially since Edward Snowden revealed the extent to which the US government, under the auspice of

the Patriot Act, collaborates with prominent high-tech corporations to spy on technology consumers worldwide. But I must listen to skilled CSE workers who have a privileged standpoint on the power and potential of technology. In this study, I stress that people both within and without the world of CSE production offer important checks and balances to one another in an effort to change who makes technology and toward what ends.

Autoethnography

Autoethnography is a methodology with which researchers can contest stereotypical representations others have made of them (McClaurin 2001). Contesting stereotypes of the dispossessed is an important goal of methodological activism in social science because dominant cultures often represent “‘Others’ as consumable and extinguishable” (Parameswaran 2008, 414). Adams and Jones (2008) argue that autoethnography allows researchers to interrupt normalizing discourses of dominant culture, making space for fluid identities and offering examples of “more free” ways of being in the world (p. 386). This is especially important in critical research because people who challenge the boundaries of normal and status quo are well-poised to become “agents of change” (Essed and Goldberg 2001, 187). For example, Zora Neale Hurston’s deployment of autoethnography marked a decisive turn in her discipline. Her dialogic and reflexive style would “later become central to what is now called interpretative anthropology” (McClaurin 2001, 66). Similarly, Audrey Lorde’s autoethnography *Zami: A New Spelling of My Name*, written from an “unequivocally Black lesbian and feminist perspective,” demonstrates that Black and white lesbians in the 1950’s were grappling with working across differences more than thirty years before the US women’s

movement took up this struggle (Mohanty 1991, 123-5; Lorde 1983). In this dissertation, my standpoint as a queer, working-class woman with the privilege of white skin has motivated and informed my struggle to be an agent of social change and to uncover the mechanisms and social relations that allow for the devaluation of women's labor in CSE production. I seek to allow my reader to witness my interpretation of meaning from my participants' experiences rather than pretend to depict an experience exactly as it was lived. I strive to put the "'autobiographical and personal' in conversation with 'the cultural and social'" (Adams and Jones 2008, 375).

Critical methodologists not only strive to form alliances with others but also view their research participants as collaborators. For example, many feminists give their participants transcripts of their interviews and allow interpretative feedback on ethnographic text (Sanger 2003). This new subjectivity, accessed through differential consciousness and methodological forms of intersubjectivity, "writes US third world feminism, subaltern, queer and de-colonial resistance back into history, theory and consciousness" (Sandoval 2000, 35). An *active presence* repudiates dominance (Grande 2008; Vizenor 1998). I am present in this dissertation as both narrator and subject in order to make a critique of power relations from a similar experiential plane as my participants. As a scholar-activist doing qualitative work with the aim of ameliorating oppressive conditions, I use both my identity standpoint and experiences as a working woman without access to a male wage as a point of departure for theorizing.

Anthropologist Faye Harrison calls this "the anthropology of liberation," where knowledge and praxis are intertwined with ethnography, documenting the texture of women's lives (McClaurin 2001, 16).

Toward this end, my scholarship is an intervention aimed at creating new perspectives on the ideologies and meanings of technology. I pay close attention to the multidimensionality of CSE labor - its power, prestige, purposes, influence, and imperviousness to diversity. My experience as an executive at a high-tech corporation enhances my ethnographic research. This experience uniquely positions me to access a variety of networks in CSE communities, to critically examine the multi-scales of power operating in these networks, and to skillfully engage with critical stakeholders in the movement to end gender segregation in CSE. I offer an emic perspective on CSE production and a structural analysis made from a social science perspective. Also, I focus on the marginalization of women in CSE production to light the processes by which gender, race, and technology are constructed in a world mediated by ubiquitous CSE commodities created to serve but a elite few.

MAPPING MY FINDINGS AND CHAPTERS

“Cracking the Code: Navigating and Subverting Dominant Class Rule in Computer Science and Engineering” is composed of seven chapters. I advance five related arguments. First, women who navigate, resist, and subvert male hegemony to persist as workers in CSE have a unique standpoint in US society and have the potential to transform, institutionally and interpersonally, unjust social relations. Second, rites of passage (Davis Floyd 1992) in CSE, for example, interviews, long hours, precision questioning, combative work styles and the valorization of logical and abstract approaches to knowledge production over creative, material ones reproduce the ideological union between masculine ideals and competency in the field. These rituals also serve to indoctrinate CSE workers’ to the core values in computing commodity

production, including constant observation, intense evaluations of others, and the devaluation of sociality. Third, participants' emotions allowed me to locate and interpret the conflicts and contradictions of women CSE professionals. Many of these contradictions signal a rupture, women's struggle to navigate the bifurcated nature of their workplace role – participants privileged to be agents in a powerful field and marginalized members of this field (Smith 1990). These sites of rupture are areas ripe for social change activism. Fourth, the majority of my participants have social change aspirations. They want to use their CSE skills to make the world a better place. These aspirations correlate with a commitment to support other women in CSE. Navigating the experience of rupture, combined with a yearning for social justice, may ignite feminist consciousness in women CSE workers, which can lead to collective action in pursuit not only of equality in CSE but also in broader cultural domains. Finally, I argue that social change aspirations are a collective form of reproductive aspirations and CSE workers can effectively *organize around the shared yearning to contribute to the reproduction of the collective well being of society*.

In addition to recounting personal strategies of career persistence, I aim to capture the broader social dynamics women must navigate in several formative stages of a CSE career. I document the norms and values of three dimensions of CSE knowledge and labor: 1) personal attributes, relationships, experiences, and emotions; 2) internal dimensions of the CSE field; and 3) broader cultural domains.

In Chapter Two, “Feminism and Diversity in Science, Technology, Engineering and Mathematics (STEM),” I review the significant contributions of diversity science and FSTS to locate my research and reframe the exclusion of women and people of color

from CSE institutions as a part of a larger historical project of dispossession aimed at maintaining and regenerating dominant class rule in the US. This analysis sets the stage for me to argue the case for advocates for diversity in STEM to join with FSTS scholar activists to not only dispel stereotypes but also struggle against epistemic and euphemized violence and normative standards of success and competence within exploitative social relations.

In Chapter 3, “Reproducing the *Body Politic* in an Era of Computing Commodity Fetishism,” I analyze gender segregation in CSE using a Marxist interpretation of class and labor value and a historical material understanding of how CSE workers shape our cultural relations, values, and epistemologies in the US. I use Davis Floyd’s (1992) theoretical construct of the “technocratic model” to elaborate on the broader cultural domains of CSE production and its applications. I frame the technocratic model of US society as a value paradigm that has enabled the virtualization of modes of production (Hartsock 2009), allowing for greater exploitation of modes of social reproduction. I articulate how this paradigm shift has resulted in a political economic regime ruled by CSE commodity fetishism which individuates and isolates the *body politic* (Scheper-Hughes and Lock 1987), regulating and controlling individual and social bodies via CSE technology, while consolidating the power of the wealthiest members of the dominant class in the US.

In Chapter 4, “Reproduction, Violence, and the Body,” I examine the cultural values and structures that constrain agency and limit transformative actions (Ortner 1996). I continue to build on Scheper-Hughes and Lock’s (1987) anthropological framework of the body to consider the implications of CSE commodity fetishism on

reproductive justice in the US. I argue technological labor and the social labor of reproduction in the US operate from similar ideologies of gender politics, which rely on physical, epistemic, and euphemized violence to reproduce structures of inequality. Resituating labor segregation as a reproductive justice issue more accurately reflects women's lives, which transgress the false binary between public and private spheres. I share the stories of my participants' lives to catalyze the social transformation of women's labor value and an economy that erases the labor of social reproduction from public discourses and policies.

In Chapter 5, "Technically, 'You're Different and Different Isn't Free:' Gender @ Work in a Dot Com World," I walk through different dimensions of organizational norms and disciplinary values that privilege male hegemony, as depicted through the stories of women who, both individually and collectively, navigate technical terrains of epistemic violence and gender harassment. I explore the geek stereotype and analyze how it operates both symbolically and culturally as a rite of passage (Davis Floyd 1992) to initiate CSE workers into a particular value system that reflects and reproduces the broader socioeconomic domains in which their labor takes place. I pay particular attention not only to women's vulnerabilities and resiliencies, but also to their skills, passions, and aspirations. Through this examination, I aim to demystify the cultural significance of CSE production and elucidate the labor value of its practitioners, as differentiated along vectors of class, race, and gender. From the stories of my participants, I excavate the standpoint of dominant group members, revealing the "fragility of male gender identity" in CSE (Harding 1986, 68).

Chapter 6, “Profiles of Persistence,” features the stories of women who have persisted in the highly male-dominated field of CSE and who are on the front lines in the fight to desegregate the US labor force. I share life histories to painstakingly document how research participants navigate through their career and reproductive trajectories and negotiate the social dynamics within cultures of CSE across multi-scaled levels of power. Powerful themes emerge regarding self-efficacy, sponsorship, yearning for collective action, social aspirations, and intrinsic resources that offer insights into the potential of transforming the use of CSE skills and technologies to advance social justice.

CONCLUSION

In this project, I use the narratives of CSE workers marginalized by underrepresented social identities to analyze the co-construction of gender, race, and technology and the effects of living in a world mediated by ubiquitous products created by an elite few. My feminist ethnography aims to transform: 1) women’s opportunities in STEM fields; 2) the institutions that support these knowledge practices; and 3) the outcome and applications of technology. I rely on interdisciplinary methods, critical race, feminist, and Marxist research, and the emotions, insights, and embodied experiences of my participants to question implicit assumptions and behavioral norms that are adopted as group values in CSE. I interpret the meaning of these values within the broader social priorities and practices governing not only CSE production but also the modes of reproduction and economic labor relations.

Chapter Two: Feminism and Diversity in Science, Technology, Engineering and Mathematics (STEM)

INTRODUCTION

Feminists have long argued that women's overall underrepresentation in STEM fields is a serious problem, a chorus recently joined by the U.S. Department of Commerce (Beede et al. 2011). Both interpersonal and institutional dimensions of cultural norms operate at the level of "the collective social imagination" (Fricker 2007, 15) to exclude underrepresented group members from cultural practices of power and denigrate their capacity as knowers (Harding 1991; Harding 2006). In this chapter, I will review various theories advanced in two bodies of literature on women's underrepresentation in STEM. The first body of literature I refer to as *diversity in STEM*, and it includes scholarship from engineering education, social psychology, sociology, history and philosophy of science, and public policy. Diversity in STEM scholars do not necessarily share common theoretical frameworks, methodologies, or strategies for outreach (Cech 2005), and I have taken liberties in grouping them and naming them. I have done so in the hopes of harnessing the vigorous spirit and rich insights that characterize this applied scholarship aimed at ending male dominance in STEM. The second body of literature reviewed in this chapter is Feminist Science and Technology Studies (FSTS). While diversity in STEM literature focuses on policies and practices within STEM communities, often from a practitioner's point-of-view, FSTS deconstructs social construction of science itself (Bystydzienski and Bird 2006). Together, these scholarships stress the social nature of STEM and the political nature of labor segregation in these fields. I summarize and consolidate these literatures to support my project of mapping the co-construction of gender, race, and technology and illuminate their

relationships as they shape labor segregation in both the public and private spheres in the US. Toward this end, I lay out in the following section the discourses challenging women's underrepresentation in STEM, the merits of a sociocultural analysis of labor segregation and the class tensions embedded in STEM identities, and the critical contributions feminists make to the problem of women's participation in STEM production to illuminate critical areas of intervention that my dissertation research addresses.

DIMENSIONS OF DISCRIMINATION

The Myth of Meritocracy

The intractability of gender inequalities in STEM has prompted the development of a number of theories. Structural and ideological discrimination transgress gender, race/ethnicity, and boundaries between public and private institutions (Browne and Misra 2003; Duffy 2005). Although women of all classes make up the majority of the US workforce, they still remain segregated to low-paying, service-oriented professions ([Shriver 2009](#); Greenberger et al. 2005; Nakano-Glenn 1992; Spaights 1995). Extensive scholarship has documented the disproportionate barriers experienced by women and underrepresented minorities in accessing and thriving from opportunities in education and employment (e.g., Morley and Lugg 2009; Boice 1993; Heckman 1998; Massey 1990; Reskin et al. 1999). In this research, the term “underrepresented group members” includes women of all ethnicities as well as African American, Latino, and Native American men. In recent years, discrimination targeting underrepresented group members participating in higher education and the workplace has been masked under a dominant discourse that mythologizes the US as a post-feminist, color-blind society

(Browne 2003; Bonilla-Silva 2004; Essed 2001; Moody 2004; Benokraitis 1995; Swim et al. 1995). Meritocracy, the belief system that wealth, employment, and power are fairly distributed on the basis of hard work and innate abilities, is racism and sexism in modern form (Hing et al. 2011; Swim et al. 1995; Bonilla-Silva 2000). By erasing prejudice as a cause of social inequalities, the ideology of meritocracy attribute the status of underrepresented group members to individual failings and group members' innate incompetence.

As such, the ideology of meritocracy serves as a consistent and persistent barrier to building critical mass support for diversity in STEM. In facilitating workshops on best practices for diversifying STEM in institutions of higher education, I have found it difficult to change people's minds about meritocracy. This ideology is deeply embedded in our public consciousness. Its emphasis on individualism and personal responsibility reflects the political economic climate in the US, a system that unjustly favors the elite ruling class and quells collective organizing. Meritocracy operates systematically to mystify the uneven distribution of power, and when people rankle when I challenge them to unpack it they do so because they feel I am attacking their personal social status and the means by which they acquired it. Meritocracy is close to the hearts of dominant group members and entwined with their beliefs about their abilities, their individual and social identities, and even the American Dream. Education is mythologized as the means by which anyone can succeed at reaching their goals in the US. This is well epitomized by the words of Bill Clinton, who when asked to define the American Dream, said: "If you work hard and play by the rules, you should be given the chance to go as far as your God-given ability will take you" (Hing et al. 2011). However, the fact is that the "income

achievement gap” – differences in standardized test scores and grade point averages – between children from families in the top 10 percent of the income distribution and children from families in the bottom 10 percent is growing rapidly. “The income achievement gap between children from the highest and lowest income deciles is roughly 30 to 40 percent larger among children born in 2001 than among those born in 1976” (Edsall 2012, page?) This data destabilizes the mantra of meritocracy – *only the best and the brightest* – and reveals it to be a euphemism for “the blessed and the privileged” (Margolis 2008, 202). The cost of the ideology of meritocracy is staggering. For example, if Latinos/as and African Americans had equal access to education and occupations, the annual increase in earnings would be \$118 billion and \$113 billion, respectively (Butler 2002).

Gains Won, Opportunities Ahead

The dominant discourse of meritocracy makes the gender gap in STEM in particular very difficult to bridge. The continued reign of males from dominant groups in STEM reflects historical patterns of labor segregation in the US not yet fully understood. How do we continue reproducing such a pervasive system of disempowerment? My dissertation research inquired into why some fields are less welcoming to underrepresented groups than others and begins to elucidate the consequences of these exclusionary institutions and practices. Perplexingly, women have made gains in other male-dominated fields such as medicine and law (Xie and Shauman 2003). While women have gained access to higher education, the gains have only challenged segregation horizontally. In other words, gender equality can be declared in broad aggregates measuring representation, but “the stubborn persistence of gender segregation across

fields and subfields of study masks deep gender inequalities rooted in traditional cultural values in US society” (Etzowitz et al. 2008, 409).

Furthermore, historically underrepresented groups continue to face longstanding barriers to advanced degrees and professional positions. Women Ph.D recipients are distressingly underutilized in the faculty ranks, especially at top research universities. We continue to fill the ranks of non-tenure track positions in the academy while tenure-track faculty and leadership positions remain dominated by white men (Wylie 2007). For example, the 2006 Women in Engineering Program and Advocates Network identified only 63 women in academic administrative positions at engineering programs or institutions with engineering programs in the country (WEPAN 2006). These leaders included 26 female deans or associate/assistant deans, 20 department chairs, nine provosts or vice-provosts, and eight presidents of universities. Furthermore, a striking pattern of segregation *within* fields of study persists. Women continue to enter traditionally female-dominated fields, like nursing, social work, and K –12 education, and when women *do* enter STEM fields, they disproportionately choose the life sciences over the physical sciences and engineering (Mann and DiPrete 2011). Medical schools graduate 49% women while CSE doctoral programs graduate less than a third of that number (Misa et al. 2010).

Explanatory Models for Underrepresentation in STEM

Research on the topic of women’s underrepresentation in STEM is prolific. In their 2010 summary report *Why So Few?*, the American Association for University Women (AAUW) identifies three themes emerging from this literature:

First, the notion that men are mathematically superior and innately better suited to STEM fields than women are remains a common belief A second theme revolves around girls' lack of interest in STEM. A third theme involves the STEM workplace, with issues ranging from work-life balance to bias.

(Hill et al. 2010, 19).

Blickenstaff's (2005) review of the last thirty years of literature addressing women's absence from STEM echoes these themes and adds greater granularity, including:

[G]irls' lack of academic preparation for a science major/career; girls' poor attitude toward science and lack of positive experiences with science; the absence of female scientists/engineers as role models ... cultural pressure on girls/women to conform to traditional gender roles and an inherent masculine worldview in scientific epistemology.

(Blickenstaff 2005, 371-2).

Note the way that many of these explanations are framed to rely on an implicit "blame the victim" ideology. The onus is put on women for not entering STEM rather than on male scientists' exclusionary practices and organizations geared to favor men's attributes and lifestyles. This way of framing the social problem of occupational segregation as an individual problem indicates the ideological influence of meritocracy. "Fixing the woman won't fix the problem" (COSEPUP 2006, 66). Too often diversity programs in STEM focus on helping women assimilate to cultures formed by predominantly white male practitioners. This is the wrong approach. Ameliorating women's underrepresentation in STEM means a shift away from the "woman as deficit" model that Blickenstaff exemplifies toward policy interventions at the institutional level (Bystydzienski and Byrd 2006). I agree with Rosser (2012) that this shift is necessary and

I am heartened to see in recent years a proliferation of diversity in STEM scholarship that inquires into racial and gender inequalities. Diversity in STEM scholarship argues that sources of inequality originate not only in individual minds but also in institutional practices, norms, and values (Plaut 2010).

Diversity Science

Diversity in STEM research identifies male-dominant practices specific to CSE, including jockeying for superior status, public criticism, impersonal communications, and competitive behaviors, especially in the classroom (Barker and Garvin-Doxas 2002; Barker and Garvin-Doxas 2004; Margolis 2008; Margolis and Fisher 2003). Social psychology research argues that women are not drawn to CSE because they do not fit the stereotypical norm of a male computer scientist (Cheryan et al. 2009). “‘There is a really strong image of what a computer scientist is – male, skinny, no social life, eats junk food, plays video games and likes science fiction,’ says Sapna Cheryan, social psychology professor at the University of Washington” (Cain-Miller 2010, 2). Others note that underrepresented groups in STEM tend to be viewed as likable or competent but not both (Barnett and Rivers 2004). Choosing whether to be liked or to be respected can stress underrepresented group members and cause them to question their belonging in dominant institutions (Eckes 2002). Just the fact of being a solo underrepresented group member in a white, male-dominated organization can create feelings of isolation that play a role in underrepresented group members’ attrition from STEM disciplines (Greenwald and Banaji 1995; Nora and Cabrera 1996; Pewewardy and Frey 2002; Potter and Rosser 1992; Roos and Reskin 1984; Rosser 1998; Rosser 1995).

The stress of struggling to belong, in addition to lack of collegiality, discriminatory practices, less money, slower promotions, and lower tenure rates, begins to explain the barriers to women's advancement in academic STEM fields (Valian 1999, 220). Dissatisfaction with working conditions significantly influences women faculty's decisions to leave their institution (COSEPUP 2007). For example, female engineers make only 83 cents for every male colleague's dollar (Frehill 2005). Mothers are paid \$11,000 less than non-mothers in the STEM workforce and male parents are seen as most qualified leaders, the most worthy of high salary, and much more competent than other groups (Frehill 2005). Women of color in STEM graduate programs found dominant group members' prejudice, microaggressions, and everyday racial slights, which reveal in and reinforce white male superiority in technical matters, far more challenging than structural barriers (Ong et al. 2011).

These daily discriminations help explain why underrepresented group members with comparable training drop out of STEM fields at greater rates than majority engineers (Seymour and Hewitt 1994; Bystydzienski and Bird 2006). Attrition has a ripple effect, with consequences for the next generation of scholars. For example, a dearth of female faculty members adversely affects female students' persistence as they have fewer role models to inspire and guide them (Eppes et al. 2010; Price 2010; Carrel et al. 2009; Blickenstaff 2005). The alarmingly high rates of attrition among women in STEM fields when compared to their male colleagues may indicate women's protest against the constraints of their subordinated positions within scientific institutions. Diversity in STEM research helps to illuminate possible pathways of persistence and areas in male-dominated STEM institutions that can be improved with the hopes of retaining women in

these fields. I argue this is not enough. We must develop pathways of resistance, where the people who produce CSE technology are not just free of harassment and discrimination but also free to trouble the institutions they work for, to agitate not just for reform of exclusionary practices but for a transformation in how technology is produced, toward what ends, and for whose benefit. As I discuss below, building pathways of persistence are efforts to make room at the table of CSE production for members of underrepresented groups, rather than efforts toward a broader goal of inclusion, which means that all have a voice at the table and that one is heard, respected, and supported when introducing difficult conversations about the social dimensions of STEM production, e.g., racism, sexism, homophobia, and classism.

Unexamined Bias

Pathways of persistence are not to be dismissed; they can help make important inroads for underrepresented groups in STEM. An excellent example of this is the scholarship on unconscious bias or implicit bias, which has received much attention both in academia and the US media. Bias is a form of stereotyping that is often unintentional and automatic and often contradictory to our conscious beliefs (COSEPUP 2006). Research demonstrates that threatening environments fostered through bias turn underrepresented groups away from majority domains (Chowdhury, Hoo and Pasik-Duncan 2007; Valian 1998; Brown 2003; Adams et al. 2006; Cohen and Swim 1995), a critical reason why diversity eludes many STEM disciplines (Malcom 1999; Trower and Chaitt 2002; Ginorio 1995; Beverly 2007). These biases dictate that people from dominant groups, and white males in particular, inhibit the success of female scientists and deny scientific communities the talents and perspectives of diverse members. Bias

can be perpetuated by highly educated, self-professed egalitarians in the course of making objective decisions. It is not always overt. It is coded in subtle ways to reproduce predictable patterns of structural inequality that privilege dominant groups (Moody 2004). Though we like to think that faculty members are objective and able to impartially evaluate others' abilities and potential, it is important we acknowledge this is a myth. Bias often comes into play in evaluation settings and leads to erroneous conclusions that women scientists and engineers are less competent than their male peers and less deserving of success, recognition, and accolades.

For example, in a groundbreaking study recently published in the *Proceedings of the National Academy of Sciences* (PNAS), Corrine Moss-Racusin and her colleagues (2012) found that both female and male science faculty members harbor bias against female students. The faculty participants were given application materials from an undergraduate student applying for a lab manager position. All received the same exact materials, except that half the participants believed they were reviewing a male applicant's materials and the other half believed they were reviewing a female applicant's materials. Faculty participants rated the female applicant significantly lower than the male applicant in terms of competence, hireability, salary offers, and willingness to mentor.

These findings augment previous research by Rhea Steinpreis and her colleagues (1999), in which male and female faculty members evaluated a curriculum vitae that was randomly assigned a male or a female name. Both male and female evaluators rated the male applicant higher in research, teaching, and service experience and were more likely to hire the male than the female applicant. These two empirical studies confirm what I

heard over and over from participants in my anthropological research on women in high-tech communities: women have to be twice as good as men to be considered half as competent. While Steinpreis and her colleagues show that bias plays a role in the faculty hiring process, Moss-Racusin and her colleagues demonstrate that bias affects women in STEM in the training phase of their careers, a critical junction that serves as a launching pad for further opportunities.

These studies offer indisputable evidence that males pursuing STEM careers benefit from a presumed competence that gives them unearned advantages in the world of STEM production. The fact that both female and male scientists perpetuate gender discrimination adversely impacting female scientists' career trajectories helps explain why diversity eludes many STEM disciplines in academia. This widespread discrimination also explains why female students switch out of STEM majors at much higher rates than their male peers (Seymour and Hewitt 1997) and more women than men with STEM degrees choose to invest their talents in other professions (Valian 1999).

UNPACKING CULTURE IN STEM

Many decry the snail's pace of progress made in integrating STEM fields as a whole and especially in the leadership phase of these fields (Ong 2005; Valian 1999). In the 1970s and 1980s, feminist practitioners in STEM fields began to agitate, organize, and speak out against the constraints of their subordinate status in their workplaces and disciplinary communities. They relied on their dissonant experiences to inform their critical analyses of behaviors and social relations that privileged men and denigrated women's capacities and accomplishments (Wylie 2012). These activists named the cultures that perpetuated systematic gender inequalities "the chilly climate" (Sandler and

Hall 1986). In defining the chilly climate, activists cited bias but also gender and sexual harassment and other forms of male hostility toward women (Sandler and Hall 1986). In the decades since feminists approached women's underrepresentation from an explicitly activist stance, the cultures in STEM disciplines continue to be cited as a significant factor responsible for the persistent lack of diversity in STEM, but yet these cultures remain inadequately defined and understood. In academic literature and programmatic interventions, bias is an oft-cited factor in ending gender segregation in STEM, but it has eclipsed other critical factors: hostility and gender and sexual harassment. While unconscious bias is extremely important to understand and interrupt, we cannot lose sight of male violence against women in STEM workforce. "Correcting biases drew attention to deeper, more pervasive problems" (Wylie 2012, 54). My research is a corrective to this dearth of academic literature decrying hostile STEM environments and the institutions that tolerate and encourage inequitable labor relations. Quantitative studies, like those undertaken by Steinpreis, Moss-Racusin, and their colleagues, are critical to demonstrating the need for cultural change, but sociocultural anthropology offers optimal approaches for enacting strategic interventions for social change. Also, revitalizing the explicitly feminist standpoint that characterized the Chilly Climate activists' initial protest against male privilege and violence in STEM fields is sorely needed to make visible the range of violence that makes the dominant group's rule possible.

Feminism and Cultural Change

Plaut (2010) explains why a sociocultural orientation is needed to augment social psychological research on discrimination:

A sociocultural analysis involves paying attention to historically rooted cultural and structural contours of human behavior and psychological tendencies...examining cultural ideas and beliefs prevalent in people's social worlds.

(Plaut 2010, 82).

My dissertation is a sociocultural analysis of values, norms, and epistemologies of CSE, in which I define *culture* as “*the collective behavior patterns, communication styles, language, beliefs, concepts, values, institutions, standards, symbols, and other factors unique to a community that are socially transmitted to individuals and to which individuals are expected to conform*” (SGISA 2003). Culture serves as a mechanism that manufactures social values and reproduces systems of power favoring the dominant class (Smith 2005; Bourdieu 1991). The study of culture from this orientation seeks to question implicit assumptions and behavioral norms that are adopted as group values in order to interpret the meaning of these values and their role in shaping social priorities and practices (Madison 2005). Science is a culture, one forged by “hundreds of years of active shunning of women” and to change it to include and welcome women of all ethnicities will require “deep structural changes in the culture, methods and content of science” (Schiebinger 1999, 11).

I am concerned that diversity in STEM researchers are too careful not to trouble the institutions they intend to transform. For example, the political nature of underrepresentation in STEM is rarely emphasized. Instead, calls for change are usually framed as beneficial to corporate “innovation” (read: profit) or America's Got Scientific Talent labor pool (Beede 2011; Hill et al. 2010). While some scholarship includes a call for justice in institutional transformation (Ong et al. 2011; Baillie et al. 2012), feminism

is conspicuously absent from diversity in STEM research. Schiebinger (2008) argues that feminist epistemologies and interventions have been mainstreamed into STEM and its frameworks, methods, and theories without credit.

Dr. Nancy Hopkins, a biology professor at the Massachusetts Institute of Technology (MIT), is an example of a social change agent who *does* credit feminism for activism in STEM fields. In an article titled “*The Reluctant Feminist*” (Zemike 2001), Hopkins describes her transformation from a “gender agnostic” – a woman in male-dominated fields who denies gender is at play in their work places – to a feminist leader challenging discrimination in some of the US’s most prestigious institutions of higher learning. Hopkins and her female colleagues gathered proof of a systematic reproduction of unequal distribution of labor roles and resources between female and male MIT faculty and garnered support to rectify this discrimination and achieve parity. In the course of this activism, she saw the value of organizing as women for women. Soon after Hopkins published her report, MIT made a public, long-term commitment to analyzing resource and salary disparities and rectifying institutional and interpersonal gender inequalities at the faculty level (Rosser 2006). Perhaps inspired by this prestigious institution acknowledging and attempting to rectify institutional barriers against women in STEM, the National Science Foundation (NSF) initiated a new awards program called ADVANCE, with \$17 million in funding to create institutional, rather than individual, solutions to the problems of white male overrepresentation in STEM (Rosser 2006). In its call for proposals, NSF encouraged this institutional transformation approach because women’s underrepresentation in STEM is often a “systematic consequence of academic culture” (Rosser 2006, 70).

I have found very few NSF ADVANCE grants that aim to investigate the systematic reproduction of male-dominated culture using explicitly feminist orientations. Why not? The movement to end sex discrimination in the US is a feminist activist legacy (hooks 2000). The Chilly Climate activists of the 1970s and 1980s were explicitly feminists. The movement to end sex discrimination in STEM is an extension of women organizing to contest a subordinated position in our society. Now, however, feminism a dirty word, even among those who support advancing women in STEM careers (Schiebinger 1999). Why is there such reluctance to identify with feminist scholarship and politics? Furthermore, what are the consequences for failing to embrace the social movement that made it possible for women to make gains in STEM? Perhaps change agents in STEM temper their politics because the funding sources for gender equity programs are fairly conservative. Or perhaps if interventions to recruit, retain, and advance women in STEM are perceived as overtly feminist interventions, they may very well be scorned or ignored by male faculty members (Frehill 2007). The framing of corrective interventions needs further consideration. Diversity in STEM scholars and activists must ask how much programmatic planning is constrained by funding institutions' and peers' resistance and what they would do instead if they were not afraid (Sanberg 2013). I argue that risk aversion is part of why feminism is not embraced by diversity in STEM researchers and the reason why a great deal of emphasis is placed on unexamined bias to the neglect of gender and sexual harassment. Plaut (2010) makes a similar point when arguing that social psychology places too much emphasis on "the individual processes of stereotyping and prejudice, which are less successful in changing

these habits than lessons that highlight the systematic nature” of cultural oppressions (Plaut 2010, 83).

Keeping feminism on the sidelines in diversity in STEM scholarship and intervention strategies is akin to respecting the decision of Lesbian, Gay, Bisexual, and Transgender (LGBT) people to remain in the closet. It minimizes the risk of exclusion and other forms of violence to marginalized community members who are already vulnerable. However, the most promising efforts and ideas for diversifying the STEM workforce come from explicitly feminist centers like the Research Institute for Feminist Engineering at Purdue University and the Michelle R. Clayman Institute for Gender Research at Stanford University (Pawley 2011; Schiebinger 2008). Research on culture in engineering fields has grown out of feminist analyses of engineering education (Godfrey and Parker 2010; Burack and Franks 2004; Pawley 2011). This scholarship has been some of the first explicitly feminist literature in diversity of STEM literature and it is no coincidence that this is the first STEM literature to qualitatively investigate culture.

The Cultural Identity of Engineers

I argue that that feminist cultural studies of science – an orientation that hails from a range of disciplines including cultural anthropology, literary studies of science, and studies of visual cultures (McNeil 2007) – needs to be in collaboration and conversation with diversity in STEM science. In order to locate my own research in these discourses, allow me to discuss an issue that will bear on my project as a whole: the cultural identity of engineers. This theme will also allow me to elucidate a methodological divide that must be acknowledged and debated if diversity in STEM scientists and cultural feminists can work together effectively. Efforts to sunder

masculinity from the engineering identity must consider how the two were fused in the first place and the legacies we have inherited in the current socioeconomic moment in which engineers labor today.

Burack and Frank's (2004) study discovered dominant group members in engineering feel threatened by diversity efforts and defend their group identity in gendered interactions and discourses. To demonstrate a range of skills in a discipline that is not well understood by the general public, engineers point out that they "use two quite different kinds of skills: 'hard' and 'soft.'" Hard skills are "technical, mathematical and scientific; soft skills are interpersonal and communicative their meanings are understood and shared, though left unspoken, by the community" (Burack and Franks 2004, 84). "Hard" also refers to "difficult," with the implicit assumption embedded in this linguistic framing that "soft" skills are really "easy" (Burack and Franks 2004). This reflects a sense of superiority among engineers, who believe they are smarter than their non-STEM peers (Burack and Franks 2004). "These terms work to inflect skills language with gendered meaning" and differentia[te] value associations between communication skills and technical skills" (Burack and Franks 2004, 86).

These common forms of language used by engineers to tell stories of the profession disadvantage underrepresented groups along vectors of gender. Women of color are perceived as less competent than their white male peers and lack mentorship and encouragement (Ong et al. 2011; Espinoza 2011) and the technical/social divide that privileges technical skills and codifies them as masculine poses social challenges for LGBT students in STEM (Cech and Waidzunas 2011).

Having worked with engineers closely for over six years, I can attest that members of this community generally agree that they have particular characteristics that define them as a group. Jorgenson (2002) refers to this phenomenon as “engineering identity” and Cech (2005) refers to it as “engineering schemas.” Broadly speaking, the engineering identity can be characterized as someone who enjoys and excels at problem solving and getting one right answer (Chachra 2012). In a facilitated workshop, my colleague at the UW ADVANCE Center for Institutional Change (UW ADVANCE) asked a large group of tenured engineering faculty members to name five characteristics of an engineer. Their answers included (in order of frequency): Analytical; Problem Solver; Smart; Designer/Developer/Builder; Creative; Logical; and Vision/Innovation.

These characteristics may be idealistic or realistic and most likely are a combination of both. Regardless, they shape the evaluation criteria and culture of engineering fields and this affects women engineers differently than their male colleagues. Jorgeson (2002) argues an important point, that STEM fields are different from other male-dominated fields because women not only have to navigate male bonding rituals but also are required to demonstrate an intense passion to talk mechanics and gear, and to tinker as a way of life, as an identity. She argues this is exclusionary. The long hours and laser focus of STEM fields operate to fit white male lives within the capitalist organization of labor, one in which bourgeois white men display their dominant position not only with unequal access to lucrative “hard skills” jobs but with stay-at-home wives and children. Within the context of capitalist patriarchy, men’s careers will fare better than their female peers who do not have the same access to free labor in their homes. The architecture of these modern patterns of labor segregation can be traced back

to the Victorian era where, in white, middle class English society, domestic work became a sign of drudgery incompatible with class-climbing aspirations (McClintock in Lewis 2003). A white middle class woman's vocation was not knowledge production but to make invisible domestic labor, the work of cleaning, cooking, and tending a home. Her labor promoted the prestige of the male buying power without sullyng it with evidence of female labor, and in the process, mystified women's labor value and transformed wives' labor power into their husband's political power (McClintock in Lewis 2003).

The historical dimensions of the cultural identity of engineers helps explain how everyday practices of exclusion are deeply woven into not only the group identity of individual members, but also the class status of the field as a whole. A man's prowess with a machine is a source of pride and tinkering a form of male middle class bonding in the US (Oldenziel 1999). The relation between masculinity and machinery in the 19th and 20th century US is a symptom of a long-term cultural alliance between science and mechanistic paradigm. I expand on this concept in Chapter 3, which refers to the core values of the western world – a systematic objectification and mechanization of the human body and domination over nature (Merchant 1980). At the turn of the 20th century, both elite and shop floor engineers conspired to keep women out of the profession to “keep alive the promise, often unfulfilled, that upward mobility was still a viable option for middle-class men” (Oldenziel 1999, 43). The precarious position engineers hold within the hierarchy of political economic organization, in a space between capital and labor, has shaped the collective identity of engineers and how competency in this arena is defined. In the professional culture of engineering, stereotypes about the social identity of group members are co-constructed with qualities and characteristics of competence (Cech

and Waidzunas 2011). The confident, even peremptory, white male is the typical icon of scientific and technical competence (Ong 2005). Ideologically, technology is canonized as the savior of the masses and upper middle class white men have the privilege of interpreting and integrating this transformative force into society. These dominant group members go further to assert that their expert knowledge can be applied universally (Harding 2004). This posturing is what Lugones (1989) calls “arrogant perception,” being at ease in the world without challenging oneself or one’s social position. Only dominant group members would assume that their knowledge claims should be applicable to all (Harding 2004). The role of hero that the engineer plays in our culture has not changed, but the identity of this hero has shifted from one who conquers the wild west frontier with dams, mechanical engines, mass agriculture, and (sub)urban planning to the stereotypical nerd, a post-industrial hero storming the virtual frontier of cyberspace. I will discuss this archetype in Chapter 5 as a function of class-based ideologies and the reproduction of masculine white supremacy in advanced capitalism.

Women who do enter these domains are often coerced to perform the masculine ideals of engineering in order to be accepted as “one of the guys” (Hacker 1990; Faulkner 2000). My research supports earlier studies demonstrating that some women navigate this pressure by denying any gender differences in both the scholarship and cultures of their fields. However, we must be careful not to reify and reproduce social identities or schemas that make women choose between a gender identity and an engineering identity (Jorgenson 2002). Faulkner (2000) recommends “pluralism” of style and identities, opening our minds beyond two popular themes – that women must act like men to succeed or that women are different from men and this is a fixed identity difference

(Faulkner 2000). The fact is though that when engineers hold high status in an organization, they dominate norms and exercise power that reaffirms a particular kind of masculinity, one that also reinforces class inequalities by affirming technical prowess and denigrating other kinds of work (Faulkner 2000). Pluralism is an excellent orientation with which to frame ethnographic methodologies when studying cultures of STEM, one that gives participants the opportunity to possess and perform multiple identities. For example, being perceived as a woman, an underrepresented minority, and a scientist is a complex and daunting negotiation of performance, social identity, and professional role confidence and female scientists of color operationalize multiple identities as a strategy of persistence (Ong 2005). To suss out the factors related to women's low participation in STEM fields, however, it is important to discuss dimensions of race, gender, and class identities within the context of a dominant engineering identity, cultivated and enacted to affirm a homosocial community of powerful professionals.

FEMINIST SCIENCE AND TECHNOLOGY STUDIES

Diversity in STEM scientists define and measure the influences contributing to the underrepresentation of women and minorities in STEM. Feminist scholars of science and technology are uncovering historical and cultural foundations to explore why and how modern technology is coded as the domain of white males (Wyer 2009; McNeil 2007; Oldenziel 1999; Forsythe 2001; Harding 1991; Lerman et al. 2003; Lohan 2000; Wacjman 1991; Lie 1997; Lie 1995; Frehill 2009; Faulkner 2001; Margolis and Fischer 2002; Margolis 2008; Rosser 2004; Henwood 1996; Mayberry 1998; Kelly 1985). Feminist anthropologists have been prominent in this field of study, extending kinship studies to critique the cultural impact of new reproductive technologies and ways in

which women and our bodies are objectified and controlled (Rapp 1979; Davis Floyd 1992; Martin 1994; Ginsburg 1999).

The main vein of difference in FSTS literature, as compared to diversity in STEM literature, is an explicitly feminist stance, which reflects in different methodologies and arguments for problems and solutions. FSTS research expands the conversation beyond numbers, a very important element, but one that needs to be placed in cultural contexts and historical legacies of systematic injustices. Dr. Shirley Malcom (2011), Head of Education and Human Resources at the American Association for the Advancement of Science, insists that inequality and injustice are the root causes of lack of diversity in STEM. Framing the low numbers of historically underrepresented groups members in STEM as inequality and injustice is a political stance, one that allows for an intersectional critique of culture in STEM and the possibility of enacting transformational change in the halls of technical knowledge and power.

At the 2005 Conference on Diversifying the Science and Engineering Workforce, Larry Summers, the former president of Harvard University, stated that women's underrepresentation in STEM is due to differential aptitude (Summers 2005). Summers' gaffe was a galvanizing moment for women in STEM fields because it made visible what Bourdieu (1991) calls "symbolic violence," a means by which those in power justify their dominance and reproduce existing structures of inequality. Summers is just one in a long line of scholars who invoke biological reasons to explain women's exclusion from sites of STEM production, thereby naturalizing patterns of labor segregation and reserving occupations that bequeath healthy returns of cultural capital for members of dominant classes (Fine 2010).

Through such strategies, gender ideologies appear immutable and the reproduction of social disparities inevitable (Vespa 2009). These ideologies undergird cultural values governing gender in the home and in the workforce, thereby co-constituting and reproducing historical patterns of labor segregation. However, arguing that science is culturally contextualized and both organizationally and epistemologically formed by unjust social norms strikes at the heart of the popular belief that scientific endeavor is separate from society (Nader 1996). FSTS destabilizes normative understandings of what constitutes the practices, inquiries, cultural meanings, and applications of technology.

Due to their interdisciplinary and critical approaches, scholars in FSTS articulate an alternative yet comprehensive understanding of the cultural production of technology (Reid and Traweek 2000). Many FSTS scholars interrogate the production, distribution, and consumption of techno-scientific knowledge as political processes (Sismondo 2010). They note that although technology is a political activity in which women and men of all ethnicities engage (for example, by using cell phones), a small minority of the population decides what gets made and toward what end. The study of culture in STEM fields (using the term “culture” as operationalized by STEM practitioners themselves) can be considered problematic given that scientific inquiry is often assumed to occur in a cultural vacuum, a “culture of no culture” (Traweek 1988, 162). FSTS scholars in particular argue otherwise, noting that objectivity is a cultural value in STEM and one that evolved out of scientific practices practiced almost exclusively by white males (Franklin 1995; Campbell 2009). Schiebinger (2008) argues further that many cultural practices in the sciences developed in opposition to women’s participation. Therefore,

naturalizing the epistemic knowledge of some and discrediting others' for the purpose of reproducing institutional inequalities must be rigorously scrutinized and combated (Reid and Trawick 2000; Hess 2007).

Anthropologists from both feminist and STS orientations agree that the discipline's long history of documenting cultural diversity is useful in debunking implicit ideologies in western societies (Brodkin Sacks 1979; Hess 2007; Martin 2000; Goodman 2003). However, the question of social reproduction and its influence on knowledge production is too often ignored in STS (Campbell 2009). Therefore, FSTS provides analyses missing from STS, anthropology, and diversity in STEM literature. In the following chapter I elucidate the Marxist and critical race feminist contributions to the social study of STEM to offer a new direction for the study of segregation in STEM.

Conclusion: Transforming Gendered Institutions

Too often diversity in STEM scientists, in their efforts to convince the public as to the importance of diversifying STEM fields, argue that STEM fields are "critical to the national economy and America's global competitiveness" yet leave these institutions unexamined (Hill et al. 2010, 1). Is it critical to sustain a labor pool for a national economy marked by gross and growing income inequality in a country that is a "competitor" to and not a neighbor of other countries? In this dissertation project I destabilize commonly held reasons for diversity interventions in STEM to reframe the exclusion of women and people of color from laboratories, faculty clubs, and boardrooms as a broader historical project of dispossession, the solutions to which require more than an "add and stir" approach to combating underrepresentation.

I have emphasized the feminist roots of the campaign to transform STEM fields because I hope all diversity in STEM practitioners will consider informing their activities and scholarship with an explicitly political stance against the reproduction of patriarchal norms in these fields. Is it enough to merely open the doors to the clubhouses of white male-dominated institutions rife with elitist attitudes mystifying inequalities? Are broad aggregates really an appropriate measurement of equality? Is equity a better goal in higher education and what does this mean? What transformations are needed to remove masculinity as the main cultural signifier of STEM production and innovation? In this research, I aim to answer these questions by probing ideological, material, and cultural practices of CSE laborers, synthesizing diversity in STEM science and FSTS, and paying close attention to how women and their allies within STEM fields can collaborate to enact institutional transformation.

What I find so exciting about participating in UW ADVANCE is that knowledge of structural, departmental, and interpersonal barriers to women's success and advancement in STEM fields is generated by female STEM practitioners (Bystydzienski and Byrd 2006). An on-the-ground emic perspective is important because it privileges the vantage point of the person actually participating in the epistemic and cultural practices of STEM fields.

However, if institutional transformation is the end goal, then incorporating outsiders' perspectives on the cultures of STEM (for example, those of social science researchers) will be helpful to attend to silences, misinterpretations, and lacunas of knowledge that have yet to be uncovered. For example, my feminist analysis of cultural norms in CSE reveals that the white male standpoint in STEM fields is so deeply

embedded, not only in norms and workplace culture, but also in the positivist tradition of western science, that performances of masculinity are taken for granted. Women CSE professionals must navigate these unspoken norms. As I report in Chapter 6, they find this navigation to be an exhausting exercise of filtering out their lived experiences so as not to disrupt how the dominant class defines the social identity behaviors of engineers, the problems worth solving, and the methods that have validity. Diversity in STEM scientists and FSTS scholars are engaged in the struggle to establish the need to transform exclusion in STEM as a political need and to define the resources, conditions, and ideological shifts that will be required to satisfy this need (Moore 1994). This requires both political engagement, like Hopkin's efforts at institutional transformation, and ideological work, like Faulkner's call for pluralism in the cultural identity of engineers to break the ideological bind between engineering identity and gender identity. Together, feminism and the lived experiences of pioneering women in STEM can disrupt the "arrogant perception" (Lugones 1989) that universalizes a singular identity of an engineer and a singular definition of competency to reproduces dominant class rule in STEM.

Chapter Three: Reproducing the *Body Politic* in an Era of Computing Commodity Fetishism

INTRODUCTION: THE POLITICAL ECONOMICS OF CSE TECHNOLOGY

In 1984, Apple debuted an advertisement for the Macintosh personal computer during the Superbowl. The scene opens inside a dystopian-looking industrial site with people in matching grey rags marching single-file through a tunnel lined with television screens. Their heads are shaved, their faces expressionless; some are wearing oxygen masks. A voice booms through the complex, pronouncing it is “the anniversary of the glorification and purification of the information era.” Interspersed with the dour march are images of a tan, muscular blonde woman running through open doors carrying a sledgehammer, pursued by troops in riot gear carrying weapons. We come to see that she is running down the aisle of a theatre. On the screen, a white male talking head in close-up heralds the advent of “the garden of pure ideology where each worker will bloom.” The marchers shuffle to their seats. The camera pans their glum mugs, row by row, as they listen passively and slack-jawed to the talking head. The woman runs down the aisle of the cavernous industrial theatre, her shorts the only color in the scene. She is the only woman in the crowd. The white male’s face fills the screen as he pronounces: “We are one people, one whim, one resolve, one cause. Our enemies will talk themselves to death and we will bury them in their own confusion.” The woman begins spinning, gaining momentum with her hammer as the paramilitary troops gain on her. She releases the hammer with a guttural cry as the talking head declares: “We shall prevail!” The hammer connects with the screen causing it to explode. The camera again pans the male audience, now covered in dust from the explosion, their mouths agape with surprise. A

new, unseen narrator announces: “On January 24th, Apple computer will introduce the Macintosh. You’ll see why 1984 won’t be like 1984.””

It has been almost thirty years since the personal computer was released as a commodity for mass consumption. I begin this chapter with this Apple sales pitch to demonstrate how CSE technology is popularized as a revolutionary social force. In many ways, however, and particularly in its production and application, CSE technology maintains and reproduces increasingly unequal relations of power (Hakken 2003). In Chapter 4, I place the social relations of reproduction at the center of my investigation of the broader cultural domains in which CSE knowledge is produced and analyze their effects on *individual bodies/selves* as well as the *social body*. In this chapter I focus on the social relations of production and analyze power by reviewing the social practices of CSE technology and their effects on the *body politic*. I borrow the term from Scheper-Hughes and Lock (1987), who define it as “an artifact of social and political control” (p. 1). I am troubled by the social myth promoted by Apple in 1984 – the notion that the personal computer will somehow allow the *body politic* to throw off the chains of totalitarian oppression and emerge from the dark-cave ignorance of our pre-technocratic era. Nearly thirty years after Apple’s commercial prophesized that computers were going to transform social inequalities and undo oppression, it appears that the opposite scenario is, in fact, unfolding. I support this claim in the following sections, first by locating my argument in the historical context of capitalism as it has shifted from a mechanistic worldview to a virtual one. I argue that the virtual nature of capital, enabled by CSE technology, is the hallmark of neoliberalism. After defining this advanced stage of capitalism, I examine the contradictions it poses for high-tech corporations, which must

earn stock investors' confidence through proscribed measures of "austerity" while also employing highly specialized, and therefore highly paid, workers. More than customers, more than the employee satisfaction, and more than environmental or community stewardship, stockholder interests are paramount to high-tech corporate survival. This is an excellent example of the contradiction inherent in the capitalist system: to survive it must reduce labor expenditures while at the same time relying on labor value as the sole measure of wealth (Marx 1973; Negri 1991).

The working class struggle over productivity and the value of labor-power has put capitalism on the defensive, struggling to come up with strategies to maximize surplus labor value (Negri 1991). Part of these strategies includes using CSE technology both in the workplace and in the intimate spaces of people's everyday lives to maximize surplus labor, extending the violent and invasive historical frameworks of capitalism to emerge in new, flexible ways of commodification and alienation. The flexible worker subject is molded from ideological materials fashioned during the eras of the western European enclosures, the transatlantic slave trade, colonization, the Burning Times, and the Protestant Reformation. They are individualistic with a tireless work ethic and, perhaps most importantly, are trained through violence into "disciplining themselves" (Ferguson 2002, 989; Federici 2004; Ngai 2005; Weber 1930). The ubiquity of automated machines in our society means that humans must discipline themselves to adapt to social environments mediated by machines. In order to discover the effects of computers on modern social subjectivity, we must ask: How does CSE technology contribute to US political economy, how does our economic system shape our relationship to CSE technology, our communities, and ourselves, and how do these forces co-construct

gender, race, and class in our culture? What are the substance, measure, and form of labor value in an era of technological fetishism?

I chose to study the CSE labor force not only for its stark gender and race imbalances but also because technologists, who hold middle class to upper middle class positions in a global industry, are critical to maintaining the power structures of our political economy. In this chapter, I use the term power to refer to how the dominant class in CSE reproduces its ruling position through epistemic, physical, ideological, and symbolic violence. Analyzing CSE workers' labor and the social uses of the commodities they produce can help demystify surplus labor value and the cultural processes by which technological machinery came to rule over the living in the labor process, reifying all workers and making us cogs in the virtual circulation of capital (Marx 1976/1990). By including CSE workers in an analysis of labor segregation in the US, I aim to add the perspective of those workers who have knowledge of the cognitive techno-scientific system that structures current society. I believe these workers' uniquely informed perspectives can help subvert the reproduction of longstanding labor inequities.

FROM MECHANIZATION TO VIRTUALIZATION: REIFYING THE *BODY POLITIC*

For my dissertation project, it is critical to make connections between the history of global capitalism and its present form, neoliberalism, in order to first understand how power operates in the political economy, how inequality is mystified by the commodity form, and what critical differences mark the historical emergence of this economy from today. I use the term "mystify" in this dissertation in the Marxist sense, to connote the concealment of injustices and efforts to deceive the majority of the true nature of labor value. The role of the commodity in capitalist societies is important in understanding the

social construction of gender, race, and CSE technology as they co-constitute norms governing labor value in the US. To begin, I explain the centrality of commodity fetishism to Marx's analysis of capital to make the case that this concept is useful in examining the function of CSE technology in the present economic moment.

The Commodity-Form and Fetishism

Wealth in capitalism is an "immense accumulation of commodities" (Marx 1976/1990, 125). Marx described the essential characteristic of the commodity as mystical (Marx 1976/1990). The function of the capitalist system is to universalize the values of these heterogeneous things in order that they may be exchanged as equivalents. A commodity is different from the commodity-form: the former has physical form and the latter "has absolutely no connection with the physical nature of the commodity ... it is nothing but the definite social relations between men [and women]" (Marx 1976/1990, 165). In other words, the value of a commodity lies not in its material dimensions but rather in its virtual, man-made value. It is supra-sensual, as Jesus describes heaven to his apostles, beyond the messiness and chaos of this non-rational, material world. To understand the true nature of the commodity-form is to know the secrets of capitalism itself: the fetishism of commodities is magic, a "great metaphysical idea" (Waring 1988, 23).

The use of the word *fetish* is deliberately non-rational or de-rationalizing. It is ironic that one of the centerpieces of Marx's theory in *Capital* requires "taking flight into the misty realm of religion" (Marx 1976/1990, 165), given Marx's disdain for religion and the philosophic theologians of abstraction like Hegel. I would argue that Marx categorizes the commodity as mystical because it operates like many monotheistic faiths, demonizing the material and sensual and worshipping the "supra-sensual" qualities of

things. Following Marx's dialectical methodology, we can better understand how these networks facilitate capitalism's rapacious appetite for conquest and consumption as well as its widespread devastation to people's bodies and the environment. By using the term "fetishism," Marx helps us to see beyond the facade of cool rationality with which the market supposedly operates.

The Mechanization of the Body

In 16th and 17th century Europe, the state divorced agrarian women and men from the land and science severed spirit from matter. Silvia Federici (2004) argues that philosophers like Descartes canonized an ontological divide between the physical and the intellect, a legacy inherited by scientific institutions producing knowledge today. Throughout the *Treatise on Man* (1664), Descartes call the body "the machine." The title of the anatomist Andreas Vesalius' 1543 text on surgery translates as the *Body Factory* (Federici 2004). In order to reify labor as exchange value, science reified the body, reducing it to a tool to be manipulated and controlled. Capitalist formations require that matter be divorced from spirit just as the worker must be separated from the means of production and the products of her labor. The mechanization of the body and "the domination and mastery of nature, became core concepts of the modern world" (Merchant 1980, 2). Under these conditions, feudal social formations began their epochal transition into capitalism.

The term "transition" is too neutral a word to describe the enclosure of common lands, or as Marx refers to it, "the bloody appropriation of the peasantry" (Marx 1976/1990, 896). Federici, paraphrasing Marx, claims that the historical conjuncture of primitive accumulation, colonialism, and the world-wide torture and murder of wise women is "among the bloodiest and most discontinuous in world history" (Federici 2004,

62). Maria Mies (1986) notes that the wealth needed to ignite and fuel the capitalist mode of production was plundered from the colonies by means of slavery, robbery, and torture. Capitalist wealth accumulated by imperial nations was made possible only by labor performed under both direct and indirect force (slavery and wage-labor, respectively). In the “Age of Reason,” a historical moment which facilitated the rise of a dominant social formation that still exists today, science and philosophy colluded with the christian church and bureaucratic state power to consolidate their ruling apparatuses. By means of state violence and scientific rationalism, both individual bodies and collective social bodies were transformed into tools for economic development, molded like machines into “a set of predictable and controlled mechanisms” (Federici 2004, 144-5). Thus nature, women, and people in the colonies were enslaved in the service of surplus value production. Under this system, a worker must satisfy the subsistence needs to support the capitalist first and then, in the remaining hours of labor, care for herself (Marx 1976/1990, 402).

The production of commodities required a vast amount of forced and cheap labor, a new ontology regarding the knowledge of what it means to be human as well as new epistemologies that provided laborers with the skills necessary to perform and reproduce labor power for capital. When Federici argues that “the body had to die so that labor-power could live” (p. 141), she means that the substance of our being was transformed into dead, inert matter and mined in the production of exchange-value. Primitive accumulation created the first commodity, labor power, by eliminating options of survival other than selling one’s body. Wage laborers made an uneven exchange with

capital while women and colonized people in bondage were forced to make entirely non-reciprocated contributions to capital's accumulation of wealth.

Baconian philosophy and state-sanctioned violence justified by christian¹ ideology separated workers from their bodies and money, and, Marx says, is “a highly energetic solvent” separating workers from the soil (Marx 1976/1990, 506). It allowed the material conditions of production and raw materials to be appropriated by the capitalist and gave the property-less worker no other choice but to labor longer than is needed to subsist. This historical process put capital in motion. The wage is the value of the necessary labor and surplus labor produces profit (Marx 1976/1990). The laborer “does not sell as commodity the use made of him [or her], he sells himself [or herself] not as cause but as effect” (Marx 1976/1990, 571). Living labor as a use value is the basis for capitalism. The more the capitalist can minimize necessary labor time, the more labor is available to create profit. This design however, makes “capital itself is a moving contradiction, in that it presses to reduce labor time to a minimum while it posits labor time, on the other side as the sole measure and source of wealth” (Negri 2009, 91). This contradiction is a factor to keep in mind when assessing the impact of CSE technology on society; we must understand that the ruling class seeks to ever more efficiently integrate human skills and intellect into machines that in turn, define our activities in both our wage-earning time as well as our personal activities.

Virtualization

Virtualization is an upgraded, more advanced version of the mechanization of the body, where instead of separating workers from the soil, the owners of the means of

¹ Following Mary Daly's example, “I have no need to capitalize christianity [or its sects.] This is obviously a matter not only of taste but of evaluation” (Daly 1984, 26).

production separate workers from organized social relations. Much like how euphemized violence operates in the sphere of reproduction to erase the voices, lives, and labors of women and people of color from history, theory, and public discourses, virtualization is the means by which high-tech multinational corporations like Disney Inc., Apple, Microsoft, and Amazon.com erase from dominant discourse workers in the South, exploiting their labor as profit (Hartsock 2009). Additionally, the invisibility of this work keeps workers from organizing (Ehrenreich and Hoschchild 2004). Virtualization is not only a process of objectification but the dehumanization of women; it is the process of erasing third world women's labor from public consciousness and discourses (Hartsock 2009). Similarly, Angela Davis (in Wing 2000) argues that we need to be concerned not only with US political and military hegemony in our world but also the speed with which repressive institutions and their conservative ideals (for example, the International Monetary Fund (IMF) and World Bank) travel. "It is the homelessness of global capital that poses the greatest threat to women throughout the world" (Davis in Wing 2000, xii). This is not to say that capital does not care about geography or place. Different places have different labor costs and regulatory oversight and multinationals can choose locations more profitable to them (Harvey 2010). I argue that the virtualized form of capital is made possible by knowledge advancements made by specialized workers in CSE, who design the cybernetic frameworks that enable efficient communication and the reduction of the time and costs of capital distribution. Its social impact needs further investigation.

Extending surplus labor time for profit is a main function of the ubiquity of CSE technology in our society. The widespread use of handheld mobile devices and laptops

has connected us to the Internet at virtually all hours. For CSE knowledge producers, this often means being available to their employers at all hours. Sandy Lieske, a white senior CSE professional and the Vice President of Global Category Support, Serviceability, and Operations at Hewlett-Packard, explains it this way:

A big part of the [work/life] struggle centers on the increased workload by virtue of always being connected. There used to be a clear separation between work and home, but that no longer exists. Although the flexibility afforded by being able to work from anywhere is often very helpful, it also can set expectations with your employer that you are always accessible. You must get really good at establishing your own boundaries.

Tony, one of my white male participants, claimed that he tried not to work on weekends and I asked: “What about email?” He replied wryly: “Well, that doesn’t count.” Answering work emails doesn’t even seem like work anymore because on-line and “off-line” activities co-constitute our social lives and have therefore become blurred (Boellstroff 2012). Capital has leveraged CSE technology to put us to work for them, for free. For example, corporations use CSE technology to replace service workers, including automatic tellers, self-service check-outs, and online travel agencies. The continued existence of the capitalist system depends of new arenas for commodification and more advanced tools for wealth extraction (Dalla-Costa and James 1980). Therefore, knowledge production and cultural norms develop around new forms to extract wealth from laborers. Successfully interacting with automated labor machines takes training and we are trained both on the job and on our “free” time. Technology plays an ever-increasing role in US society, “often mediating significant choices and changes, yet is rarely seen as a part of the contending values of society” (Solomonides 1985, 6).

Robbie E. Floyd-Davis (1992) describes how people are socialized in today's virtualized world, one which she calls the "technocratic model," meaning a society that is led by technocrats and highly prizes technical, empirical knowledge and technological artifacts. This paradigm is a more advanced, sophisticated development than its predecessor, the mechanistic model. "Unlike religions, which explicitly spell out their doctrines, the technocratic core value system in our culture, although it pervades our experience in countless ways, is below the level of consciousness for most of us" (Floyd-Davis 1992, 65). This model of rule, unlike religious rule or power relations in the mechanistic era, is less conspicuous about its machinations, motivations, and applications. In other words, technocratic core values mask social relations of labor. Much like Marx (1976/1990) turns to "the misty realm of religion" (p. 165) to describe the nature of the commodity, Davis Floyd (1992) uses religious metaphors to describe the process of birth in the technocratic paradigm and how the majority of Americans are inculcated into mainstream beliefs and practices that do not respect their autonomy or serve their best interests. These beliefs spring from the unconsciously activated and applied values engendered in and created by CSE commodities that animate the largest institutions in the US and the intimate spaces of our lives. Technological artifacts are prime socializing agents in our technocracy and are used ritually to serve and perpetuate existing power systems of inequality. The producers of CSE knowledge have greater insight than the American population into the social-cyber networks of power and therefore offer valuable insights in what could interrupt the reproduction of injustices.

Solomonides (1985) supports my critique of Apple's 1984 commercial myth-making. He argues that we must critique computer technology as a form and expression

of social values and as a potential tool for totalitarianism. The promise that computer technology would enlighten humanity and erode suffering is proving to be a false one.? Cooley (1981) outlines three myths about computer technology: 1) “automated machines will free humans from soul-destroying work; 2) greater benefits for workers and shorter weeks and longer holidays and 3) mass data collection will improve decision-making and bring progressive ideals to life” (p. 1). Mander (1991) argues that the real uses of technology are for state control and coercive power. Computing commodities are tools of distraction for the masses. This is why we need to look beyond the artifacts of technology and ask more holistic questions about how computer technology affects society and life on our planet. Mander (1991) suggests seven categories of analysis for assessing outcomes in our high-tech society, including: 1) pollution and health; 2) **employment**; 3) **quantification and conceptual change**; 4) **surveillance**; 5) rate of acceleration; 6) **centralization**; and 7) the worst-case scenario: automated computer warfare (p. 54; my emphasis). These are all important avenues of analysis. In this chapter, however, I focus on numbers two, three, four, and six as they help frame my argument that advanced capitalist extraction of profit, through the extension of surplus labor value, is made possible by computers. While outside of the scope of this chapter, I believe current drone weaponry used by the US military and law enforcement agencies in counties across the country constitutes the manifestation of Mander’s worst case scenario.

THE RISE OF THE MACHINES AND THE FUNDAMENTALIST ECONOMY

“It is the task of analysis to uncover what might now be possible and to place it firmly in relation to what is likely given the current state of class relations throughout the world”
(Harvey 2010, 71).

The extreme inequality of networks of access to CSE technology seem to parallel growing inequities in wealth in the US. Today we now live in a world operating by the rules of a new phase of capitalist development, one where the majority's working conditions, if available, are worsening and social divisions are widening. For example, between 1991 and 2000, the average earnings of corporate executives in Silicon Valley "increased 2000% while production workers' earnings declined seven percent. The earnings ratio shifted from 41:1 to 956:1" (Walby et al. 2007, 23). The growing chasm in wealth distribution is a result of neoliberalism, an "ideological crusade," also known as "free trade" and "globalization" (Klein 2007, 17). Neoliberalism operates by exacerbating already existing social inequalities (Mohanty 2003). The logic of the "free market" is to "ignore national borders, avoid regulation and taxation and amass new wealth" through evolved forms of primitive accumulation within previously untapped sites (Klein 2007, 19). Ferguson (2006) even goes so far as to claim nation-states only exist these days as legal apparatuses to rubber stamp transnational firms' plundering extraction projects. Recent events, like the criminal activities of Wall Street that bankrupted many Americans and the failure of the Justice Department to prosecute these banks or compensate their victims, lend evidence to this argument. In the neoliberalist logic of economics, risk and costs are society's burden and benefits reaped are private property.

In academic and corporate sectors, neoliberal economics are the logical application of scientific rationalism:

As dominant discourses would have it, the economic world is a pure and perfect order, implacably unrolling the logic of its predictable consequences and prompt to repress all violations of ... the policies [it] imposes: reducing labor

costs, reducing public expenditures and making work more flexible.

(Bourdieu 2003, 1).

“Like all fundamentalist faiths, [free trade] economics is, for the true believers ... a perfect scientific system and when crises happen, the neoliberals’ solution is to tighten the screws so to speak, and apply a stricter and more complete application of the fundamentals” (Klein 2007, 62). It is also important to note the doctrine of austerity is a one way street. The corporatized state is brought into being not by following rules but through the deregulation of financial markets and public measures for accountability.

Bourdieu (2003) is the first person to help me make sense of my experience at Amazon.com, and specifically the ways in which the company responded to investors’ threats of losing “market confidence” and the impact of “reorganizational” measures on me, my colleagues, and the organizational culture. Very abruptly, less than two years before the 2001 dot com bubble bust, Wall Street imposed sanctions on Amazon.com to prove it was a viable company. “Proof” came in the guise of routinized layoffs, “stacked-ranking” performance reviews (evaluations of employees are made relative to one another and must all fall evenly along a bell curve, encouraging competition among peers), benefit and stock option reductions, and expansion into the cheapest labor markets. It behooves our understanding of neoliberalism to consider Bourdieu in his own words:

The globalization of financial markets, when joined with the progress of information technology, ensures an unprecedented mobility of capital. It gives investors concerned with short-term profitability of their investments the option of ... penalizing [the largest corporations’]

relative setbacks. Subjected to permanent threat, the corporations themselves have to adjust more and more rapidly to the exigencies of the markets under penalty of losing ... the support of their stockholders.”

(Bourdieu 2003, 2).

These austerity measures also coincided with my boss leaving. I was asked to indefinitely take over her executive level job in addition to my current senior project manager job for no extra pay. Company growth at the time was expediential so I hoped for advancement. Soon, however, it became clear that the decrees of the global financial market had a terrible local impact. Cost reduction measures were aimed almost solely at lower paid positions (generally, non-technical, non-executive) while the ranks and benefits of executives, vice-presidents, and their successors-in-grooming were swelling. Measures to garner stockholder assurance resulted in increased exploitation of women workers and golden parachutes for male industrialists. Middle-manager men in my department got promotions and women middle managers got fired, or, as in my case, got more work for equal pay and, at best, horizontal advancement. The lucky few who joined the company early, vested early and quit. Department culture became intensely hostile and then over 400 people, the majority of my department, were fired in a hotel ballroom by the department’s vice-president, a wizened man with tattered cuticles. Imagine coming back from a burrito lunch break and being stopped at the door by an armed guard who won’t let you back in your workplace. Even though my house keys were in my office, I was denied entry and told to go find my boss at the Hyatt down the street. This is the ugly reality of the flexible accumulation of capital in the neoliberal state.

Quantification and Conceptual Change

“I think everyone in this country should learn how to program a computer because it teaches you how to think” Steve Jobs (Partovi and Partovi 2013).

Hakken (2003) prefers the term “automated information technology” (AIT) to differentiate computers from other social forms of technology, in that “they are both programmable and run in the relative autonomy from an active human operator” (p. 147). This has implications for both the external and internal organization of knowledge in our culture. First, in a world mediated by AIT, knowledge is stored externally and no longer “stored intracognitively” (Hakken 2003, 137). For example, people who own internet-capable cell phones now rely on this technical tool to settle debates instead of relying on one’s critical thinking skills and education and engaging in dialogue with others. Knowledge is increasingly standardized in our educational systems and our capacity for intellectual rigor and problem-solving is routinized, which can lead to a rigidity of thinking antithetical to creating social change. The design of computers influences our processes of knowledge conceptualization. My participants told me that logic, precision, binary thinking, and compartmentalization are ideal skills to become adroit with this social tool, the consequences of which I discuss in Chapter 5. As quoted above, Steve Jobs argued that learning to program computers teaches you how to think, but within the bounds of computer programs, are there limits to what can be thought? Hacker (1990) argues that “programming may limit not only creative decisions about resources of materials, as in the degradation of traditional crafts, but choices about allowable modes of thought as well” (p. 178). Is it possible that epistemic limits imposed by computers on CSE users’ and practitioners’ creative and intellectual autonomy influence these workers’ ability to imagine and enact practices that welcome all practitioners and challenge systemic injustices?

The influence of the systems design of CSE technology extends beyond the singular consciousness and individual self. It affects the political economy and the external order of our society. Our political economy prizes a social order that is efficient, hierarchical, and obsessed with security. Toward that end, computer systems intensify the reification of workers. A famous computer system design engineer arguing for the assimilation of “human materials so we can think of them as metal parts, electrical power, placing human materials on the same footing as any other material ... human operating material” is dangerous, and when using them, engineers “must devise appropriate safeguards” (Cooley 1981, 17). This disdain and fear of the computer user is part of the systems’ very design, harkening back to the philosophy of Fredrick Taylor, who marked a turning point in industrial capitalism with his scientific management of labor practices. Taylor argued that the worker is to be told what to do and how to do it and any creative input from the worker is fatal to the successful management of the project (Cooley 1981).

The essence of Taylorism, increasingly exacerbated under the imposition of the computing commodity-form, can be summed up in the adage: “People are trouble but machines obey” (Cooley 1981, 74). In my ethnographic research, three out of my 42 interview participants expressed this sentiment almost verbatim as a reason why they take pleasure in technology. As Theresa, a white senior CSE professional working in academia with prior experience in industry stated, there is a sense of comfort that these machines “do what you tell them to do.” A commonly held belief among CSE professionals is that technology is morally neutral. The owners of the means of production exploit this faith in objectivity by training CSE professionals to attend to a logical thinking that stresses minutia and a “blind devotion to tasks” without

consideration or scruples about the nature and application of these activities (Cooley 1981, 15). Therefore, the owners of the means of production can use the intellectual knowledge gained from their creative workers without having to contend with the “mess” of social mores or personal values, extracting, reifying, and absorbing the skills and knowledge from CSE workers and channeling these “human resources” into the machine itself. The owners of the means of production thereby gain not only the surplus labor value from the products that CSE workers create but appropriate part of the worker herself, who confers part of her life force into the machine, which will in turn come to rule over other humans, herself included, in the form of commodities and surveillance mechanisms (Cooley 1981; Marx 1976/1990).

Centralization

The production, design, and engineering of computers combine with the use and domain construction of CSE in law and fiscal policies to “extend considerably the terrain on which capital might be reproduced. The ‘new economy’ manifests in the new ways to *own knowledge*,” which in turn can transform the dynamics of social reproduction (Hakken 2003, 145; my emphasis). I will return to the theme of social reproduction in Chapter 4. In the process of destabilizing the myth that computers usher us into a progressive state of global enlightenment, we must consider the centralization of power and control in our highly technical world. Mimicking the original process of primitive accumulation during the emergence of capitalism, powerful institutions are increasingly centralized while workers are socially alienated and individuated. The workers are isolated from one another; “they enter into relations with the capitalist, but not with each other” (Marx 1976/1990, 451). Workers are further divorced from the means of

production via the division of labor in manufacturing, where each worker performs a single task repetitively (Marx 1976/1990). These divisions require exclusive tools and functions for each type of worker, setting the stage for the rise of the machines, the combination of simple instruments into one centralized system of control.

CSE technology makes different sites of production interchangeable and the physical limitations of scale obsolete. “The convergence of technology means the convergence of control” (Solomonides 1985, 7). Centralization of power may go undetected in part because the networked individual appears autonomous and the specter of the powerful patrons of the center can exert control behind the curtain of computer fetishism and mystification (Solomonides 1985).

This is how the myth of progress in the digital age can flourish and the negative effects of computers can be overlooked. Rather than engendering egalitarianism, computers contribute to a new global economy marked by large gaps in economic development, ecological disasters, a hoarding of resources by the few resulting in the impoverishment of many, and the weakening of democratic political structures and their ability to regulate and influence global problems and corporate multinational entities (Hakken 2003).

Now that nation-states are in cahoots with non-democratic, unaccountable multinational corporations and their henchmen (for example, the IMF, the Organization for Economic Cooperation and Development, and World Bank), Gramsci’s (1971) definition of hegemony needs to be updated to reflect neoliberal configurations of modes of exchange, distribution, consumption, production, and reproduction. Hegemony operates through both the spheres of the state and civil society. The dominant group in a

society, through mechanisms within civil society, rules from above with consent from below (Gramsci 1971). Civil society is now global and consent is complicated when the majority who consume CSE commodities are unable to access knowledge about how they operates. In this way, an invisible process unfolds, amassing a centralization of control over the working class without obvious means of repression. Together, the myth of objective rationality and the fantasy of power that the personal use of CSE commodities bring to individuals combine to consolidate state coercive power.

A feedback loop exists in which the personal use of CSE commodities provides powerful institutions of control with further information to exert control. Also important to keep in mind is the fact that the “reproduction of economic relations is at once economic, social, technical and above all ideological” (Essed and Goldberg 2001, 54). This helps explain a connection between the advent of the personal computer, its entrance into many upper middle class homes (and specifically, boys’ bedrooms in those homes (Margolis and Fisher 2003)), and the significant drop in the number of women majoring in CSE that began in 1985. This connection cemented a firm bond between ideologies of CSE technology and masculinity. Both Althusser (1970) and Gramsci (1971) agree that ideology, though a contradictory site, is one that creates the conditions for the expansion of capital, making us social subjects, who, in absence of resistant consciousness and actions, reproduce and fortify inequitable relations of power.

CSE technology has enabled a state of virtualization in which our social practices are largely made up of abstract concepts rather than engagement with real objects in use (Hale 1980). In other words, CSE technology further alienates us from material, sensual reality and, at the same time, produces a new kind of knowledge: a technical knowledge

made rote and compartmentalized. This process of social re-organization, predicated on a strict adherence to individual rationality, has far-reaching implications for structural power relations, collective action and spiritual, cognitive, and interpersonal experiences. Even Sergey Brin, a white, male mid-career CSE professional and the co-founder of Google, admits that “You are actually socially isolating yourself with your [smart] phone” (Brin in Tate 2013, 1).

This is not to suggest that neoliberal social formations are monolithic. In the following sections I discuss contradictions in the discourses, practices, and values in the production of CSE commodities and acts of resistance to these cognitive enclosures created by traditional approaches to CSE.

“We Want To Recruit You:” Externalizing The Costs of Specialized Labor

Recently, the declining pool of trained and available CSE professionals in the US has gained attention (Ashcraft 2010; Ladner 2009). Politicians, entrepreneurs, and artists are making public calls for more students to learn to code. For example, the non-profit Code.org, which promotes computer literacy among US youth, made a video of these public calls. In just a couple of months it received 12 million visitors. Their website features even more entreaties. Here are a few highlights of the 83 people who joined the rally:

At a time when people are saying "I want a good job – I got out of college and I couldn't find one," every single year in America there is a standing demand for 120,000 people who are training in computer science (President Bill Clinton).

Our policy at Facebook is literally to hire as many talented engineers as we can find. There just aren't enough people who are trained and have these skills today (Mark

Zuckerberg, founder of Facebook)

Here we are, 2013, we ALL depend on technology to communicate, to bank, and none of us know how to read and write code. It's important for these kids, right now, starting at 8 years old, to read and write code (Will.i.am, entrepreneur and musician in the Black Eyed Peas).

An understanding of computer science is becoming increasingly essential in today's world. Our national competitiveness depends upon our ability to educate our children – and that includes our girls – in this critical field (Sheryl Sandberg, Chief Operating Officer at Facebook).

There's a spirit of innovation in Washington State that's driven world class advances in aerospace, IT, biotech, health and agriculture. But we're falling behind in meeting the workforce needs of today's economy. To remain at the forefront of the innovation economy, we must prepare our kids for today's jobs and the jobs of the future. Computer programming is one example of just such an opportunity (Jay Inslee, Governor of Washington State).

These are just a small fraction of pleas to the general public stressing the importance of CSE training. The overriding themes include the financial and career opportunities these skills offer, the lack of Americans trained well enough to participate in the field, and the cognitive advantages of a CSE education. Will.i.am points out the disparity between the great majority who consume CSE commodities and the elite minority who produce them. Two outliers' comments stand out in this sea of sophistry. Jane Margolis (in Code.org, 2013), an ethnographer at UCLA who has made important interventions that advance underrepresented groups in CSE, argues that the exclusivity of CSE is a civil rights issue. Snoop Dog, an American performer, appears to address his comments to leaders rather than students: “support the American dream n make coding available to EVERYONE!” (Snoop Dog in Code.org, 2013). He frames the problem of

CSE education in the US as an access issue. Unfortunately, this perspective is lacking among leaders who have the influence to make CSE education more accessible.

Take Jay Inslee for example. The Governor of Washington State urges his constituents to prepare kids for future jobs in high-tech. On the surface, this seems practical advice, given that Washington State is home to the some of richest CSE corporations on the planet and offers many employment opportunities. However, the fact is that “the research clearly shows that [high-tech] jobs have already left Washington because employers couldn’t find qualified candidates here” (HeraldNet 2013). A recent editorial in the Everett Daily Herald (2013) focuses on a new report issued by the Washington Roundtable, “a group of business heavy-hitters,” which warns that high-tech companies will continue to look outside the State to meet their demand for laborers if the State does not increase capacity and interest in CSE. The Everett Daily Herald editorial is one of the few Washington State media sources I have come across in my seven years as an advocate for diversity in STEM education that addresses the elephant in the room: Who will pay for increasing capacity in these specialized, high-investment fields (HeraldNet 2013)? What mechanisms provide laborers with the skills necessary to perform and reproduce labor power for capital? Will the industrial “heavy-hitters” and academic and political leaders in Washington State provide financial support for these mechanisms or will they content themselves with issuing platitudes and vaguely threatening reports about the problem?

Tech Untaxed

The Everett Daily Herald editorial goes further than raising the question of who will pay for increasing interest and capacity in CSE training. It also recommends that

Washington “clos[e] outdated tax loopholes and weigh a capital gains tax” (HeraldNet 2013). CSE industrialists take advantage of tax laws written for a mechanistic economy (not the virtualized one that exists today) and companies like Amazon.com, Google, Apple, and Microsoft, some of the “largest and most valued industries, are among the least taxed” (Duhigg and Kocieniewski 2012, 2). For example, while “retailers generally pay a tax rate of about 30 percent, Amazon paid only seven point nine percent on its \$1.8 billion in profits from 2008-2010” (Singer 2011, 2). Facebook made \$1.1 billion in 2012 and it not only did it not pay taxes, but also received a tax refund of \$429 million (Rivlin-Nadler 2013). Microsoft and Apple have small offices in Reno, Nevada, where the corporate tax rate is zero, in order to avoid billions of dollars in taxes each year (Duhigg and Kocieniewski 2012; Reifman 2012). Between 1997-2011, Microsoft used its Nevada office to dodge over \$1.5 billion in Washington State taxes and specifically the Washington State Software Royalty Tax. “If you include impacts from the [Microsoft’s] lobbying and calculate its savings at the original 1.5% rate, it’s saved \$4.37 billion” (Reifman 2012). The tax dodging schemes of CSE corporations go beyond “loopholes” like tax havens. Federal tax laws are simply “ill-suited for today’s digital economy” (Duhigg and Kocieniewski 2012, 1). It is beyond the scope of this project to go into detail about income tax laws, but high-tech companies report their taxable income on an annual Form 10-K, which, according to economist Kimberly Clausing, “is a fiction for most companies, but for tech companies the form goes from fiction to farcical” (Clausing in Duhigg and Kocieniewski 2012, 3).

As a result of this legal wizardry, tax evading CSE corporations bankrupt their communities and the educational systems that would train future workers. For example,

since 2008, Washington State has cut \$4 billion from K-12 and higher education (Reifman 2012). So even though Bill Gates (chairman of Microsoft) and Steve Ballmer (CEO of Microsoft) joined the Code.org call to recruit more students into CSE, they are not willing to pay their fair share for the social reproduction of their own labor force in their own communities. Like Apple, Microsoft makes strategic donations to local universities' STEM programs, but corporate philanthropy is a poor substitute for good citizenry. ““When it comes time to pay for these companies – Google, Apple and Facebook and the rest – to pay their fair share, there’s a knee-jerk resistance,”” says De Anza college president Brian Murphy, whose campus is just miles from Apple headquarters in Cupertino, California and is suffering a major budget crisis. ““They’re philosophically antitax and it’s decimating the state”” (Duhigg and Kocieniewski in the New York Times April 28, 2012, 10). Murphy illuminates the neoliberalist agenda that drives these companies to refuse to contribute to the social reproduction of their communities and States. The tax dodging activities of prominent CSE corporations contradict their explicit pleas to the public to help transform the dire shortfall of available specialists in CSE fields.

Abbate (2012) provides a historical perspective on the role crisis plays in the CSE field. She argues that since the advent of CSE in the 1950s, the field has constituted itself as being in “permanent crisis” (Abbate 2012, 73). Abbate (2012) claims the manufacturing of crisis was a challenge to disciplinary boundaries and gender identity. During World War II, programming was considered “women’s work” and efforts to rebrand programming as “software engineering” were aimed at raising the status of programming by making it the purview of male expertise. This history sheds light on the

meaning of crisis in CSE today. CSE leaders use crisis rhetoric to tout the prestige and power of their industry as a means to leverage political power and, as I demonstrate in Chapter 5, male workers in CSE use crisis as way to exert power and solicit accolades within their organizations. Skepticism must be exercised about the rhetoric of crisis in CSE (Abbate 2012). I find it more useful to reframe crisis as a struggle over authority, resources, and prestige between male CSE professionals and corporate and government leaders, and a potent example of the contradictions of capital, where profit is dependent both on the valuation and devaluation of workers' labor value and on the gendering of this labor.

The Mythinformation Age

Hakken (2003) questions the glory of the Information Age and asks whether the new millennium has ushered in a true knowledge society or an era of “mythinformation” (p. 325). I borrow this term to refer to the widely held and wildly speculative belief that computers are necessary and useful to the large majority of people in our society. Putting my doubt into words makes me worry about being cast a Cassandra or a Luddite, but please allow me to share a few example of mythinformation in an effort to separate the myth of computers from real world applications. I draw my critical strategies of the CSE industry from critical medical anthropologists who examine the social and cultural contexts that shape the development and delivery of medicine. In Chapter 6, I discuss how CSE is at a disadvantage in attracting educated people who long to use their skills in the service of a higher good. Biomedicine in the US has “evolved out of [the] tradition of service to suffering humanity” (Loustaunau and Sobo 1997, 126) and CSE out of the more utilitarian discipline of engineering. Thus, even though medical practice in the US

is consistent with the values of the capitalist market – profit is prioritized over people – its historical roots of service lend it a veneer of magnanimity that tends to attract highly educated people with a hankering for doing good. CSE industrialists, on the other hand, must proactively manufacture a reputation for the “revolutionary” social contributions of their commodities.

The Apple commercial that begins this chapter is one example of this mythmaking. The hammer-throwing woman is revolting against a virtual image of the Party Leader who preaches on the power of the collective. A consistent message in the mythinformation of computers is that they empower the individual. For example, in her keynote address to three thousand female CSE professionals at the 2011 Grace Hoper Celebration of Women in Computing, Sheryl Shandberg, a white senior CSE professional and the Chief Operating Officer of Facebook, said:

If you think about what changes our lives the great things that have changed lives over the course of history there's political movements and there's technology, and technology is what's driving now Then think about the information revolution which has happened with the Internet, you think about the social revolution which is happening now, where each one of us gets technology to power who we are as individuals, I don't think there is anything you can do which has more impact.

This is an interesting admission that CSE technology is separate from political movements but still an impactful force in our culture. I do not agree that computer technology is apolitical and find it an amusing claim from a powerful CSE executive who hosts heads of state in her workplace (Sandberg 2013, 27). I do wonder what is to be gained from at once lauding and depoliticizing such an influential, multidimensional institution?

The answer lies in the individual's relationship with technology. Sandberg (2013) suggests that the Internet empowers individual users. Her commitment to individualism reflects one of the foundational tenets of liberalism, a philosophy of governance that espouses "protecting property, civil liberties, tolerance for difference, securing a free press ... and preserving a commitment to equal opportunity" (Coleman 2013, 5). We also see this ethos operating in Apple's 1984 commercial, where an individual blows up the image of a figurehead who is espousing social collectivity and unity (and note that her act of resistance is against a virtual person not a real person).

To problematize individualism, I rely on Susan Sherwin's (1998) feminist analysis of autonomy and agency and how these concepts frame the terrain of US discourse and politics on reproductive justice. Sherwin (1998) suggests that feminists use the term autonomy to mean a "comprehensive notion of freedom where not only is the immediate choice un-coerced but the circumstances that structure that choice are also free of the coercive dimension of oppression" (p. 12-3). Sherwin's transformative analyses frame reproduction not as an individual "choice" but rather in a political and social context where "the society, not just the agent, is subject to critical scrutiny" (p. 37). In assessing the impact of the digital "revolution," operationalizing individual autonomy in Sherwin's feminist sense can help us be mindful of the circumstances which structure our engagement with CSE technology and whether this engagement occurs within coercive conditions of oppression.

What concerns me about the myth of the digitally empowered individual is that the corporate entities that create and promote CSE commodities are not committed to other aspects of the liberal philosophical tradition, including privacy, property rights, and the

social reproduction of their communities and own labor force. The CSE industry, as it operates in the formal economy, is a part of the political movement of neoliberalism. I give examples of CSE corporations' collusion with US neoliberalist and military organizations below. Here, allow me to stress the importance of the atomized individual to neoliberal ideology. When suffering is solely the burden of the individuals who experience it rather than the social arrangements which may have caused the suffering, the failure of capitalism to meet social need is mystified (Ginsburg and Rapp 1999).

Mythinformation goes beyond an apolitical concept of an individual plugged into technology. Mythinformation also includes emphasizing the social benefit of a technological innovation (and often, only its *potential* social benefit) while eliding its more insidious applications. For example, Microsoft Research produces an expensive booklet (more than a glossy, some of its pages are three-dimensional) to advertise to CSE faculty the social benefits of the work they do:

We envision a future in which computers increasingly work on your behalf rather than at your command and we see the emergence of user interfaces as a key area of research. We collaborate with leading researchers in medicine, education and earth and environmental sciences to transform society for the better through technology

(Mundie and Hey 2011, 3). The booklet is a promotional tool to convince non-corporate researchers that MicrosoftResearch's investigations have the *potential* to be useful for both "commodity computing and ... the creation of knowledge services that are relevant to the research community" (Mundie and Hey 2011, 17). For example, sensor nodes in the Amazon could help scientists develop better solutions to "climate issues," (Mundie and Hey 2011, 21), biosensors embedded in contact lenses "could help monitor glucose

levels in diabetic patients” (Mundie and Hey 2011, 39) and “robots can be used to explore areas too dangerous or difficult for human teams to search” (Mundie and Hey 2011, 41).

I believe that there are socially beneficial applications of CSE commodities. However, I argue that the speculative promise and promotion of CSE contributions to the social good is not borne out in reality. For example, Microsoft Research recognizes its high performers with prestigious Technical Recognition Awards. They claim that these awards recognize “work that changes our world for the better” (Seattle Times Feb 12, 2012, A9). In 2012, a year after Microsoft Research’s 3-D promotional kit touted the promise of Microsoft Research “computing commodities,” the all male, 89 percent white Kinect Skeletal Tracking Team that developed Xbox technology that tracks players’ movements received this prestigious award. How exactly do video games that track players’ movements change the world? Apparently, by shifting the “paradigm for the entertainment industry ... and selling 18 million units” that year (Seattle Times Feb 12, 2012, A9). Microsoft continues to leverage this technology to read an individual’s body language as she consumes advertisement messages in order to better tailor these messages to her consumptive habits.

While it is true that many CSE innovations like those featured in Microsoft Research’s PR packet have potential uses that may benefit people, the most profitable uses for these technologies take priority. Lynn, a white early-career CSE professional and software developer, told me that she and one of her professors built an application for an eye-tracking device intended to help people with disabilities but that the application was eventually developed for marketing purposes in order “to track where people look on the

screen for retrospective [marketing] analysis.” Her collaboration with this professor was a success and she was pleased that they published their findings. However, Lynn reflected that CSE professionals like the idea, or the *potential*, of applications for people with disabilities much more than the actual implementation of such applications:

And at the time I wanted to do something for people with disabilities, and I felt like I got all this positive experience in academia for it, and my perception of industry was not going to care so much, it's not going to be a priority to serve people with disabilities, because it's expensive and probably not on their priority list. So then I went into academia and I realized that, you know, people in academia also don't care about this situation as much as I might have thought. They liked the drawing program with the eyes because it was exciting and sexy, but when you start talking about like practical accessibility issues, people kind of turn off sometimes.

Given the choice between shareholder confidence or social benefit, investors trump workers and society every time. CSE corporations evade taxes, refusing to contribute to the education of their own labor force. It's fantastical to argue that those same corporations will build socially beneficial applications without profit-motive. This point will be important in Chapter 6 where I discuss how women are not attracted to CSE because they perceive it as divorced from social concerns and helping people. Diversity in STEM advocates think that this is a PR problem but I wonder if women and girls see through the mythinformation propagated by billion dollar corporate marketing teams.

Paul Solomon, in a PBS on-air segment called “Man [or Woman] vs. Machine,” also questions the social impact of CSE commodities. Placing his comments in the context of a 17% un- and under-employment rate in the US, he remarks: “The mantra is that high-tech is a cornucopia machine churning out more than enough to go around”

(Solomon in Soloman 2012, 2). To which his colleague Richard Freeman responds that high-tech industrialists are:

[A] very optimistic group that is pushing for tech which they say will make us a million times better off. I don't think they actually think all that much about how it will be distributed. That's not their business. That's the business of another set of people in this society, who have not done a very good job of worrying about that problem ... mean[ing] politicians, business people and fellow economists.

(Freeman in Soloman 2012, 2)

The optimism Freeman is referring to is more aptly conceptualized as a “reboot” of commodity fetishism. Marx (1976/1990) emphasizes the terror of the commodity-form, how things come to rule over people and rob them of what he deems our essence: creative labor capacity. CSE commodities are no less terrifying and perhaps even more so than Marx could have dreamed.

Computer Applications: Beyond Mythinformation

When I asked Danielle, a white undergraduate CSE student, what she enjoyed about programming, she replied she found that “to push a button, and get the right answer” was very satisfying. Growing up under the Reagan regime, I remember feeling frightened of nuclear war, exemplified by images of a red button and a mushroom cloud. I learned from my family and teachers that the president had his “finger on the button.” My historical and psychological orientations urge me to link Danielle’s satisfaction to the political arena. Is Danielle describing feeling satisfied from control derived from using a computer or is she glad to be recognized by the computer? Danielle’s pleasure in being right, as deigned by the machine she is interacting with, reminds me of Althusser’s (1970) theory on the “science of ideology” in which he claims citizens are “interpellated

by ideology” (p. 135). Like the president who, through the advancement of computerized warfare technology, controls the fates of millions with a button, is it possible that using a personal computer offers a simulated experience of power while simultaneously making one vulnerable to *being* controlled? Like the bidirectional telescreens in Orwell’s *1984*, we are interpellated by computing machines which not only feed us information but also collect information about us. Computing machines bring new meaning to Marx’s (1976/1990) description of technology as dead, inert labor value that rules over living labor. With CSE commodities, workers are under surveillance even when they are off the clock.

As more and more people use computers to communicate, bank, shop, and access information, we share and store personal information on-line. The nation’s Supreme Court is still shaping intellectual property and privacy laws in our digital era, but it is clearer than ever that the government accesses our private information without warrants (Friedman in the New York Times January 2012; Schneier 2013; Peterson 2013). Marketing corporations and analytics firms also track the tiny details of our daily lives, including our communications and locations, which they can, *and do*, sell to law enforcement with grave implications for social protests like the Occupy Wall St. movement (Ungerleider 2012):.

The internet is a surveillance state [I]nternet [data] is being combined with other data about us. This is ubiquitous surveillance: all of us are being watched all the time and that data is being stored forever. This is what a surveillance state looks like and it is efficient beyond the wildest dreams of Orwell.

(Schneier in CNN.com March 16, 2013).

Just as the laws of enclosures at the advent of capitalism “freed” peasants from their land, CSE technology is helping to “free” individuals from privacy. “To Facebook’s Mark Zuckerberg, transparency means sharing personal information constantly; he has gone as far as to declare the death of privacy” (Coleman 2012, 7). Civil liberties advocacy groups are banding together to maintain US civil liberties through reform of the Electronic Communications Privacy Act (Peterson 2013). These legal challenges are necessary to our democracy. In the next section, however, I describe how privacy advocates and government transparency activists with CSE skills are well positioned to mount a skillful resistance to corporate and state encroachments.²

RESISTING THE TECHNOCRATIC STATE AND ITS CONSEQUENCES

I pay heed to Coleman’s (2013) advice not to clump all digital projects together and Gibson-Graham’s (1996) warning not to overstate capital’s power nor conceive of this power as invulnerable to social transformation. With this wisdom in mind, I turn to the ways in which CSE technology is being used to oppose the neoliberalist agenda, marked chiefly by a centralization of power through surveillance and the externalization of production costs to the public sphere. Sandoval (2000) reworks Althusser’s (1970) “science of ideology” by claiming that an active subject who accesses differential consciousness developed by “US third world feminism, subaltern, queer, and de-colonial movements can write resistance back into history, theory and consciousness” (p. 35).

² My dissertation was completed before Edward Snowden revealed the sophistication of US surveillance infrastructure and insidious collaboration between IT corporations (like Google, Microsoft, Apple, and Amazon.com) and the US military to collect and store computer technology users’ data. Snowden’s revelations were not a surprise to privacy activists but significant in that the news of these violations reached a mass audience worldwide and elicited public outcry. My future work will develop a deeper understanding of the impact of these revelations, US policy on CSE whistleblowers, and how the routine interceptions of our most private communications connect to neoliberalist encroachments into the spheres of social reproduction.

Instead of being interpellated by technocratic ideologies, a person with oppositional consciousness can interpellate ideology to form the subjectivity necessary to act and resist in a world constituted by traditional ideologies maintaining a social order favoring dominant power structures.

The group Anonymous is the best example of people who use advanced CSE skills to preserve democratic values. Using free and open-source software (F/OSS) rather than proprietary software, Anonymous hackers “labor within a framework of their own making ... [and] short-circuit the traditional uses of copyright: the right to exclude and control” (Coleman 2013, 1). F/OSS is free software with a license that ensures anyone can copy, adapt, and disseminate the source code. It is not a potential alternative but “an actually existing alternative” operating in parallel with propriety software (Schneier 2013, 2). This type of software fascinated anthropologist Gabriella Coleman (2013) who is now considered the foremost expert on Anonymous and other “hackers.” Coleman (2013) defines hackers as those who love to tinker, problem-solve, and create technically and who are committed to information freedom and mistrustful of authority. They breach both corporate and government security walls to liberate information and redress the gross imbalance of power by which the majority of Americans have little privacy and corporate intellectual property laws grow more and more restrictive, creating another stage of the capitalist enclosure of the commons (Coleman 2013).

One of Coleman’s participants explained the difference between F/OSS and proprietary software: “Free software encourages active participation. Corporate software encourages consumption” (Coleman 2013, 40). While many Americans value transparency and free, uncensored inquiry in the abstract, hackers are active participants

in fighting for these values on our behalf (Schneier 2013). Hackers have come to care so much about these liberal values “through practice, by what those values enable them to produce and when hackers are able to solve technical problems by setting information free, they start to imagine what other kinds of problems they may be able to fix” (Schneier 2013, 5). This growing imagination is evinced in the wide-range of crimes that Anonymous has worked to expose, from the execution-style murder of women and children by American troops in Iraq and a later airstrike to cover it up (Taibbi in Rolling Stone Magazine, March 22, 2013) to the gang rape and kidnapping of a teenage girl by high-school football players in Steubenville, Ohio and a subsequent cover-up (Abad-Santos in the Atlantic Wire month, January 2, 2013).

Hackers invert the tools and practices of the surveillance state and turn the tables to expose those who abuse power. For example, Anonymous members have exposed the extent of corporate and government efforts to collect and mine personal information (Coleman 2012). In doing so, they have revealed that the very foundation of the neoliberal state – the individual – does not really exist because the protection of private information “by a benevolent security apparatus is a myth” and therefore there is no difference between our private and public selves (Coleman 2012, 9). The insistence on anonymity for group members is both an attempt to protect themselves from authorities and also an example to the American public that we need to actively safeguard our privacy and thus our individuality (Coleman 2012). Hacktivists make public the fact that CSE corporations and the government are, like the enemies of the figurehead in the 1984 Apple commercial, of “*one whim, one resolve, one cause*” and that the myth of a liberated individual is a neoliberal fantasy. This makes them dangerous to the

neoliberalist state.

Birgitta Jonsdottir, a Wikileaks activist, wants Americans to understand that activism to hold the US government accountable has moved on-line and that these activists are facing prosecution under the Obama administration at unprecedented levels (Pilkington in the Guardian April 5, 2013). Bradley Manning, a whistleblower who admitted to sharing US government documents with Wikileaks, has been sentenced to thirty-five years in prison (Taibbi in March 22, 2013). Internet activist Aaron Swartz was found dead from hanging after being incarcerated for making scholarly articles public (Pilkington in the Guardian April 5, 2013). Notably, Swartz's other exploits include organizing the on-line protests that defeated the intellectual property bills SOPA and PIPA, bills that the US government is now revising to insure legal immunity for CSE corporations that share citizens' private information with the government (ACLU (Richardson) 2013).

The lengths to which the US government will go to apprehend and jail hacktivists demonstrates the significant threat that a radicalized worker with CSE skills poses to US technocratic political economy.

CONCLUSION: PRIVATE INTERESTS VS PUBLIC GOOD

CSE corporations' commitment to social reproduction and socially beneficial applications is as farcical as their income tax statements. In this chapter, I have augmented Marx's (1976/1990) concept of commodity fetishism to the digital age. CSE commodity fetishism doctors people's view of power relations in US society and serves as a critical ideological tool that reflects and reproduces the reigning values of the powerful elite in our society. Fetishism, from the mechanistic era to the virtual era, works

to conceal the contradiction of capitalism which Marx (1976/1990) believed would be its undoing – that wealth is an amassment of commodities and the value of commodities is the reification of human labor. To reproduce itself, capital must both exploit laborers and tend to its sole source of profit. My study of CSE laborers yielded evidence that the contradictions of gender and labor practices experienced by women CSE workers can be extrapolated to better understand the current crisis of capitalism in this technologic era and how this may point to ways to restructure work, reproduction, and the social impact of CSE technology.

Since high-tech companies themselves have used the totalitarian metaphor from Orwell's *1984* dystopian novel to sell their products, I have employed it here as an analytical tool to question under what socioeconomic conditions and through which cultural norms have the majority of the US population adopted CSE technology, to what result, and to whose benefit? I have strived to demonstrate how computers affect the *body politic*, but individual, interpersonal, and micro-cultural examinations can illuminate more dimensions of CSE commodity fetishism. I blended Sherwin's (1998) feminist conceptualization of autonomous individuals with Coleman's (2013) insight into the fantastical nature of the individual in a computerized society to help better understand the danger of participating in technocracy with unswerving faith. Mythinformation is a project of distraction aimed at further extracting labor value by any means and any body necessary.

I have presented a few examples of expensive, well-orchestrated PR campaigns that overstate the social benefit of the CSE industry and hide its collusion with the US military to control people and extract profit from our minds, bodies, wallets, and

communities. In Apple's 1984 commercial, we never see what happens to the activist who destroys the image of the man who claims to speak for one people, but unfolding right now in 2013 we are in a position to see what happens to those who part the curtain to reveal how CSE technology has tipped the balance of power to an extreme imbalance that favors the ultra-wealthy and dispossesses billions of people from sovereignty. Solomon's (2012) segment "Man [or Woman] vs. Machine" comes to a similar conclusion: The future holds very little work for those who are highly privileged, resulting in a handful of billionaires and a couple of jobs for the rest of us to fight over. Computer scientists themselves are well-aware of the broader socioeconomic domains of their work. As Tony, a white male mid-career CSE professional, said: "I should teach my kids to program. It's going to be like the only job that's left in 20 years."

In our current neoliberal political economic climate, the *body politic* is centralized and secret, the *social body* is individuated and exposed. In the coming chapter, I present women who navigate CSE workplaces and intimately experience the struggle to be individual knowledge creators within structures that may have oppressive effects for society at large. They are outliers – at once knowledge liberators and participants in a field helping to structure and reproduce inequitable power relations. Most importantly, women who persist in CSE have powerful, multidimensional standpoints in our society and can therefore offer a unique perspective on cultural norms and values. Like most Americans, they consume CSE commodities. But they are some of the few who create these commodities and contribute to their applications. Very few people have this insight into our technocratic culture, and as marginalized members of the male-dominated CSE field, they lend unique insight into the disciplinary norms, values, and institutional

transformations that would not only desegregate the field but also liberate computing tools to serve as means for social justice rather than means for profit and social control.

Chapter Four: Broader Cultural Domains: Reproduction, Violence and the Body

“The greatest power you have is your body.” Bayard Rustin

INTRODUCTION

I have discussed how influential CSE knowledge production is to culture in the United States. In this chapter, I aim to elucidate how reproduction influences labor segregation in the CSE workforce and the broader societal implications of this. I draw parallels between the reproduction of white male hegemony in the production of CSE technology and the reproductive injustice that gives women fewer options for economic independence. I argue that sexist violence and ideologies regenerate the devaluation of women’s labor value and naturalize labor segregation patterns with arguments that rely on the biological inferiority of women.

Like Faulkner (2007), Cech and Waidzunas (2011), and Latour (2003), I argue that the ideological dualism between the technical and the social in CSE work is a false one. I also reject the false binary between the workplace and the domestic sphere. Using ethnographic methods critical of power I analyze women’s lives across the artificial binary of “public/private” and contextualize them within cultural norms, ideologies, and a segregated US workforce. The undermining of social resources by forces of privatization obviously intensifies unpaid work in homes and communities, a burden that women disproportionately shoulder, by filling in the gaps between the state and the market in order to maintain the well-being of their families and communities (Benería 1999; Katz 2001; Bakker and Gill 2003; Ehrenreich and Hochschild 2004). Drawing upon the works of Nakano Glen (1992), Katz (2001), and Duffy (2007), I use the term reproductive labor to define labor in the realm of necessity - the work and relationships of social

reproduction, attending to sustenance needs like food production, provision, and preparation; providing care for others' physical, mental, and emotional well-being; maintaining kin and community ties; and reproducing the labor force, both on a day-to-day basis and generationally. In this chapter I pay attention to the presence of social reproduction in my participant's lives and the absence or obfuscation of it.

We are in neither a post-colonial nor post-patriarchal moment. I define systems of power as state, international, educational, and ideological formations as well as interpersonal relations that reproduce the dominant class rule. To wield power in this century requires access to networks of computer engineering. The majority of people who produce computer products and dictate their uses are wealthy white men. The 2008 economic collapse of the US financial system signaled a bankruptcy of our political structures and the increasing intensity of economic injustice along vectors of gender and race. This would not be possible without networks of virtualization made possible by CSE technology.

The extreme inequality of networks of access to CSE technology seems to parallel growing inequities in wealth. For example, only four percent of Fortune 500 CEOs are women whereas 64% of low-wage workers are women. I also note an increase in anti-choice legislation, a blindness of justice to bankers who have made poverty much more a reality for millions of Americans, and the second act of the war without end (both its international dimensions and domestic paramilitary ones).

To make connections between labor inequalities and reproductive justice, I find critical medical anthropologists' interpretation of the body useful. As proposed by Scheper-Hughes and Lock (1987), two feminist medical anthropologists, the body can be

viewed from three perspectives: (1) as a phenomenally experienced individual *body-self*; (2) as a *social body*, a natural symbol for thinking about relationships among nature, society, and culture; and (3) as a *body politic*, an artifact of social and political control. In Chapter 3, I analyzed the *body politic* to describe how the owners of the means of production shape social interactions in the US populace as well as its social relations, consciousness, and policies through CSE technology. In this chapter, I will rely on the first two definitions of the body – the *individual-self* and the *social body* in order to understand women’s economic strategies within the shifting structural conditions and normative systems of gender, race, class, and CSE technology.

Systems of social stratification in western culture are not only capitalist but also sexist and racist. By placing reproduction in the forefront of this discussion, I am purposely counteracting the western tradition to ignore the “cyclical process of regeneration” (Ginsburg 1989, 18). I employ an inclusive definition of reproduction as a means to wed the personal and the political within the stories of women’s lives and the broader cultural domains in which our stories unfold. In the forty-two interviews I conducted, I spoke with women with incredible grit, intelligence, and coping strategies. The question I ask in this chapter is: what reproductive life strategies correlate with persisting in, what US leaders call, the most powerful field in our time? Are these norms incompatible with institutional norms of gender relations? I bridge the “striking” gap between feminist technology studies and cultural anthropology (Bray 2007) to trace gendered ideologies of labor across public and private spheres. Motivating these inquiries is my hypothesis that women’s primary responsibility for reproduction is connected to exclusion from lucrative jobs and women’s segregation in lower-paying, service-oriented

professions in the US economy (Shriver 2009; Greenberger et al. 2005; Nakano Glenn 1992; Spaights 1995). In my research, I seek to understand how this connection manifests and what cultural mechanisms reproduce gendered labor segregation in the US.

The stories of women's lives that I collected for this research span social structural and intimate relations. In capitalist economies, labor that produces commodities is considered valuable. Reproductive labor, taken for granted by dominant groups in society, is not. An orientation transgressing the divide between production and reproduction will make visible three dimensions of violence which undergird the dominant social relations of our society: 1) physical violence; 2) "euphemized violence," the erasure of the lives and labors of women and people of color from history, theory, and public discourses; and 3) epistemic violence, the ways in which "western patriarchal discourses suppress, disqualify, and destroy other ways of knowing and being in the world" (Peña, *personal correspondence*, 2007). Together, these mechanisms of violence create reproductive injustice. I connect epistemic and euphemized violence, forms of discrimination hidden in everyday relationships, and the obfuscation of reproductive labor through biological essentialization. I draw on the theoretical contributions made by feminist anthropologists, especially the insistence that reproduction is not to be ignored in political economic analyses (Ginsburg and Rapp 1991; Browner 2001). Though the study of sexism in CSE fields is somewhat neglected in anthropology (Bray 2007), feminist anthropologists have challenged the validity of the public/private binary and framed the family as an economic unit, thereby connecting reproduction to the economic relations of production (Rosaldo et al. 1974; Leacock 1981; Rapp 1979; Ginsburg and Rapp 1991; Moore 1988; Sargent and Browne 2005; Sanger 2003; Browner 2001; Bray 2007). In this

chapter, I map the politics of reproduction onto the domain of CSE technology production to resituate the struggle over the gendered segregation of labor and further elucidate the causes of women's underrepresentation in CSE.

EUPHEMIZED VIOLENCE: SOCIAL REPRODUCTION RENDERED INVISIBLE

Feminist research has established that men from dominant race and class groups hold cultural power that enables them to define economic structures, social relationships, values, and the meaning and purpose of technology. Feminist organizational theory posits that public institutions are guided by unexamined masculine principles that work to exclude women and impede their success and advancement. Hidden within this framework of the "ideal worker" is the labor required to maintain and reproduce the labor force, both on a day-to-day basis and generationally. Anne Hardy, a white mid-career CSE professional and the Vice President of Developer Evangelism at SAP Labs, notes: "Masculine norms at work make it hard to combine motherhood and career advancement." Organizational theories regarding the gendered nature of work call attention to the obfuscation of masculine principles guiding workplace organizations as well as the productivity of women's unpaid labor in the domestic sphere. These social norms, based on sexism rather than any biological imperative of women and men, govern organizational behaviors and role assignments (Acker 2000).

Jobs within CSE organizations are designed for workers with little to no reproductive responsibilities, a framework which assumes a particular gendered organization of social reproduction (Valian 1998; Williams 2000; Acker 1990). Leading scholarship correlates the persistent gender gap in CSE fields to women's primary responsibility for labor in the home (Watts and Eccles 2008; Xie and Shannon 2003;

Valian 1998; Schiebinger 1999). It's no secret that long hours are required in computer science institutions. Two women featured in the Anita Borg Institute's "Senior Technical Woman Profile" reflected on the lack of leisure or "free time" in their lives due to work commitments. Carla Ellis, a white senior CSE professional and a Professor Emerita of Computer Science at Duke University explained:

Years ago, I was told to write a bio for a Microsoft event, a bio that included the phrase "in her spare time, she enjoys (fill in the blank)." I said, "But I don't have spare time," but they insisted. So I wrote, "In her spare time, she enjoys overworking," which people thought was funny, so I left it that way.

Wei Lin, an Asian American senior CSE professional and the Senior Director of Engineering at Symantec said:

We have endless amounts of work. I work even on my days off (I just work less than usual). In a highly competitive industry and market, work/life balance is a tough call.

These women do not frame the work/life binary as a balancing act but instead challenge us to reframe this debate as one that is structured in terms of compromises and trade-offs. This lens makes space in the debate for inquiry into the politics governing reproduction, work, and leisure time in the US; challenging these politics has the potential for broad-based coalition building. For example, women scientists and engineers cite balancing work and family as their most difficult challenge (Rosser and Ziesennis 2000). Women's primary role in US society is to do reproductive labor for free or a low-wage; women engineers are often forced to choose between successful careers and family (Xie and Shauman 2003; Chu 2011). Kelly, a white senior CSE professional

and a technical fellow in the corporate sector, admits to working a hundred hours a week for many years:

I have no personal life. I am not example of work/life balance ...You can't have it all. Women wreck their lives trying to be superwoman. I never wanted kids, never felt like I needed a husband to be complete. Over the years, I've seen that women who want family life must carry the burden of this cultural baggage. I've seen women give up leadership roles for men and male companionship.

Valerie, another white senior CSE professional and IT leader who has worked in the financial industry for over 25 years, never wanted to work in a female-dominated job and never wanted to have kids. She compared high tech work to doctors' long hours: "But at least doctors have shifts, in the tech world, you have no life. You are like a dog on a leash. The only people here with kids are men with wives. How do women in IT with kids do it?"

To broaden Valerie's question, how do high-tech companies account for the social reproduction of their laborers and their future workforce? The common stereotype of the individual computer scientist is someone who, in essence, eschews normal habits of social reproduction: bathing, eating well, and kinship. I will expand on this cultural trope, which I call the "geek mystique," in the following chapter. This stereotype signals the lack of regard that CSE corporations and academic institutions have towards modes of reproduction in our society. Given the great influence computer technology has on our society, the effacement of social reproduction reflects and reproduces labor value within normative structures of the US economy.

Kelly and Valerie's experiences as senior CSE professionals and childfree women bring attention to a critical failing of CSE institutions— the diametrical opposition of

social reproduction and technical production and the associated cost for both women and men in the high-tech sector. Kelly's use of the term "the burden of this cultural baggage" is a negative reference to women's primary responsibilities for social and biological reproduction and Valerie's description of being a high-tech laborer is no less grim. "Technology does not necessarily entail a low valuation of [women and families] but [it] is embedded in and created out of society's dominant belief system ... to serve and augment given power systems" (Davis Floyd 1992, 46-47). Our society's dominant belief system is predicated on what anthropologists Faye Ginsburg and Rayna Rapp (1995) call "euphemized violence:" the state and corporate powers that efface the centrality of reproduction to our society and fail to acknowledge the impact of this effacement on the lives of women, families, and communities. Social reproductive labor is easily mystified because it is deeply embedded in everyday life and our capitalist culture's core values (Ginsburg and Rapp 1995). This form of racist patriarchal violence works to mask the failure of capitalism to meet social need.

In US culture, "suffering is located in the individuals who experience it rather than in the social arrangements that may be responsible for the problem" (Ginsburg and Rapp 1995, 11). As long as reproduction is a personal service (Dalla Costa and James 1980, 165) and the cost of reproducing people and the labor market falls squarely on the shoulders on individual families, people will be more apt to fall into more traditional reproductive roles – care-taker and breadwinner – and broader, historical patterns of labor inequities will continue to be reproduced (Fraser 1999).

REPRODUCING THE SOCIAL BODY: THE LOGICS OF EPISTEMIC VIOLENCE

Reproductive politics is more than childbearing and childrearing. It is a question of economic justice. Women in the United States shoulder the majority of childrearing and household responsibilities (Brines 1994; Schiebinger 1999; Shelton and John 1996; Van Anders 2004; Ward and Wolf-Wendel 2003). In the production of CSE technology, the gendered division of reproductive labor is ossified into organizational practices governed by cultural ideologies about women's labor value. Despite the fact that women now outnumber men in the workforce (Shriver 2009), the ideology that women should assume primary care responsibility for the next generation persists (Brodkin 1979; Williams 2000). Even when women work outside the home, they still bear responsibility for most childrearing and household chores (Hennessy and Ingraham 1997; Barker and Feiner 2004). The labor required to maintain and reproduce the labor force, both on a day-to-day basis and generationally, is assigned to women via cultural sexism, thus denying the majority of the population rewarding and lucrative career opportunities (Acker 1990).

Those who are interested in joining the fight for women's reproductive justice must understand the needs of women from a wide range of ethnicities and socioeconomic positions. For "women of color, reproductive and sexual health problems are not isolated from the socioeconomic inequalities in their lives" (Silliman et al. 2004, 13). Anti-racist activists insist that reproductive control means not only having access to legal abortion and contraception but also access to the economic means to bear and raise healthy, wanted children (Nelson 2003) and, I would add, the choice to remain childfree. I offer a broad definition of reproductive freedom to elucidate the reproductive politics that shape and are shaped by CSE knowledge production. This broadly defined definition of

reproductive justice demands that all women are able to exercise reproductive freedom and have the opportunity to do meaningful work without economic impoverishment.

Why is women's access to CSE jobs a reproductive issue? To answer this, we must understand the stakes and significance of CSE to our society and the influence of this field from which underrepresented groups are barred. Sheryl Sandberg, a white professional and the COO of Facebook, in her keynote address at the Grace Hopper Celebration of Women in Computing conference in 2011 said:

Technical jobs get paid a lot more and they're where all the growth is. If we continue to have so few women go into and stay in technical careers eventually the wage gap progress is going to go the other way. And we fought long and hard to get women as leaders, we don't have enough of them, but if technical skills are increasingly important for leadership in every sector of the economy, if we don't have enough women in technology we're not going to have enough future leaders.

Gender segregation in CSE is a key strategy in maintaining women's second class citizenship in this country and coercing women into doing reproductive labor. It is process of limiting options for people; it is the logics of oppression. As Coontz (2012) notes in a recent article *Why the Gender Revolution Has Stalled*, structural sexism, like the absence of paid maternity leave in the US, encourages individuals to make inequitable compromises that reproduce traditional gender roles. Gender segregation is another form of structural sexism that plays an influential role in whether or not women can exercise economic independence. "Capitalism and patriarchy function as mutually reinforcing parts of a system where the sexual division of labor stands with wage labor as a central feature of capitalism and where gender differences in wages, while failing to count women's contributions to reproduction and child rearing as 'productivity' in a capitalist

economy, reinforce patriarchy and power differentials in the home” (Rosser 2005, 3). These structures of social power thwart epistemic practices of the marginalized and normalize this violence (Fricker 2007).

Epistemic violence is an injustice which seeks to denigrate a subjugated person’s capacity as a knower. It constrains a knower from articulating, and perhaps even consciously understanding, her experiences within western patriarchal, colonial modes of knowing (Fricker 2007). It is a form of violence whereby the dispossessed must live within a world of meanings and discourses that erase and mask the systems of domination and legitimize their oppressive authority. I see credible parallels between this term – epistemic violence – and what Bourdieu (1991) calls “symbolic violence,” a means by which those in power justify their dominance and reproduce existing structures of inequality. Because CSE requires intense and on-going educational investment, I use epistemic violence in this chapter to make explicit the point that exclusionary practices deny underrepresented groups access to theory-making and CSE knowledge production. These sociocultural barriers are forms of oppression regenerated under the guise of “science” (Wylie 2007).

Ben Barres (2006) calls the naturalization of women’s exclusion from science and engineering “The Larry Summers Hypothesis,” because, as described in Chapter 2, Summers publicly stated that men are smarter than women. Barres notes that Summers is not an anomaly and this sentiment is a popular one with male scientists. Summers supported his argument that women are innately less competent at math from the works of Peter Lawrence (2006) and Simon Baron-Cohen (2003) who argue that “males are ‘on average’ biologically predisposed to systematize, to analyze and to be more forgetful of

others, whereas females are ‘on average’ innately designed to empathize, to communicate and to care for others” (Barres 2006, 1). Summers further argues that men are innately better equipped to aggressively compete in the “‘vicious struggle to survive’ in science” (Barres 2006). Steven Pinker (2005), in his book supporting “The Larry Summers Hypothesis,” makes the case that women lack innate capability for abstract reasoning based upon studies that purportedly demonstrate that there are a higher proportion of men at the high end of the scale of math, logic, and spatial tests. To further buttress his hypothesis, Pinker relies on outdated and disproven data, using 1985 data on the gendered math achievement gap while ignoring data after 1985 that shows the math achievement gap is nearly bridged (Barres 2006). I agree with Barres that Pinker’s scientific method is shoddy and that this demonstrates Pinker’s epistemic violence against women. And yet, Pinker still holds a prestigious professorship at Harvard University and continues to receive accolades and awards.

Even women who have overcome barriers to participating in CSE fields have internalized these gender ideologies to try to make sense of the lack of women in leadership positions in CSE. After I gave a talk on my research to a group of female electrical and computer science engineers, Kathy, a white mid-career CSE professional at a Fortune 500 social media corporation, approached me to discuss the dearth of women at her company. After describing her experience as the only woman on her team in a company where only five out of 800 managers were women, Kathy asked me: “But isn’t it true that men and women’s brains work differently?” I asked her to explain what she meant and she said “Isn’t there research that supports men are more logical and women more social?” Even though women have all but closed the math achievement gap (Barres

2006), the stereotype that women are not good at abstract reasoning still persists in the cultural imagination. In fact, when I told Karen, a CSE professional with an advanced degree, that studies on the math achievement gap showed that there was no such gap, she was skeptical.

This epistemic violence is painful to women in CSE fields. Anita, a professor of color in computer engineering, shared her feelings about having her intellectual prowess dismissed because of her gender:

I'm always somebody who is over here on all the [math, logic and spatial] tests [indicating the highest level within a range]. And it's very annoying to me, to be told that, you know, there's something wrong with me for being like that ... for my advanced spatial abilities. It goes the range from the official tests about mathematics tests, where they say that the people that scored at the very, very high end of the mathematics tests are almost all men. Well, it's like, "Excuse me, I scored at the top end, too." You know? You saying that – that – that hurts me."

Anita's candor regarding her emotions illuminates how sexist scholarship that promotes epistemic violence makes advanced rational aptitude incommensurable with the female gender. Conversely, when reading Anita's reflection counter-hegemonically, we can better see how ideologies of science and ideologies of masculinity and femininity are constructed to reinforce one another and exclude any threats to this ideological union. Promoting this unholy union has its rewards. Summers, Lawrence, and Pinker are all white men with enormous prestige and influence. Members of the younger generation of CSE professionals imitate their epistemic violence against women. Tara, a white early-career CSE professional, recalls:

I was talking about applying to grad school with a faculty member, ...and he said, "Well, what are some of the things you're looking at [in graduate programs]?" I said, "Well, one of the things is how many women there are in the program." He said, "Oh, so how are we doing here?" I said, "We're doing really well at this school, we're almost at 30 percent." And one of the students popped up from the back of the room saying, "We must be making it too easy then." And the professor just lets it stand.

Tara calls our attention to both the male student and male professor's participation in epistemic violence against her. The male student saw women's participation in CSE training as a decrease in the rigor and quality of the department's pedagogy. The male professor failed to disabuse him of this prejudice and committed euphemized violence by disregarding a woman's experience of speech that targeted her. The male student's logic also illuminates a structural level of violence at work here, one that strives to purge the CSE field of undesirable elements, which, in this instance, correlates with femaleness. I will discuss in the next chapter a variety of examples from my ethnographic research documenting sexism targeted at a number of my research participants in sites of CSE production and the denigration of their technical competency. These narratives offer evidence that males pursuing CSE careers benefit from a presumed competence that gives them unearned respect and an advantage in the world of CSE production, while females do not. When viewed through a multi-layered framework of violence, these stories also illuminate the tightly woven ideological strands that uphold cultural assumptions regarding masculinity, scientific competency, and disciplinary prestige.

Put simply, men and women are treated differently as cultural knowledge workers. Tara again reflects on her experiences of bias in graduate school:

Tara: I wouldn't say that anybody went out and did anything on purpose – right?

Coleen: Yeah.

Tara: But certainly there were things that I think happened that would not have happened had I been a guy.

Tara uses the logic of implicit bias theories, which stress that microaggressions can be perpetrated without perpetrators being aware of their actions. Reflecting on another level of sexism in CSE, Carol, a white senior CSE professional and software engineer working in industry, shared one of her mentor's experiences:

She was way older than me, and as far as I was concerned the system had eaten her up and spit her out. She wasn't married. You know, she didn't get the career advancement that she – she wanted, and I have no doubt would have got if she had been a guy.

The work of Carol's mentor was devalued because of her sex. This devaluation over a lifetime warrants greater explanation than bias theories can offer. Carol's metaphor of her mentor's career experience is structural and explicitly violent. Her mentor in CSE was not only devoured but also discarded. This follows historical patterns in western science, which, according to scholars of Traditional Environmental Knowledge (TEK), assimilates non-western sciences into its practices and then denigrates and denies the efficacy and relevancy of this indigenous knowledge (Harding 1986). These patterns, evident on multiple levels, reveal science in western technocracy to be not only a knowledge practice and belief but also a network of power relations that enforces whose knowledge counts.

Ben Barres (2006), a white mid-career CSE professional and a female-to-male transgendered person, found that passing as a cisman in the world of CSE production protected him from sexist bias:

By far, the main difference that I have noticed is that people who don't know I am transgendered treat me with much more respect: I can even complete a whole sentence without being interrupted by a man.

Shawna, a white early-career CSE professional and a male-to-female transgendered person observed:

But the really sort of interesting thing in all this is that I have had that perspective, you know, I was like coming from both sides. It's one of those where I'm like the classic resume studies, of where they just changed the name. ... And I can honestly say, "Yeah, guys aren't treated this way."

These stories all share a common theme of comparing the interpersonal and institutional experiences of women and men in CSE careers. Being a target of a range of violence, from being interrupted to being metaphorically devoured and discarded, is a woman's cross to bear if they persist in male-dominated CSE careers. Based on the analysis of these stories, I argue it is fruitful to categorize unconscious, unexamined bias as a form of epistemic violence that supports a larger project of institutional violence to deny women the agency, competency, prestige, and compensation in their CSE careers and to reproduce the ideological marriage of masculinity and techno-scientific knowledge production.

The Necessary and the Free

Discrimination against women, regarded as "natural," has a long history. Nancy Hartsock (1995, 187) traces the current manifestation of the sexual division of labor back to the Greeks who created a "division between a realm of necessity and a realm of freedom." Women are assigned the former and men the latter, resulting in cultures

dominated by male abstraction. The “realm of necessity” is social reproduction, what Marx referred to variously as “socially necessary labor,” “subsistence,” “procreation,” “the perpetuation of labor-power for the market,” and “the means necessary for the workers’ replacement” (Marx 1976/1990). Hartsock’s review of Greek epics, plays, and philosophies supports her argument. The domestication of the Furies, elements from an older, female-centric religion, is symbolic of women’s constrained role in Greek patriarchal society. Hartsock demonstrates how Greek men insulated themselves from nature, female power, and reproductive labor.

This tradition is still alive today in US capitalist society, especially in CSE fields, where the highest prestige is given to abstract reasoning and the lowest to feminine qualities, bodily experiences, and social relations (Hacker 1981). Hacker explains this in terms of gender: “The mind is an instrument of creation; women have been identified with the body” (Hacker 1981, 349). In the spirit of Marxist feminism, I would argue that women are identified with the material world as a whole and men in dominant race and class groups are identified as those chosen to pursue the realm of freedom, a freedom predicated on outsourcing the realm of necessity.

Philosophy and science divided the mind from the body at the same time the state divorced agrarian women and men from the land. Together, these forces combined to subjugate and reify the natural world. The reproduction of epistemic violence in the US today is critical to maintaining traditional labor roles in which men with social dominance can participate in the “realm of freedom” where material needs are regenerated by someone else and the virtual is paramount. I argue that CSE is an example of the mind/body schism par excellence, evinced in its organization values regarding the

technical and the social and an epistemological preference for the virtual rather than the material or social.

Though the gendered division of labor is a patriarchal phenomenon that predates capitalism (Federici 2004), it has also been structured by the emergence and preservation of capitalist modes of production. With the rise of industrialization, “Women can to be equated with motherhood and motherhood came to mean the opposite of production” (Sacks 1979, 24). Regardless of whether a woman has children, “women find themselves defined by the label ‘mother’ and it is a label that defines their relation to work and social relations” (Moore 1994, 99). This reductionist approach to women’s social identity supersedes the public-private boundary (Duffy 2005; McDowell 1990) and women are often steered into performing “caretaking” tasks while men are steered into more technical work in the paid labor force. Tara, the white early-career CSE academic quoted earlier in this chapter, exemplifies this perfectly:

My advisor at the time had two Ph.D. students: myself and a guy. And we were talking about this big project that we were working on, and he said, “I’m going to put Jack in charge of these things, and I’m going to put you in charge of these things.” And I looked at him and I said, “So basically you’re putting Jack in charge of all the technical stuff, and you’re putting me in charge of all the content.” Yeah, so after I said that, he just kind of stopped.

Even though Tara stuck up for herself, and managed to prove her competence as a technical scholar, her advisor still undermined her by ignoring her technical skills and calling attention instead to her culinary talents. Tara again:

So a legendary computer scientist came to visit my group, and my advisor was going around and he was saying things about each of the student’s concerns, and the other

student[s], he'd go around, you know, like, "And this is Jack, and he's graduating this year." And when it came to my turn it was, "This is Tara and she['s a great cook]." And then after stewing on it for a while, I said basically, you know, "I'm glad that you like my cooking, I enjoy it too. But I really can't have this being the only thing that you're going to tell about me to other visitors." And he responds to this, "Fine, but aren't we being a bit oversensitive?"

His act of overlooking her technical talent and relegating her status to culturally appropriate labor roles is ignored and he goes on to compound the problem with even more stereotypes about women's tender disposition. Three other participants reported being called oversensitive when confronting a male colleague about his sexism. I find these men's responses reminiscent of victim-blaming techniques and argue that these responses serve to reinforce the bond between masculine identity and technical competency. Anne Hardy, a white mid-career CSE professional and the Vice President of Technology Strategy at SAP Labs, explains it as follows:

Technical women often face and live with wrong assumptions that because they are women they can't be as technical as men.

Women in CSE must find ways to face and live with peers' and superiors' sexist assumptions regarding their talents and abilities. These women's experiences help to shed light on the mechanisms by which gender ideologies are reproduced to maintain gendered labor segregation and give males preferential access to power in CSE production.

Persisting as a female in CSE thus requires a measure of self-efficacy to delink technical competency from masculinity identity.

BODIES AND SELVES: REPRODUCTIVE POLITICS IN THE COMPUTER SCIENCE AND ENGINEERING WORKFORCE

People who care about computer technology's influence on our society must not efface reproduction from the conversation about gender segregation in the labor force. "There are some aspects of the elaborate political and economic institutions ... which can only be explained by understanding the influence of reproductive processes" (Moore 1994, 89). In this section, I demonstrate through stories from women who have children, women who do not have children, and women who plan on having children that womanhood and motherhood are social constructs, not biological destinies. However, regardless of our social identity and our relationship to the means of reproduction, all women are affected by the devaluation of reproduction.

When women talk about gender in the context of work and gather together as women, they often talk about reproductive politics. Efforts within CSE communities to combat this euphemized violence are political struggles aimed at recognizing the necessity of reproducing households and redistributing, as Kelly, a white senior fellow in industry noted above "the burden of cultural baggage" of this work (Moore 1994). Susan Landau, a white senior CSE professional and a Fellow at the Radcliffe Institute for Advanced Study at Harvard University, said:

In the forty-plus years since the start of the modern women's movement, the work world has not yet caught up to two-career couples. Whether the absence of tracks for years of part-time work while children are small (or when elderly parents need care), or the lack of work-from-home policies, the lack of flexibility tends to disproportionately affect women.

People of both genders who have reproductive commitments are at a disadvantage in a field where long hours are expected and vigilance in staying current in a field

dependent on planned obsolescence is required. Wei Lin, the Asian American senior CSE professional quoted earlier in this chapter, notes:

Another barrier is how women can keep up with the technology while taking care of their family. Traditionally women play a more important role in a family with children. This responsibility takes a lot of energy and time. On another hand, if you are in high tech, you have to constantly learn new technologies. For example, an operating system can be obsolete in 5 years, a language is replaced by another in maybe 7~10 years. The Internet in 2000 was not the same magnitude as today. That takes a lot of study time to keep current. It is very challenging for a woman who has young kids.

This supports the theory that the obsolescence of computers operates to favor the young male worker who is well-steeped in the latest technologies and systems organization (Cooley 1981). Wei Lin helps us to understand the reproductive domains of planned obsolescence. As consumers, it is hard to keep up with every upgrade to your software products and the cost of machines that have a life span of a few years and a far shorter cultural value. From a labor perspective, it is an intensification of a computer scientist's work. In addition to the long hours and the requirement to always be improving, upgrading, or rendered obsolete, CSE workers have many ways to be virtually tethered to their workplace. Sandy Lieske, a white senior CSE professional and the Vice President of Global Category Support, Serviceability, and Operations at Hewlett-Packard, explains it this way:

Women often still remain the primary care giver when they have a family, and I believe there will continue to be a struggle with managing your career and raising your family. A big part of this struggle centers on the increased workload by virtue of always being connected. There used to be a clear separation between work and home, but that

no longer exists. Although the flexibility afforded by being able to work from anywhere is often very helpful, it also can set expectations with your employer that you are always accessible.

Always being accessible to your employer sounds like a drag for anyone, regardless of gender. I argue however, that white males are culturally rewarded for playing a bread-winner role – a cultural capital incentivization. Men have built-in advantages to succeed in the capitalist workforce because they are often recipients of “the flow of family work” that enable the long hours required in male-dominated fields (Williams 2000, 3). Men are rewarded culturally for being a breadwinner in ways that women are not, and perhaps are better able to withstand an intense, combative culture at work. Women who enter male-dominated CSE fields often must withstand intense expectations at work *and* social penalties for transgressing gender role allocations in the labor force. Conversely, men suffer too from missing out on the rewards of care-taking. Sheryl Sandberg, the white senior CSE professional quoted earlier in this chapter, said:

It is absolutely true that we have taught men that their identity and respect, that only comes from their professional success. And we haven't put enough responsibility on them to get not just respect, but satisfaction and respect for things they care about in the home. And I think we've made it harder for men.

The sexual ideologies of “breadwinner” and “caretaker” are not only a major constraint on women’s life-affirming activities, but constitute a systematic form of economic injustice which impacts women by constraining their choices. In the mid-1990s, Faith, a white mid-career CSE professional and an associate professor at a technical institution, was kicked-out of her doctoral program when her advisor found out

she was pregnant. Only after threatening legal action was she reinstated to her program. Not all women face such severe circumstances, but constraints regarding reproduction are acutely felt by many of my participants, especially in the early-career stage when they are planning their future. Social reproduction may not be highly valued in the CSE field, but women practitioners are concerned with it. I wonder if part of this anxiety relates to the knowledge that they lack a “flow of family work” to support their labor-intensive careers coupled with worries about the cultural consequences of transgressing gender segregation in the workplace. Women in the training and early-career phase in the CSE career trajectory expressed anxiety when they considered their futures and the potential conflict between remaining “the best and the brightest” in their field and realizing their social reproduction aspirations:

Cynthia, a white CSE undergraduate: I mean to be married and have both my kids by 33 ... Biologically a woman’s ability and health, as far as conceiving a baby goes, drops dramatically – like drastically by age 33. You drop from maybe 80 percent, you drop down to like 50 percent, and then it plummets down, really fast, and becomes more and more dangerous – so.

Ava, an Asian American CSE undergraduate: Is that right? What if you don’t have time? What if you’re working up that ladder?

Cynthia: Oh, I will stop.

Ava: Well, it’s just not me I guess that’s not for me. Like I’d like to [have children], but then at the same time, a lot of my motivation is to get a job – a good job, because I know I’ll have to support my parents at a certain time, and, you know, if at that time I don’t have the money to support children and I need to focus on my career, then I will focus on my career.

Note how both women have social reproduction aspirations. Childrearing is even more important to Cynthia than persisting in the field, whereas the social reproductive aspiration of eldercare motivates Ava to prioritize her career. It is important to be able to talk about the ideological and political coercion that assigns women primary care responsibility without reducing the definition and discussion of reproduction to biological reproduction within white western normative family structures. Shawna, a white early-career CSE professional, expressed her frustration at the singular focus on biological reproduction in women-centered activities in CSE:

I find that a lot of these efforts to support women in computing, in particular, all the like women's lunches we had, so it's usually grad students and undergrad students, invariably would devolve into a discussion of having kids while being an academic. I understand asking that and bringing it up ... but it just happened so much There was a visiting female professor, she was giving a talk, and so we had a lunch around the same time. So she said, "Why don't you come?" And invariably at one point somebody brought up, you know, having kids while trying to get tenure. And it was the? female visitor she – I appreciate her honesty – said like, "It was really, really hard and stressful." Oh, my God. A lot of the more senior female grad students panicked. There was like discussions going like, "Oh, you know, we have to correct this. We need to have like another lunch real soon where we convince the female undergrads that it's not really that bad." [They did not] invite the one who had an adopted kid- this pissed me off, and, yes, she was at least 15 years older than the other women. But...

Coleen: Why did it upset you?

Shawna: Well, I asked about that. I was at a conference at the time, so I didn't actually attend that lunch, but it was like I was basically told it's like, "Well, you know, her perspective is from a different generation." I'm like, "So?" And then I actually got one of them to admit, it's like, "Well, she didn't actually, you know, she adopted a kid,

which is not the same as actually going through pregnancy and maternity leave.” Because, you know, the adoption process is so easy.

Shawna’s anger at the marginalization of an adoptive parent from a group discussion on reproduction highlights the fact that “discourses on rights and needs are also stratified and organized in ways which are congruent with societal patterns of dominance and subordination” (Moore 1994, 100). In efforts to dismantle institutional sexism, we cannot privilege certain social identities over others, else we risk reproducing traditional systems of power. Shawna also notes that reproductive constraints are privileged over other violence that women in CSE careers must contend with, like gender harassment and racism.

What about social reproduction in the narratives of women who are in the CSE workforce with children at home? Some women discuss the trials and tribulations of “juggling” and balancing, without mentioning how they negotiate this labor with their partners or whether they hire someone else to do this labor. Only three mentioned social reproduction services, like daycare or housekeeping services. Two participants shared the details of how reproductive labor is distributed in their domestic spheres:

Lynn, a white early-career CSE professional who was pregnant at the time: I’d still like to work and try to keep working full-time, if I can. And I know my husband wants to do that, too. So we probably need some help.

Coleen: What kind of help?

Lynn: Nanny, daycare.

Carol, a white mid-career CSE professional with children: I hate to cook. I don’t cook. Um, you know I can buy raw ingredients and I can put them on the table. I’m pretty good at that. Um, I don’t, I don’t house clean. Writing checks, someone else comes and cleans the house. I’ve

recently discovered that you can take your dirty laundry and they will wash it and they will dry and they will fold it. I feel the same with babies Both my kids were day care babies which was great.

Egalitarian partners are also critical to women's success in CSE. Sheryl Sandberg, the white senior CSE professional quoted earlier in this chapter, explains:

The data shows this really clearly, if you have a heterosexual couple a man and a woman who are married and have kids and both work full-time, the woman will do twice as much housework and three times as much childcare as a man. This is not as true in same-sex couples. So if you're at all considering that, go that way. But – oh I'm not joking – but if that's not an option for you, it is not too early to think about it. The single most important decision you will make that impacts your career is whether or not you have a life partner, and who that partner is – it is more important than anything else you do.

Sandberg's advice echoes Linda Hirschman. In her 2005 article *Is Your Husband Worse Than Larry Summers?*, Hirschman implores: "I recommend that women start by refusing to play their gendered role, preparing themselves for lives of independent means, bargaining from this position of power with the men they sleep with" (p. 2). Preparing oneself for a life of financial independence in an economy predicated on gendered labor segregation and the effacement of reproduction requires guts, grit, and risk-taking.

Sandberg again:

I wish I could tell you that if you're ambitious you won't pay a price... I think there's a price to pay for women where we are right now, but we need to be ambitious anyway.

Sandberg also offers an answer to Valerie's question quoted above about how women

who work in CSE manage to compete in such a high-pressure culture with kids at home:

If you were to talk with every senior woman out there, they either have husbands like mine who are super supportive or husbands who are supportive enough to even stay at home, there are no exceptions.

Unfortunately, I was not able to talk with every senior woman in the CSE field, but nineteen out of my forty-two interviews were women in either the mid-career or senior phase of a CSE career. Sandberg is not exaggerating; my research supports her claim that there are no exceptions. Of these nineteen women, those who had children all credited their supportive male partners for their persistence:

Carol, the white mid-career CSE professional quoted earlier in this chapter: Okay, so I never wanted children, not ever and in fact so much so that when I got pregnant my family assumed it was an accident. But Bruce really, really, really wanted children, so we had an arrangement. I would take them for the first nine months, and he would get them for the next eighteen years.

Coleen: Wow, okay. And he'd be like a stay at home dad or like primary care?

Carol: Primary caretaker. Primary because I know about me and cooking. I know about me and babies, you know, it's not, not my thing. But, um, there's this thing called "hormones." I was entirely, entirely unprepared for how much I would adore them. But I didn't want to work any less at all. So when my son was born, I – what day was he born, Monday and I worked Friday. And there was such an exciting project going on at work and I didn't want to miss a minute of it. I just completely loved it. I didn't love him any less but I just, you know, anyway, poor kid. But you know he'll live.

Diane, a senior foreign national from Europe CSE professional and an academic leader, discusses how she and her husband negotiated a move across country for her career advancement:

So, at that point he was not as driven by his career as I me, and so at that time we had two very young kids, and he had a job in Madison, and he had switched jobs in Madison a lot; he kept switching jobs. And so he figured, well, he could just as well just switch jobs again. So he quit his job in Madison and we moved out west... he did part-time from home, and that was great because we had young kids, and he was at home part-time working.

The early- to mid-career CSE professionals with male partners, regardless of their status as parents, had also picked partners who were supportive of their careers:

Coleen: You were mentioning how you might want to move to another environment within the U.S. to explore a different culture – will you make that decision with your partner? Or are you guys going to have separate tracks?

Regina, a foreign national early-career from Asia CSE professional: He doesn't believe in long-distance relationships, so he will have to move with me.

Tara, the white early-career CSE academic quoted earlier in this chapter, reflects on negotiating the job market with her husband, who also earned his Ph.D in CSE:

So my husband had said that he was willing to go wherever I thought I needed to go, because he thought that I cared about my career more than he does on his.

Hirschman's advice about financial independence has been taken to heart by two participants:

Ava, an Asian American CSE undergraduate: Oh, well, 'cause my mom, she had my sister and I when she was

really young, and it was just really difficult for her supporting us while trying to go and, you know, climb up that business ladder. I have no idea what she does, I just know she worked really, really hard in life, and she's made a lot of sacrifices for it, and I appreciate that. But I just feel like some of the struggles we went through, were not necessary. And if I have kids I want to be able to devote my entire being to raising my kids, and honestly with like engineers work crazy hours, too. Like the demand at an engineering job is just ridiculous, and I feel if I'm not in a secure position where I feel like I could take time off for that, I would probably want to just focus on getting to a more secure place first. Also I'm okay with adopting, I will adopt a kid, and it's going to be okay.

Jeannine: Better for your body, too. [*Group laughter*]

Becca, also a white early-career CSE professional: It seems that academia isn't as bad as I thought. I don't want to be one of those crazy people ... you know, the super mom ... 'cause I definitely still wanna bring in a paycheck. I definitely wanna have my own career because my mom became a stay-at-home mom because of me ... she wanted to go into law and she never did because of the kids. And so she's always like, "Don't let a man stop you. Do not let kids stop you" I didn't get a Ph.D. just to get a husband.

These women's narratives show that the relations of reproduction are central to women's participation in CSE. Women who persist in this non-traditional field must not only buck status quo gender norms in the sphere of production but also in the sphere of reproduction.

Conclusion

In this chapter, I asserted that science and technology are two things they are not usually identified as: both cultural practices and reproductive practices. I supported this claim with stories from my participants about their reproductive aspirations and practices. The myth of objectivity in scientific practice functions much like the myth that

reproduction (and its attendant role allocations) is a natural, not cultural, phenomenon. Both naturalize inequitable power relations along lines of gender, class, and race. Both technological labor and the social labor of reproduction in the US operate from similar ideologies, which rely on epistemic and euphemized violence to reproduce structures of inequality. Women who persist in CSE must work long hours, combat epistemic violence (in the form of microaggressions and gender harassment), and make strategic decisions in their personal lives about whether or not to partner and whether or not to have children. Those who do have children must successfully negotiate non-traditional role allocations in their homes in order to persist in their non-traditional field.

In the coming chapters I will continue to document the costs and benefits of CSE work to women's lives. I advocate for the desegregation of CSE not so that more women can experience the "dog on a leash" lifestyle of an intense IT culture. Like Rapp (2001), I placed reproduction at the center of my analysis of the broader domains of CSE. I do so to assert that CSE culture, which aims to exalt itself into the realm of freedom where the virtual and artificial are considered more valuable than the material and social, reflects our US culture. The necessity of social reproduction is denied and concealed in US workplaces. Public policy and discourse and people in power ignore it too. This is why it is especially important to understand euphemized and epistemic violence within the context of the production of technology artifacts because these artifacts have a great reach in our society and "reflect and perpetuate the paradigm underlying" society's dominant belief system (Davis Floyd 1992, 46-7). Mohanty (2003) argues that "the lives of marginalized communities of women provide the most inclusive paradigm" for operationalizing reproductive justice (Mohanty 2003, 231). Women in CSE are elite yet

marginalized in the places where they spend the majority of their time and the organizations in which they invest their life force. Their dissonant experiences when compared to those of their male colleagues highlight the ideological bond between masculinity and technology and also the fragility of the male identity (Harding 1986) in sites of CSE production that require protection from people with other gender identities. Can women's grit, tenacity, and struggles in CSE help inform the struggle to enact reproductive justice for all women?

The 2011 Grace Hopper Conference I attended had a visionary theme where participants and speakers were encouraged to ask: "What If?" This has inspired me to ask the following questions: What would a world look like where all women were financially independent and free from the threat of poverty? What would meaningful work for all people look like and what relationships and labor allocations would support the regeneration of human life? What if we took my participants' experiences to heart and reframed work/life balance in terms of a binary opposition and a debate structured in terms of compromises and trade-offs? What role would computer artifacts play in this more just world? Based on the evidence I presented in this chapter, I conclude that the ubiquity of CSE technology artifacts in our culture has not helped our society make great strides toward either economic or reproductive justice. To remedy this, we must continue to consider reproductive justice within the context of a society that fetishizes CSE technology and reveres its makers. Transforming the value of social reproduction requires imagining what CSE technology offers "the realm of necessity" (Hartsock 1995, 87) and those who labor within it. Transforming women's underrepresentation in CSE could very well transform dominant social values and the artifacts we value.

Chapter Five: Technically, “You’re Different and Different Isn’t Free:” Gender @ Work in a Dot Com World

In early 2001, Tim [name removed] became the Vice President of US Operations of Amazon.com and my new manager. In Tim’s first team meeting with his direct reports, he told a story about parading about our office building naked. He said a security guard asked him to put his clothes back on. Apparently, he was so tickled with this escapade that he returned to his office and called his 23-year-old female executive assistant at home at 9:00 pm to share it with her. I was disgusted and creeped out that he shared this story at our meeting as an “ice-breaker.” Three months later, I was contacted at home by Anne [name removed], the Director of International Site Development of Amazon.com. I had never met her before but my friend had told her about Tim’s “naked in the office” story. She had just heard Tim make “an alarming sexual joke about his wife” at a company-wide meeting hosted by Jeff Bezos, the founder of Amazon.com, and she wanted me to confirm the “naked in the office story” before she spoke to the Amazon.com board of directors about his offensive behavior.

INTRODUCTION

The events described above were the impetus for my attrition from the CSE workforce and the initiation of legal proceedings against my former employer. This naked parade of power was the most absurd thing I had witnessed, but not entirely out of character for an organization with male bravado and bonding rituals that were cultivated and fostered as the company moved from being a start-up to a Wall Street darling. I begin this chapter with this story for two reasons. First, it encapsulates themes I want to depict and explain: gender and sexual harassment, gendered labor value and practices, and the

ways in which women respond to workplace violence. This autoethnographic evidence and the supporting claims made by the participants of this study dispute Fitzsimon's (2002) claim that male CSE workers do not actively try to oppress women in the workplace. Second, as a feminist ethnographer, my goals are to share the same plane as my participants and allow the reader a fair opportunity to interpret my analyses of my data through a clearer lens of my experiences and standpoint. Sharing one's story of discrimination is not easy and I am indebted to those who participated in this study for their candor. As I illustrate below, speaking out against violence in CSE labor sites can lead to its escalation. My labor experiences have motivated this research and fuel my goal to understand how gender dynamics and hostile environments operate in sites of CSE knowledge production, toward what ends, and for whose benefit. Most of all, I seek to better understand how women navigate high-tech fields, marked and constrained by difference, and how they evaluate their experiences of being outnumbered. This provides the context for Chapter 6, in which I explore the strategies women employ to persist in CSE.

This chapter begins with a symbolic analysis of the computer scientist that exists in our collective imagination - the geek stereotype and its shifting signification. I adopt Robbie E. Davis Floyd's (1992) concept of the rite of passage to unpack the meaning and power of the geek mystique and lay the framework to interpret participants' stories of discriminatory labor values and practices and bonding rituals solidifying male hegemony. According to Davis Floyd (1992), rites of passage have a four-fold purpose: 1) to give humans a sense of control over their natural environment; 2) to protect initiates during their transition from one social status to another, while tapping into their vitalizing energy

and power; 3) to cement core values of the society she or he is being initiated into through repetitive messaging and emotional and physical manipulations; and 4) to continually renew and celebrate core values to insure the vitality of belief system and its regeneration. Davis Floyd employs this analytical tool in her deconstruction of power in the medicalized ritual of birth in the US.

Here, I adopt it to apply to better understand the social construction of CSE workers who create and maintain computer systems in the US. I provide data to support my interpretations of male bonding practices, hostile behaviors, and the formal, hierarchal “canonical approach to programming” (Turkle and Papert 1990, 141) as rites of passage for the CSE laborers who make US technocracy possible. I argue that ritualized rites of passage signal the social matrix from which social values in CSE sites of knowledge production spring. The core values developed and reinforced via these rites relate to formal modes of thinking that stress control, efficiency, and compartmentalization of knowledge. These compulsory logics have implications for CSE commodities, organizations, disciplinary norms, and demographics, as well as general society.

Finally, I highlight women’s responses to gender dynamics in CSE within the context of their social identities and career stage. I elucidate the mechanisms of power by which social identities are ascribed meaning and the ways these mechanisms can be both celebrated, denied, and mystified and why. I offer evidence that women’s underrepresentation in CSE is due not only to gender bias and geek stereotypes, but also harassment, exclusion, and hostile environments where threats of violence try to silence reports of discrimination. I make central *practices of power* in CSE communities and

define and operationalize them in Ortner's (1996) terms: "domination, control, violence ... or on the other side: rage, pain, humiliation, collaboration ... struggle, resistance, revolution" (p. 4). I explain how the internal processes by which technologists are acculturated in CSE organizations and the ways in which marginalized members persist are implicated in the practice, production, and application of CSE technology in US society.

GEEK MYSTIQUE

In Chapter 4, I explored how several dimensions of CSE culture indicate that the field is disinterested in social reproduction. As further evidence to support this claim, I decode the cultural meaning of the geek stereotype to better understand how it symbolizes qualities of a particular kind of laborer who plays an important role in extracting "untapped" dimensions in the social reproduction sphere. I then examine how the image of the geek is shifting. I interpret the meaning, influences, and implications of this shift within the context of the US political economy and gendered labor relations.

Karen Panetta, a white mid-career CSE professional and professor at Tufts University, described the geek stereotype in her interview for the Anita Borg Institute's newsletter:

What you see on TV is that brains don't matter and pretty girls can't be smart. The mass media portrayal of tech workers isn't any more nuanced, you sit in the dark, eating pizza and playing video games.

Social psychologists argue that the geek stereotype plays a role in the lack of diversity in CSE because it deters those who do not want to conform to this stereotype from being initiated into its culture (Cheryan 2009). Our culture harbors a common

stereotype that CSE practitioners are anti-social white males. Leaders in the field and social scientists who are concerned with women's underrepresentation in CSE are keen on dispelling this stereotype in the hopes of that girls and women will be more willing to invest their talents in the field. I agree with them; this stereotype is harmful to those in the CSE field and harms efforts to recruit a diverse group of participants to the field. But the stereotype cannot simply be dismissed because, upon examination, it yields some deeper insights into the production of CSE technology and its applications.

The geek stereotype operates on two co-constitutive levels: 1) symbolically and 2) organizationally. First, key descriptive elements of the stereotype – namely, that the geek is in the dark and more comfortable with machines than people – were discussed by five of my participants in ways remarkably consistent with Dr. Panetta's description above. Lynn, a white early-career CSE professional working at a prominent CSE corporation, explained the geek mystique as follows:

Lynn: I think part of [the problem of women's underrepresentation in CSE] is self-selection, because of the perceived culture, and because of the perceived stereotypes.

Coleen: Stereotypes of women, or stereotypes of computer science?

Lynn: Stereotypes of the job. That I'm going to be sitting at a computer all day and, you know, that's not something I want to do. I'll be in a dark corner drinking my Mountain Dew and eating pizza.

Becca, white doctoral candidate in CSE, had a remarkably similar description of the geek stereotype: “[CSE has] a negative persona attached. It's radical. So, it's a guy in the basement eating pizza and Mountain Dew.” The content and the consistency of the

language used to describe the stereotypical image of a computer scientist strike me as a sign of a rite of passage, whereby an initiate is separated from a preceding social state (Davis Floyd 1992). The geek stereotype symbolizes how “competent” CSE professionals move from the social world to the virtual one and, in doing so, signal their choice to prioritize the latter over the former. Other social activity is discouraged and a myopic focus on CSE is expected. Tony, a white male mid-career CSE professional and a manager in industry, explains how this manifested in his initiation to the field:

Tony: I remember really clearly my first class at Brown [University] in computer science. There was this guy who was on the basketball team. For all I know, he was on a basketball scholarship. And I remember the professor saying to him, “You have to choose - computer science or sports. You cannot do both.”

Coleen: The CSE teacher said that?

Tony: Yeah. But what if this poor kid was on a scholarship? Like, what if he couldn't choose? Like, I have a lot of memories like that where it's like that - talk about non-inclusive!

Tony’s undergraduate CSE professor is imparting technical wisdom and, in return, he expects disciple-like reverence in return. This is an example of a rite of passage in the classroom that encourages one right way of doing CSE to the exclusion of developing other talents. This pedagogical approach also mutes students’ curiosity about the integrated computational elements of a program (Turkle and Papert 1990). This translates into labor market practices where devices and systems can be integrated into a worker’s labor practice without knowledge of their internal workings. This labor practice, called “black boxing” by CSE practitioners, mirrors how the inner workings of the CSE

field appear to the majority of CSE commodity consumers: opaque and darkly veiled in mystery.

According to Katz (2000), geeks invented and maintain the Internet and the World Wide Web, “the systems that run the world In this era of Geek Ascension [geek is] a positive, even envied word” (Katz in Hakken 2003, 6). The exalted status of CSE professionals reflects a broader social consciousness that is growing more and more deeply embedded in the logics of formal abstract thinking and centralized systems of control. Therefore, I use the term *geek mystique* instead of geek stereotype to invoke the sense of a shift in the geek’s prestige in US social imagination. For reasons similar to Marx (1976/1990), who felt compelled to use the word “fetishism” to describe his thoughts on labor value, I wish to convey a sense of the “misty realm of religion” (p. 165) operating within the cultural milieu of the CSE worker. CSE is a lucrative field with class rewards of power; practitioners’ labor holds meaning in our culture because their creations are everywhere and are consumed by everyone. However, *very few individuals are CSE specialists*. There is a strategy to its mysteriousness. Programmers describe what they do in terms of art, science, and black magic (Ensmenger 2010). Programming is a language that sets CSE practitioners apart from everyday mortals who depend on technology in every aspect of their lives and rely on tech whizzes for their entertainment, work, communication, and knowledge production. We are a society highly dependent on CSE laborers.

Even before Jackson Katz published the *Geek Ascension* (2000), in which he refers to computer science as “the high priesthood,” I called my IT colleagues (all of whom were men) “the high priests of technology” because they had highly-valued, little

known knowledge, an insular community, and lordly attitudes. I am heartened that another scholar deeply invested in understanding the power and cultural significance of the CSE labor force has echoed my religious metaphor. Members of the CSE community also use religious metaphors to describe their labor. For example, in the technology start-up sector, technologists who build branding and excitement around new products are called “tech evangelists.”³ CSE professionals are angels of industry and “progress” but are still vulnerable to the austerity measures of senior management who answer to Wall Street. This produces a complex negotiation over labor value and power relations that strongly influences the bravado and peremptory nature of CSE cultures.

Part of CSE workers’ power is lies in the mysterious nature of their work, but not all practitioners are satisfied with this. Lynn, the white early-career CSE professional quoted earlier in this chapter, is frustrated at the public’s lack of interest in her career:

The perception is that you’re crunching numbers and writing code, and it’s not even clear what it does [for society]. So now when I tell people I’m a software engineer, they say, “Oh,” next topic. They don’t even say, “What do you do?” There’s so many cool projects that people are working on here, you know, all these different things but people just hear “software engineer,” and they’re like, “Oh.” There’s not the rest of the conversation there ... they think, “Oh, I probably won’t understand the answer if I ask what they do anyway – so.”

I agree in part with Lynn’s assessment of this type of reaction to her job. The mystery surrounding CSE workers’ labor practices enhances their labor value and prestige. But it frustrates Lynn because she seeks for her work to be seen as something that makes a social contribution and to engage others in this work. Later in our interview,

³ See http://en.wikipedia.org/wiki/Technology_evangelist.

Lynn told me she does think CSE has a positive social impact but that it is not “advertised.” I wondered in Chapter 3 if corporations and engineering schools spend money advertising the potential social impacts of CSE technology in order to cover up their organizations’ less savory associations and collaborations. Why has this public relations campaign failed to take hold in our cultural imagination? I think Lynn’s story points to a shared element in both the older version of the geek and also its recent makeover: in the “collective imagination” (Fricker 2007, 15), CSE knowledge production is divorced from social concerns.

While the media certainly perpetuates the geek mystique, they are not alone. I argue that the geek mystique is carefully cultivated in the workplace as a means of status performance and power negotiations between CSE laborers and corporate bosses. For example, a white male mid-career CSE professional and executive at Cisco Systems Inc. told a story at the Grace Hopper Celebration of Women in Computing conference about supervising two groups of workers – software engineers and hardware engineers. In a forum on the business case for increasing diversity in CSE, he described that before big launches, the male-dominated hardware team would often discover a big bug shortly before launch and want to hold up timeline. As their boss, he would refuse to push back the launch date and the hardware engineers would very dramatically stay in office all night and day, not shower or go home, eat pizza and drink soda, and “heroically” deliver on time. Afterwards, the boss would give them all awards. Then the female director of the software team told the boss: “Do you notice my team goes home at 5 everyday, including during launches, and we deliver with no problem on our deadlines, no drama, and no awards?” The boss was stunned to reevaluate the situation in this light. “The women-led,

more diverse team made the work look effortless – on time, every time.” The male-led hardware engineers created crises in order to look like “heroes.” Their performance of heroism included willful denials of self-care and healthy means of daily reproducing oneself (for example, bathing, sleeping, and eating nutritiously). I was very familiar with these types of histrionics in my interactions with software architects and engineers at my former job.

At Amazon.com, I was a project manager on an interdepartmental team with a business developer, a real estate agent, an architect, and a lawyer – all of whom were male and all of whom were very respectful and kind toward me. The IT director, however, taxed me greatly with his dramatic posturing for vice presidents at the company and his combative, dismissive behavior toward me and my female boss. Instead of being an anti-social analytic like the pervasive geek stereotype, he was bully, a show-off, and an obstructionist, whom, with the benefit of hindsight, I now recognize as a new incarnation of the geek. I also found his behavior was gender specific. When my female boss quit and was replaced by the man whom I describe in the fieldnote that opens this chapter, the ritualized hazing that had characterized my and my boss’s meetings with IT for over three years stopped. My male boss Tim was welcomed warmly and Tim quickly learned that his acceptance by the IT team grew the more he marginalized me, now the only woman in the room. I suggest that the gendered, ritualized practices of the high priests of technology who work to create and maintain our knowledge economy are for male initiates alone, leaving women to navigate CSE organizations against the current and without respect, support, or valuable networks of support.

Some male CSE leaders argue that the geek stereotype in CSE is passé and look for new solutions to create more welcoming environments. “What’s happened in our field is that the [geek] stereotypes are no longer accurate, but the perception still exists,” says Ed Lazowska, a white senior CSE professional and the former chair of the CSE department at the University of Washington (Lazowska in Denman 2010, 1). “I would really love research that points to intervention that we haven’t thought of yet – something that we and others in the field could do that would have an even greater impact” (Lazowska in Denman 2010, 1). Lazowska’s argument supports research by Chu (2005) and Faulkner (2000) that shows that the specific norms and behaviors that dictate performances of masculinity in CSE cultures need further study. The geek mystique has shifted from soda choice and social awkwardness to a peremptory bravado reminiscent of the stereotype of the nouveau riche. I document this shift to not only explain the workplace environment that women CSE professionals must navigate in order to persist in their chosen field but also argue that we are in a new stage of technology evolution in which the power that initiates of CSE wield signals a new pattern of social relations (Hakken and Andrews 1993). This new stage is characterized by a white male hegemony over ideas and artifacts that have reached such a widespread level of dissemination that CSE initiates feel a sense of hubristic control over the paradigms of reality perceived by the majority of people in the US. It is this hubris that compelled me to embark on a deeper analysis of masculinity at work in high-tech environments at three different stages of a CSE career. I seek to define and disrupt this dominant paradigm created by and for the dominant classes in the US.

In the following sections, I present stories from women about their experiences navigating all levels of male-dominated culture of CSE in order to document the internal processes by which CSE workers are initiated into this influential labor force and to elucidate the shifting parameters of power at work in CSE environments as perceived and experienced by workers marginalized by their social identities. This analysis, premised on the “outsider within” perspective (Collins 2004), offers new areas of intervention for increasing diversity in CSE by both transforming interpersonal relations within the field and challenging epistemic boundaries. I am happy to destabilize the traditional stereotype of the geek, characterized by Star Trek posters and pyramids of Mountain Dew cans in cubicles and labs. This stereotype is evolving to reflect the foothold of power that CSE professionals have gained in US society. Unfortunately, the evolution of the geek is not following a linear progression to egalitarianism but instead signals that the power of the “pale male” (Lazowska 2002) is still vigorously upheld by “gender ideologies and other forms of difference such as race and class, which draw on social identities ... based on ‘naturalized’ cultural conventions” that regenerate dominant power structures and systems of inequality (Moore 1994, 92).

LABOR VALUES AND PRACTICES

In Chapter 4, I reviewed feminist organizational culture scholarship, which makes visible how institutions are structured around unexamined masculine principles that work to exclude women and impede their success and advancement. In this section, I expand upon this theme to focus on these gendered and gendering labor processes within CSE sites of training and production. I realize some readers may bristle at my argument that women experience a range of sexist violence in cultures of technology. I have had many a

conversation with women CSE practitioners that involve a disavowal of any bias or harassment followed by a story documenting them. I share stories that offer insight into the reasons and function of denial. Generally, I interpret this cognitive dissonance as part of a ritualized initiation process whereby the core values embedded in sites of CSE production are internalized by the initiated, overriding critical analysis borne from personal experiences. In the following section, I review certain work practices in CSE that connect to the larger role CSE technology plays in the *body politic* (Scheper-Hughes and Lock 1987), demonstrating the core values which the frequent use of computers imbue in consumers and producers alike: constant observation, intense evaluations of others, and the devaluation of sociality.

Conscious and Permanent Visibility

In Chapter 3, I discussed how consumers of CSE technology sacrifice privacy for the convenience and pleasure of the tools CSE produces. Producers of CSE technology also experience this phenomenon. Some CSE corporations use proprietary open-source software to allow employees to oversee their peers' work. Lynn, the white early-career CSE professional quoted earlier in this chapter, defines this work style as "a cultural issue that does not appeal to women." She explains her feelings further:

So one thing that's been hard for me to get used to is how public everything is here. At my job, everybody can know everything about what anybody is doing. None of my work is private to me [I]t's available for anybody to review, and people do; they pop in and say, "Oh, I don't think you should do it that way, you should do it this other way," and it's kind of unnerving to have your work so on the line like that – so available for everybody to see all of your mistakes. And then when I do submit it, if it did cause any problems or errors, or whatever, I have people right away over the chat thingy saying, "Hey, you broke the tree. You

need to fix it.” And then the next question is: “How fast [can you fix] it, because the tree” – where we keep all the code, it’s open-source, and anybody can download it at any time. So we don’t want people to be able to download broken code. So they want it fast. And if you can’t fix it fast, then you need to take your change off, and then fix it, and then put it back on. And it’s just kind of like – it’s very public.

Lynn frames what could be interpreted as a team-oriented, collaborative approach to work in terms of lack of privacy and peer criticism, which spurs speed-ups in productivity. Lynn says this “cultural issue” is not intended to exclude women, but inadvertently has that effect because it is not an anonymous process and can make underrepresented group members feel that much more conspicuous within the organization. Thus, in addition to being tethered to one’s mobile CSE devices, CSE professionals are accessible to their employers through competitive jockeying and peer oversight. Companies benefit from these practices because they foster a sense of urgency that gets work done more quickly. This scrutiny can stress even the most accomplished CSE workers, like Lynn, who disdain the spotlight and would prefer to work without being constantly observed. Thus, in both the use and creation of CSE technology, our actions are publicized and under constant observation.

The mechanisms for observation extend beyond the design of communication tools to the design of CSE buildings. For example, the first thing I noticed when I walked into a Bellevue, WA office at Microsoft Research was key-carded turnstiles and an administrator who asked for my state-issued identification. Upon entering, I looked up. The ceiling extended many floors up and was ringed by beige hallways and glass office doors. The design reminded me of walking out of the elevators in the Paul Allen CSE building on the University of Washington Seattle campus, where the building is arranged

in a circular design and those in the center can observe inside the interior of each office. I realized that these buildings' designs eerily mimic Foucault's description of the Panopticon, an architectural design for prisons so prisoners must always assume they are constantly observed (Foucault 1977). The Panopticon keeps inmates in a "state of conscious and permanent visibility, a systematic functioning of power ... a way of defining power relations in everyday life" (Foucault 1977, 201-5). Computerized systems of power help government and corporations monitor CSE consumers and the design of CSE platforms and workplace architecture reflects that one of CSE's core values is "conscious and permanent visibility." I asked one participant who had just received a promotion at Amazon.com if she was getting an office. "No," she replied with a hint of disdain for such a concept, "we work in a fish bowl – just a big room with a bunch of desks." Facebook designs their offices this way too: "At Facebook, we work hard to be nonhierarchical. Everyone sits at open desks in big open spaces – no offices, cubes, or partitions for any of us" (Sandberg 2013, 78). At Google's offices in Seattle, WA and Mountain View, CA, I saw evidence of minimal partitioning between office desks and small offices with two to three people in each and windows for walls.

These working conditions in academic and corporate sites of CSE knowledge production reflect that the core value system of the modern computer is "at once surveillance and observation, individualization and totalization, isolation and transparency (Foucault 1977, 249). The computer has increased the power of the ruling class by weaving the Panopticon into CSE workers' everyday practices of creating technical products and into consumers' everyday lives through the use of these artifacts.

Interviews as a Rite of Passage

Another aspect to labor practices specific to initiation into the CSE workforce is the painful process of hiring interviews at technology corporations. Carol, a white senior CSE professional and software engineer, describes the interview process at her former job:

Carol: When I see sexism, or, gender norms getting in the way, I get cranky. At Digital, we were hiring the very best people, and we were such a hot team, and the economy was tanked, but we were hiring like crazy, so we were really attracting lots of great candidates. And we just drove the hell out of candidates, and made Google interviews look easy, to be honest with you.

Coleen: Yeah, I have heard some really scary stories about the Google interviews.

Carol: We would interview all day, ... and then we would get together in a room, and we call it a "Town Meeting," and would dissect the candidate and decide whether we wanted them or not. And we interviewed this gal, and she was – she was really good. And we get into the Town Meeting, and, uh, the conversation went like this: “Well, I think she's really good.” Um – uh, and, you know, so and so, “you're an OS, you know, a file systems person. What'd you think about her file systems?” “Well, I don't really know if she really knows file systems.” “Oh, you know, you have asked her some questions and she couldn't answer?” “Well, no.”

Turned out what was going on, is the guys were not asking her questions, 'cause they didn't want to hurt her feelings. And then they were getting into Town Meeting and saying, “Well, I don't know if she can really do the work.” And I'm like, “Hello!” Cranky-time.

Because she was a woman, they were going to be gentle and nice. But then they would get into Town Meeting, and they had no awareness that this bias effect, and they had only kind intentions. You know, let me just be super clear about that: there was no unkindness intended. But the

bottom line was, when they would get into Town Meeting and they'd say, "Well, I don't know if she can really, you know, encode binary trees." And I said, you know, never again.

Well, [the women] got hired, because we'd go at it in the Town Meeting and they would say, "Well, I don't know if she can really do this." And I'd say, "I do."

I see a tension in Carol's account. On one hand, she seems proud of her team and their ability to attract and grill candidates intensely during the process of evaluating them. On the other hand, she understands that this process is gendered by her male colleagues' bias against women. "Driving candidates hard" is a ritual that her male colleagues reserve for male candidates. Carol insinuates that they did not extend this hazing ritual to female candidates out of chivalry. Later in our conversation, Carol shared evidence that seems to dispute the claim that her male colleagues treated the female candidates with kid gloves. After Carol made a feminist intervention by interrupting bias and hiring two female candidates, these women confided to her that they had gone home from the interviews and "sobbed." This is another instance of cognitive dissonance, in which Carol vocally objects to her male colleagues' negative stereotypes about female candidates' competence but does not make a connection between this and the aggressive and grueling hiring process. I interpret the tension in Carol's account of CSE interviews as a good example of Smith's (1990) concept of "rupture," which, as I described in Chapter 1, is the tension that arises from negotiating social relations both as a member of a dominant group and as a marginalized group member. By employing bias theory to interpret why her male colleagues' dismissed female candidates, Carol could make a successful intervention. However, the individualistic orientation of bias theory constraints her ability

to critique the evaluation process itself and its function as a tool to renew and revitalize core values of aggression and male-bonding in her CSE workplace.

Unlike Carol, Janice, a white senior CSE professional working in academia who holds positions on the boards of several well-known CSE corporations, makes the connection between the undermining of women candidates and the structure of the interview process:

This year one of our students who actually – a female CS grad who ended going to work for Microsoft, she interviewed at four tech companies. She didn't meet a single female in any of the interviews, not one. Moreover, the way both tech and finance companies tend to interview is incredibly obnoxious to many young women. So basically you walk into the interview and the person may not even say "Hello." And then they'll say, "I want you to know how you would program a red black tree that did such and such." It's awful. It's just like, so you know, I actually heard a good question that somebody from Microsoft – they were doing some kind of junior intern program that they do for students in their first summer or second summer. And the question they were asking them was: "Tell me how you would explain Java or another object-oriented language to a five year old." That is a good question, 'cause it's not stressful. It's not something you have to study for, but it really shows how you think about object-oriented languages. And it also shows what your communication skills are. And so I think the first thing that needs to happen if you want to recruit more women is you need to change the interview process.

In this anecdote, Janice presents the worst and best practices for evaluating potential initiates for the CSE workforce, stressing that the common practice of hazing job candidates needs to be transformed. Within the context of other labor practices common in the CSE field, hazing candidates in the interview process makes more sense. It is the first of a series of rites of passage that convey repetitiously to initiates that

excellence is defined not only by one's competency but also by one's ability to withstand derision and hostility.

Precision as a Weapon

I describe in Chapter 6 how many women who persist in CSE take pleasure in particular aspects of their technical work. One aspect I noted among some of my participants was pleasure in the precision that coding requires. However, a dark side of this aspect also emerged. The need for control and precision in CSE work can lead to a combative climate that is differentially harmful to underrepresented groups. The following quotes show some of the ways in which this combative environment is generated and how CSE workers navigate it, often with serious costs to their mental and physical health:

Diane, a senior foreign national from Europe, CSE professional working in academia: I think also our field – because we're computer scientists, we're very precise, and I think we badger each other too much about precision. Like if something isn't precise, you're going to be challenged, you know. And I think it's meant well, but I think it's wearying.

and:

Tony, the white male mid-career CSE professional and a manager in industry (quoted earlier in this chapter): By the time I got there [to] Microsoft it was still pretty abrasive. Like very abrasive. Like there's even a class there called Precision Questioning where basically you learn how to ask lots of questions because asking a lot of questions is a good way for you to understand something and to suss out if there are parts of something that haven't been thought through enough. The whole class was on asking high-level questions like zooming in on certain precise details and it's like the most annoying thing you can do conversationally. It's like kind of like a level of abrasion that is accepted as

commonplace that is not acceptable in most normal social situations.

and:

Janice, the white senior CSE professional working in academia quoted earlier in this chapter: My friend told me about interviewing at MIT. He told me that when he gave his talk, two of the most [new] people in the field came up to – about his thesis research – came up to him at the end – I apologize for the language I'm going to use – and said, “Well that was really just a whole bunch of little pieces of shit rolled into a ball.”

Coleen: Oh my God! That poor person.

Janice: So my friend, bless his heart, said “Yeah, that's what I think about your work, too.” I mean, can you imagine you were interviewing a candidate you were trying to hire and that's what you tell them.

Coleen: I can't even imagine.

Janice: I would say that that kind of thing would just never happen at the places that I've mentioned as good places. Just that kind of put-you-down, adversarial rudeness. And, uh, really it's trying to intimidate people.

Coleen: It's kind of a bully mentality.

Janice: It's a bully mentality, yes. But there are computer departments where they genuinely want everyone to succeed - both students and faculty. And they do tend to be places that are more attractive to females.

and:

Anne Condon, a white senior CSE professional and head of CSE at the University of British Columbia, quoted in her Anita Borg Institute newsletter interview: What I hear from some junior academic women is that they do not feel that their work is valued or that they are truly included in the computing research community. Shoddy practices in the research culture, such as hyper-critical evaluations, can have a disproportionate negative impact on women or others who may already be questioning whether they

belong in the field.... those early years needn't be so hard! I encourage all of us who are more established in the field to take mentoring seriously, and to model and publicly recognize productive and respectful exchange of ideas.

and:

Tara, the white early-career CSE professional working in academia quoted in Chapter 4: I was up for tenure this year, and that's been a whole 'nother kettle of fish.

Coleen: Oh my, that's a stressful year. How are you holding up?

Tara: Things are looking positive right now, so that's helpful. I had a negative letter. I mean really negative, as in there was a line in there – I think my favorite line was something on the lines of: 'In summary, I don't see that any of the work that Tara has done has had any impact, or will have any impact in the future.'

Coleen: Oh, my God! That's brutal.

Tara: Why would somebody do that?

A few days later, Tara wrote me an email to try to answer her own question:

In discussing my letter with a friend and colleague who is also faculty member, we both agree that people are just NASTY about things in Computer Science and Engineering. People are rude, unpleasant, and hyper-critical about things where they really don't need to be, and it really makes you question if you want to be there. Maybe this isn't because of the gender balance, but I do not think that it helps. We're really only selecting women to make it through the process who survive beating their heads against the wall repeatedly and are willing to come back for more.

Tony's description above of Precision Questioning training classes at Microsoft demonstrates that CSE's focus on being precise is *actively* cultivated into "abrasive" communication practices. The female CSE professionals I highlight here describe as these practices as "shoddy," "hypercritical," "nasty," and "put-you-down adversarial rudeness." Tara's metaphor for these practices is gut-wrenchingly violent. Paying

attention to participants' emotions regarding labor practices in CSE helps us understand that the value of precision in CSE knowledge work has morphed into a behavioral norm that erodes collegiality in sites of CSE knowledge production, differentially impacting underrepresented practitioners.

Policing the Boundaries Between the Technical and the Social

I got into a heated debate with a male senior CSE professional working in academia about diversity in his field. He felt that following my advice and valuing a candidate's social impact when evaluating faculty candidates would contribute to a loss of prestige for his department. His equating empiricism with prestige is no surprise. Western society is governed by strict ideological binaries between public/private, male/female, logical/emotional, reason/creativity, and the technical/social. Our technocratic society grants different valuations to each side of these binaries, privileging quantitative, abstract rationality while denigrating the social, material, qualitative aspects of the world. Theresa, a white mid-career CSE professional working in academia who worked at Microsoft for many years before transitioning to academia, observed that her CSE students were uncomfortable when she included social science methods in her courses. When I asked why she thought this was, she answered:

And I think what happens is that people are so messy. And, you know, computer systems aren't, they're challenging, but they're not messy. They eventually do what you tell them to do, so the onus is always on you, you're always in control.

In Theresa's opinion, CSE students are more comfortable with numbers and machines than with people and they derive a sense of control from working with them. Scientists and engineers are trained in the empirical method and generally regard

numbers and statistics as more reliable than qualitative data. Research that considers human need and social impact is considered inferior and its practitioners are undermined. Shawna, a transgendered white early-career CSE professional working in academia, started a Ph.D program focused on theory and algorithms and then wanted to include qualitative research methods in her dissertation project to be able to create tools useful for disabled students. She describes her struggle to gain support and one obstructionist in particular:

Shawna: [The department] had just hired Rick. Rick talks a good game, but he's not supportive of education research.

Coleen: Oh, I see. Not a fan of social science?

Shawna: Oh, yeah, it's a softer science. Oh, "veneer of science," that's how he describes it.

The Merriam-Webster dictionary defines veneer as: "a layer of material of superior value to be glued to an inferior material or a superficial or deceptively attractive appearance, display, or effect: a façade, gloss." One way to interpret Rick's assessment of non-quantitative scholarship is that he believes that it is inferior to technical scholarship and fears that if his colleagues investigate the social dimensions of computing, his department will suffer a devaluation of status. However, veneer also refers to a covering and I wonder what Rick is indirectly referencing – what does he think lies behind the "façade" of social science research?

I characterize gatekeepers' resistance to social science as the second stage in Davis Floyd's (1994) analytical construct of the rite of passage – protecting initiates from dangerous outsiders who threaten ritual conductors' unrestricted access to the regenerative power and value that their acolytes supply to their system. As in other male-

dominated institutions, for example christian religious sects, there is only one legitimate way to participate in the organization and those elements associated with the Earthly realm are dismissed as lowly pursuits. Epistemically, Rick's dismissal of social science research indicates his slavish commitment to a technocratic paradigm, a cultural mindset whereby technical artifacts and those who make and control them are "supervalued" over social need and social reproduction (Davis Floyd 1994, 46-7). Shawna also faced resistance to her project from her peers:

Shawna: The lab itself was always a bit boisterous in my mind; they had their basketball hoop, you know. And they just really were pushing the technology, you know, and focusing more on the computer part, as opposed to the human part. And I felt that whenever I brought up the human issues, that they were ignored, mainly. In fact I earned the moniker, "Accessibility Bitch."

Coleen: Oh, my God! That is so offensive.

Shawna: Yeah, actually, I took it as a compliment.

Coleen: Really, even with the "B" word?

Shawna: Hey, I subscribe to the magazine.

Faulkner (2007) argues that "good" engineering requires a combination of "hard" (quantitative) and "soft" (qualitative) skills, but that convincing engineering communities that technical and social dimensions are equally important is a critical and "radical challenge" (p. 351). The professor I debated and Shawna's peers lend evidence to the difficulty of valorizing the social in CSE. It is also important to note Shawna's use of humor to deflect her detractors and the confidence and pride she has found in her efforts to use computers to support those with learning disabilities. I suspect her subscription to

the feminist magazine *Bitch* indicates a feminist standpoint, which may play a role in her self-efficacy in spite of her colleagues' derision.

HEGEMONY

While listening to CSE workers' share their challenges and remembering my own feelings and responses to harassment in the high-tech industry, I marvel at their resolve. In the data analysis phase of my project, I also began to see a pattern of male behaviors emerge in my participants' narratives. Gramsci's (1971) concept of hegemony is useful in analyzing these patterns. Hegemony operates to maximize the authority of a dominant group, who, through socially constructed mechanisms, "rules from above with consent from below" (p. 12). The dominant group threatens those who do not consent to assimilation and structures exclusionary institutional norms to consolidate their power (Gramsci 1971). I also adopt Ortner's (1996) conceptualization of hegemony as the maintenance and regeneration of prestige. She argues that orienting ethnographic data with this in mind is analytically liberating because, despite loose ends and maddening contradictions, "there is an ordering – a hegemony in the sense of a relative dominance of some meaning and practices over others" (p. 147). In this section, I illustrate how the labor practices described above are operationalized to secure and reproduce white male hegemony and the privileging of the technical over the social. The following categories of behavior begin to make sense if we liken them to craft exclusion, discouraging women and people of color from CSE in order to maintain prestige and preferential treatment for dominant class members.

Combativeness

Other participants shared Tara's opinion (quoted above) that "people are just NASTY about things in Computer Science and Engineering." Participants who work both in industry and in academia made these claims and provided evidence to support their claims. For example, Theresa, the white mid-career CSE professional working in academia who worked at Microsoft for many years before transitioning to academia and who is quoted earlier in this chapter, told me:

You know, and what I would see is like, you know, we'd start these meetings – these bug meetings every morning called "war team meetings" – right? You start off by literally who yells loudest gets the floor. And so I was – I would really feel good when I hear things like, "Damn, she's such a fucking steamroller." Absolutely! But then like on the way home I would actually feel bad about my behavior at work, you know. I would cry a lot at work, because I also felt like I had no sense of self, because there was this mean person – I think I have – kind of had a sense of self before I started at Microsoft. But then I have to go to this mean role, and then I would feel bad about that. And then at the end of the day, you know, driving home and being like: 'I am not really proud of my behavior today.'

Coleen: You might have been rewarded for it though.

Theresa: I think I was, and I had great performance reviews my whole way through.

Theresa describes a workplace where hostile attitudes and a warlike approach to collaborating are not only tolerated but also normative and rewarded. Fitting into this culture resulted in the loss of her "sense of self." The aggressive behavior required to persist and succeed conflicted with her personal values. Like Carol's story about the interview process at her former company (quoted above), Theresa's anecdote expresses a contradiction involving pride. Theresa felt proud to be commended at work and accepted and lauded as a "steamroller." However, once she left her work site and was on the road

travelling home, her feelings swung in the opposite direction and she felt ashamed of her behavior in the office. I probed this contradiction some by asking why she thought hostility is normalized at Microsoft. She replied: “I think the hostility is how people see passion.” Theresa frames aggression and hostility in CSE organizational culture as measurement tools to assess competency and commitment.

Microsoft is not alone in fostering hostility. In an interview with the Huffington Post, Ruchi Sanghvi, the first female programmer at Facebook, describes a similar environment. She recalls:

having to change her working style to adapt to the “aggressive” environment, a shift she said affected how she was perceived. “Engineers are either aggressive or passive aggressive. You need to just dive straight into it, and sometimes there are social repercussions because of it,” Sanghvi explained. “The impression that people had of me was that I was really harsh, hard-edged, brusque and to the point. All of that happened because I am a woman, and I was acting in that kind of environment.”

(Sanghvi in Boske 2011, 2)

Janice, the white senior CSE professional working in academia quoted earlier in this chapter, tried to help me understand that intimidation tactics in CSE workplaces proliferate because computer engineers emulate their leaders:

Janice: I have sat in the room with Bill Gates when he just goes, “That’s the stupidest thing I think I’ve ever heard. What are you trying to do, just destroy this company?”

Coleen: Wow.

Janice: Yeah, I mean, and it’s like – and I’ll go “Bill, that’s not appropriate.”

Coleen: Good for you. I bet a lot of people don't stand up to him.

Janice: Exactly, exactly.

Coleen: What's his reaction when you say that?

Janice: He'll go, "Well, if you don't want me on the board, I can leave." And he'll always burst into tears. And I'll say, "Bill, I value your point of view. You're a wonderful board member. I just don't think you should scream at people."

Coleen: Wow.

Janice: Yeah.

Coleen: He's almost like, "I'll take my toys and go elsewhere."

Janice: Exactly, no, exactly. I mean, you know, so the problem is that if you have a tradition of people at the top yelling and screaming at people and it filters down. And then, you know, the other thing that happens is that if you're a woman in – in one of these fields, I know for me, I survived by holding my own. I mean, being just as aggressive and...

Coleen: So you would sometimes mimic that behavior, you mean?

Janice: I mean, if Steve Ballmer yells at me, I probably wouldn't – at this point, yell back at him. But when I was 30 years old, I would've yelled back at him.

Janice speaks about herself at two different stages of her career. In her early career phase, she would have met a male leader where he is at. Now that she herself is a leader, she questions aggressive behavior and tries, through example, to change the tone and tenor of the debate. Her emotional calmness when confronting the tears and anger of arguably one of the most powerful men on the planet disrupts Gates' ability to regenerate the ritual of "steamrolling" his peers, a ritual that his employees have Microsoft have

adopted, as described by Theresa above. Janice's shift in communication and behavior style suggest that women leaders could help change the entrenched combative climate rife in CSE workplaces.

Sheryl Sandberg, the white senior CSE professional and COO of Facebook quoted earlier in this chapter, supports Janice's argument about the "filter down" effect of leaders' behavior. She claims that high-tech leaders' everyday comments and behaviors have an enormous impact on their employees and organizational culture and that their authority greatly amplifies their actions with far reaching consequences that may not have been consciously intended (Sandberg 2013). In Janice's story, Gates first acts nasty and then starts to cry. If Gates were a woman, he would likely be accused of being oversensitive. Male emotions are valorized and women's emotions are demonized; bold behavior in men is considered assertive while the same behavior in women is considered aggressive. Tony, the white male mid-career CSE professional and a manager in industry quoted earlier in this chapter, noted that, during his tenure at Microsoft, employees had mood swings like their leader:

I saw a lot of people be mean to each other and ... people there would talk about how tough they were but I saw so many people acting abrasive and tough and going back to their office and being upset about it. You know what I mean, like people are like, a lot of techies are actually very sensitive.

Tony asks us to consider the sensitive side of CSE professionals. Theresa, the white mid-career CSE professional working in academia who worked at Microsoft for many years before transitioning to academia and who is quoted earlier in this chapter, asks us to consider the divided consciousness that emerged while she negotiated a hostile

workplace environment and her personal values. Both participants, I argue, exhibit signs of oppositional consciousness, a rupture catalyzed by their attempt to reconcile their personal values with their organizational workplace culture. Janice, the white senior CSE professional working in academia quoted above, goes further and is expressly fed up with certain kinds of behavior that are tolerated and encouraged within sites of CSE knowledge production. The behaviors she describes as exasperating oscillate between hostility and histrionics. Janice says that women do not tolerate these behaviors lightly: “For many women, it's just like ‘Oh, grow up.’” The sensitivity Tony reminds us to consider happens away from public view. However, these private moments of reflection and reckoning, uncovered through interviews and life history narratives, offer possibilities for interventions that could help CSE laborers integrate their personal values and their CSE work. These moments represent CSE workers’ yearnings for a change in the core values espoused by their leaders. The impact of leaders’ behavior on CSE workers suggests that educating powerful leaders on the importance of collegiality may go a long way to improving organizational cultures in CSE workplaces.

All of these insights are important to consider in evaluating the landscape of CSE knowledge production. I would like to also consider what it means to inhabit a woman’s body when outnumbered in a male-dominated environment that values abstraction above all else and rewards verbally abusive interactions among colleagues. In my own experience, when I was in a tiny, 600-square foot conference room and the only woman in the room with three men, one of whom, a three-hundred pound ex-Marine and the vice-president of IT at Amazon.com, was screaming and pounding his hand on the table, all I could think was “Oh God, he’s blocking the door.” I was scared and this experience

of fear in the CSE industry has helped me to be sensitive to fear in other women's narratives.

Brogrammers

After Christopher, a white male CSE undergraduate student, used the term "brogrammer" in our interview, I sought out to discover what exactly one is. Brogrammer is an emerging male identity in the CSE workplace that seeks "to recast the geek identity with a competitive frat house flavor." (Raja 2012, 1). Another interview participant sent me a link to the Facebook page for "The Brogrammers." Their tagline reads: "Brogrammers rage on code, rage in the gym, and rage at the club." The webpage is rife with images of women with enlarged breasts, booze, and protein supplements. The use of the word rage is telling, especially in light of the combativeness that is encouraged in most CSE workplaces.

The website Quora.com⁴ asked the question "How does programmer become a brogrammer?", and the responses were illuminating. In one Quora forum, Connor described a brogrammer as follows:

A Brogrammer can work well under the tightest deadlines, or while receiving oral sex; maintains a solid 120 wpm on the keyboard while drunk and dancing; can figure out how to drive a stick in the middle of a gunfight; "pair programming" does not threaten your masculinity; are as concerned about your body-fat % as you are about your test cases passing; are willing to openly discuss, and even enjoy discussing, your fraternity past; actually concerned about what car you drive, not at all concerned about mileage though; [l]ots of red meat; push-ups on one hand, while coding on the other; sunglasses at all times; a tan is important; popped collar is a must. It's important that you can squash anyone who might call you "geek" or "nerd"

⁴ See <https://www.quora.com/>.

and that you can pick up girls, but also equally important that you know the Star Wars movies by heart, and understand programming ideas, like recursion and inheritance.

Josette, a woman on the Quora forum, offered a counter-narrative to this caricature of masculinity heralded as excellence in CSE work:

Alas, despite mad technical skills I will never be a member of the elite circle of “brogrammers.” See, I was born with ovaries and breasts. I have sat up at night trying to devise clever plans to infiltrate this elusive circle of super secret friends. It makes me sad.

My participant Christopher, a gay white male CSE undergraduate student, also offered a counter-narrative to this caricature:

The entire bro-culture, you just never feel comfortable if I come out, I'll be next in the frying pan. I just don't want to do all that. We had this professor, she was like 29. She had us form small groups and talk about what would make this class better. And people were saying things like lower necklines, or more skin showing [T]hey'll make fun of the women, saying “Some of these women are such dead weight.” They can't like hold their own. It's hard. If I came out, in that kind of environment I would ... I just wouldn't want to deal with it.

Christopher frames brogramming culture as a male bonding ritual premised on the objectification of women. His colleagues marginalize women by characterizing them as burdens to the engineering community. As a gay man, he gauges how he would be treated if he came out by how male peers treat women. Masculinity and heterosexuality then are defined by exclusionary practices of hostility.

“Cuz You’re a Girl”

Early initiates in the training phase of CSE quickly learn which sexual and gender identities are most valued. Avowedly heterosexual white men can leverage existing hegemony to bolster their feelings of belonging in the field. This can help explain the peremptory attitudes that feminist ethnographers have noted in male CSE students (Faulkner 2007; Barker and Garvin-Doxas 2004). The ways in which dominant class members form a sense of belonging in CSE is far less studied than the ways in which underrepresented group members form a sense of not belonging. Reversing this academic trend could yield new insights about defining gender, competency, and belonging in CSE. Sharon, an Asian American CSE undergraduate student, told me:

Okay, so it's not a story from me, but it's a story from one of our friends in the sorority. She told me that one of her friends, who's a guy, wants to do CSE as well. So he said to her that she wouldn't do better than him in Physics 122 because she was a girl. And I was like, "Oh, no, he did not!" Well, she got a better grade than him – so. That's the sweetest revenge!

...

We were doing the group project where you had write out the instructions for something related to computers. We chose how to clean a fan on a computer. So I'm like, "Okay, step 1, take apart computer. Step 2, clean fan. Step 3, put computer parts back together. Step 4, done," but, one of the guys – the other guy was super nice, um, but the other – one of the guys was like, "Oh, you're a girl, you don't know what you're doing. You can do all of making the instructions pretty, and all that stuff, but I'll take care of the computer." I'm like, "One, I know how to take care of a fan in a computer. Two, like – uuhh?" He thinks he's a geek god.

Both of these stories demonstrate that male students feel the need to prove their competency by leveraging a sense of entitlement related to male identity. They seek to belong in the CSE community by dismissing and marginalizing female peers. Julie, a

white early career CSE professional working as a software developer in industry, also spoke about navigating sexist behavior in CSE, this time on the part of an inspirational CSE professor:

He was great. I mean, he was really great at what he did, and what he did for the school, but he was the epitome of an ego maniac – I had him for four classes, and I used to joke with some of my classmates that you would get a check minus if you're a girl who questioned what he said in class.

Julie's experience is an example of how many women who persist in CSE have contradictory feelings toward and relationships with men in their field. In this instance, Julie seeks to work with a male professor who she respects and uses humor to negotiate his paternalistic attitude toward her. Becca, a white Ph.D CSE student, experienced a similar conflict when her intimate partners dismissed her accomplishments because she is female:

Becca: At my last internship after my freshman year ... my boyfriend at the time was like, you know, the only reason you're getting this internship is 'cause you're a female.

Coleen: Someone you cared about told you that?

Becca: Oh, yeah.

Coleen: Oh my God, that must've been devastating.

Becca: Mm-hmm ...

Coleen: So, he said the only reason you got the Intel internship was because you were a girl?

Becca: Yep. I had another ex-boyfriend insinuate the same thing. For example, I got this Anita Borg Scholarship which is for females in computer science and he was like, "Oh, like all your stupid female things, the white male gets nothing." That's not all ... another ex-boyfriend I've had in

this department, yeah, he was like trying to explain to me how I was like of average intelligence and I'd have to work hard. He said he was more capable, but didn't have as much work ethic or something like that. He told me that once. And then I started yelling and - basically what I got out of him – I was, I was just drilling him, 'cause I'm not afraid to drill somebody. And what he finally said was he was upset that I got so many more fellowships than he did.”

Becca's former partners were threatened by her success and turned to sexist reasoning to bolster their sense of belonging in this competitive field. An illuminating exchange between Ava, an Asian American CSE undergraduate student, and Cynthia, her white peer, demonstrate the complex gender relations in CSE and how women's perceptions differ:

Cynthia: People don't like outright discriminate, or like [say], “Oh, you don't know what you're talking about, you're a girl.” Like I've never heard that, or anything.

Ava: I have.

Cynthia: Like slightly seriously?

Ava: Very seriously. And it's like, “What? I'm going to slap you.”

Ava and Cynthia's exchange epitomizes two camps of women I met during this research into male hegemony in CSE fields: those who believe “outright” discrimination is alive and well in CSE and those who do not. Cynthia holds a leadership position in her engineering sorority and helps organize undergraduate women *as women* in engineering majors at a top research university. Based on this activism, and my two interviews with her, I believe that Cynthia knows that her field, Human Computer Interaction, could be more welcoming to women. In this sense, she different from female computer scientists who got peeved when discussing gender politics – for example, a female CSE

undergraduate student who called the Grace Hopper Celebration of Women in Computing a “celebration of separatism.” Instead, Cynthia perceives her path in CSE as free of overt sexism, which can sometimes lead women to generalize their own experiences in analyzing the problem of women’s underrepresentation in CSE. My goal in the following section is to act as Ava did and to offer stories documenting evidence of harassment to show women like Cynthia, who want to fix the low numbers of women in CSE fields, that violence is at play in CSE workplaces and in the halls of CSE learning institutions and that this is important to recognize and act on whether or not your personal experience confirms its existence. Transforming labor segregation in CSE will require greater indignation than bias theories alone seem to muster. Ava’s fighting spirit is the type of invigoration diversity efforts needs.

Sexual and gender harassment

Male hegemony in CSE is a sign of a much larger social imbalance of power and clues to the systematic operation of power in technocracy can be found in interpersonal relations in sites of CSE knowledge production. Thanks to Anita Hill and the groundswell of feminist activism in the early 1990’s, sexual harassment has entered into US mainstream consciousness and public policy (Ong et al. 2011). In the course of this research, I discovered that awareness of sexual harassment and resistance to it must be augmented with the fight to end gender harassment in the workplace. Gender harassment refers to disparaging conduct that is not intended to elicit sexual cooperation; rather, it is verbal, physical, and symbolic behaviors that convey hostile and offensive attitudes about women. Examples of gender harassment include anti-female jokes, comments that women do not belong in CSE or management, and crude terms of address that denigrate

women. Gender harassment communicates hostility that is devoid of sexual interest but aims to insult and reject women (Leskinen et al. 2011).

Sexual harassment and gender harassment together define the legal category of a hostile work environment that is, unfortunately, all too pervasive in CSE. Becca, the white Ph.D CSE student quoted above, was an undergraduate in CSE when she was sexually harassed:

Becca: I've had some inappropriate things happen at internships too. I went to a Google retreat kind of thing and they actually had a dance party, I actually had a drunk married guy try to grind me.

Coleen: Ugh! Yuck, yuck, yuck! Oh God!

Becca: I know, right! And I would like run away from him and stuff. And then later ... he actually like – he found my screen name and then instant messaged me and said, “Want to have lunch?” And, but – he was like, “I need to talk to you.” So, I knew it wasn't anything, you know, and he actually apologized to me. But the way he said it was, “I was drunk.” I was like, “Yeah, I know you were.” And he was like, “I'm happily married and I have a kid.” I'm like, “I know, and I have a boyfriend and I just knew, you were just drunk, don't worry about it.” You know? But, you know, it had to be handled over lunch, right?

Becca, who became interested in CSE through participation in a study on gendered uses of software products, points out three important dynamics here. First, she ran away from him more than once. Second, he apologized *not* for trying to rub his genitals on her after she protested, but because he was unavailable due to his martial commitment. Finally, he bugged her at a party *and* wasted her break-time at work. Even if we assume he did not know she was underage, Becca's harasser still qualifies as what Carol, the white senior CSE professional and software engineer quoted earlier in this chapter, calls a “chauvinist pig”:

I have run into a couple people who have been chauvinist pigs, but I have encountered chauvinist pigs since I was, you know, old enough to walk. Evidently, I was born with a chauvinist pig detector. Like the guy, who was a peer, who wanted me to do something that I was not interested in doing. And he said to me, “Get back here, young lady.” I just kept walking, I mean, come on!

Diane, a foreign national from Europe CSE professional and a full professor in academia, recounts an incident of harassment that was compounded by her department chair’s cruel response:

Diane: And it was just one thing after another, and then I did get a graduate student of my own who harassed me and got him expelled from the university.

Coleen: Male or female?

Diane: Male. And nobody, you know, I kept trying to get help. When I went to the head, he said that I was a bleeding heart liberal and I deserved what I got.

Shawna, the transgendered white early-career CSE professional working in academia quoted above, experienced a similar form of harassment, an instance of epistemic violence that illuminates the gendered power dynamics embedded in the technical/social divide in the CSE field:

Shawna: When I switched from theory/algorithms to Human Computer Interactions, this old professor said to me: “Well, you know, it’s okay that you’re doing, you know, lesser fields of computer science, because you’re a woman.”

Coleen: Uh, no!

Shawna: At the time I was still pre-surgery, and I almost wanted to go like, “Even though technically my testicles have been like withered due to taking anti-androgens and

estrogen for several years now, I still have more balls than you.” That’s what I wanted to say. Mind you, this guy did not have a great track history with women, you know, and supporting women in computer science – so. He’s actually been caught – he was caught a couple times bragging about getting female students to drop his class.

Note how Shawna subtly questions the man’s sexuality. This professor is the old fashioned kind of bigot who is desperate to keep exclusively homogenous company.

Importantly, Julie, a white mid-career CSE professional and a user experience designer, connects this kind of sexism with hate:

So there are the geeky kids who respect intelligence. Then [there are] the ones that have the ego problems that are threatened by women, it just doesn’t end up going well. I mean, I can cater to it for a while, but I just lose. I mean, with women – like a ego-driven boss or manager, it’s just a pain in the ass, but it feels like it’s *really* a pain when it’s a male having the ego issue being that you’re female. Then you’re dealing with hate issues, and sexist issues, and things like that.

The emotions present in Julie’s account tell us much about sexist male leadership in CSE. The words “pain” and “hate” signal the level of violence imposed by the male managers whom Julie describes as having “ego problems.” To further support Julie’s insights into male violence in CSE, I draw on media analysis of a recent incident of harassment at a tech conference. Adria Roberts, an African American mid-career CSE professional, spoke out against sexism at a March 2013 PyCon conference and quickly became the target of hate. During a panel presentation, two men behind her made sexual innuendo jokes. Although flustered, she tried to ignore them. Then the conference featured a young girl learning to code. Adria says that this girl motivated her not to sit back and endure another instance of sexual harassment:

I realized I had to do something or she would never have the chance to learn and love programming because the ass clowns behind me would make it impossible for her to do so.⁵

She tweeted a photo of the two offenders with the note: “Not cool.” Adria was supported by the PyCon conference staff who spoke to the men and reminded them of PyCon’s code of conduct. Her post went viral and Adria was fired from her email service company “for dividing a community she was supposed to unite.” In addition to losing her livelihood, she was the target of a barrage of racist and misogynist messages, including threats of rape, murder, and dismemberment. In this case, speaking out against sexism was deemed divisive and a woman who broke the code of silence regarding sexism was threatened.

Like Adria, I was reprimanded at Amazon.com for calling out unexamined bias publicly in meetings. Colleagues and superiors both told me that these types of complaints were better handled one-on-one and in private. I made repeated complaints of both gender and sexual harassment in private to my boss and to Human Resource (HR) staff. I complained three times to HR about one repeat offender, a peer I worked closely with. My colleagues also made two complaints about him and an anonymous female employee spammed our entire department about this man’s incessant habit of sitting on the edge of a desk in front of women colleagues and scratching his testicles. The anonymous spammer insisted that he stop this form of sexual harassment. Not only was his behavior tolerated, this ex-Navy man was promoted to a senior leadership position by

⁵ I quote from Adria Richards’s “But You’re a Girl” blog, which, at the time of the completion of this dissertation, has been disabled: <http://butyoureagirl.com/14015/forking-and-dongle-jokes-dont-belong-at-tech-conferences/>. Tech journalist John Koetsier reported in March 2013 about the threats of violence targeting Richards and that her main priority was “staying safe.” <http://venturebeat.com/2013/03/22/adria-richards-im-staying-safe/>.

the department's vice president, another ex-Navy man! The only time my protests were heard was when I went public and got litigious.

Fear of Speaking Out

In the fall of 2012, women CSE professionals working in the gaming industry took to Twitter to document their experiences of bias and sexual and gender harassment. The theme of the thread was #1reasonwhy, referring to women's stark underrepresentation in the gaming industry. This reminds me of the grassroot efforts by women on college campuses in the 1990s to initiate public discourse about rape by writing names of men who raped them on public bathroom walls. Katie, a gaming journalist who writes the blog *Alive Tiny World*,⁶ wanted to join the conversation but first expressed her trepidation:

TOO MANY REASONS WHY I've been watching the #1reasonwhy hashtag on Twitter with an anxious kind of understanding. Part of me wants to jump right in and post a dozen of my own experiences, but I've also learned what happens if you say that shit publicly: you're berated, blamed, dismissed. I've been there. But why should I have to fear posting this? I've been quiet on Twitter and Facebook lately, for many reasons, but you know what? I think I'll make my own list of Reasons Why right here:

- Because we still have people saying, on a daily basis, that sexism will go away if we just stop talking about it.
- Because when I call out this behavior, I'm told it's my fault for having an "attitude problem" and maybe I should be less of a bitch.
- Because I have other women in the games industry tell me to "just be quiet" if I don't want to be harassed.
- Because every disclosure of harassment feels like risking never being hired again
- Because I'm told to "stand up for myself" – and then, when I do something like this, I'm dismissed.

⁶ See <http://alivetinyworld.com/>.

- Because I'm scared to post this on Twitter.

Women working in technology fields are sharing not only their experiences of sexism, but also their experiences of a pervasive pressure to remain silent and fearful of the consequences of breaking a culturally-enforced norm that women's voices and gendered standpoint are unwelcome. In my data collection, it took me too long to catch on to women's heightened sense of fear of backlash for critiquing sexist norms in their workplace. I finally became sensitive to this emerging data point after speaking with Josephine, a white senior CSE professional and software developer, at a high-tech conference. At first Josephine said that she didn't think her Fortune 250 company was unfair to women workers, but in the next sentence she mused that only 5 senior leaders out of 800 were women. Then, four other women came up to us and the conversation traversed many instances of gender harassment. I tried to turn the conversation back to women's exclusion from leadership positions and mentioned Josephine's company and its "leadership problem." She gasped, turned bright red, and said: "Hold on – I want to keep my job." I felt bad for transgressing a boundary I had not seen. I now better understand the stakes of speaking out against sexism and why women fear reprisals.

Sheryl Sandberg, in her feminist talks and her new book *Lean In: Women, Work and the Will to Lead* (2013), asks women in CSE what they would do if they were not afraid. "I asked myself that a number of years ago and I started getting on stages and talking about being a woman" (p. 12). It is telling that the woman whom Forbes Magazine named the fifth most powerful women in the world in 2011 (Sandberg 2013) is afraid to speak about her gendered standpoint in cultures in CSE. At the 2013 World Economic Forum's annual meeting in Davos, Switzerland, Sandberg relayed how her

lawyer warned her not to speak out about discrimination in her field, to which she responded: “If someone wants to sue me because I’m talking about gender discrimination, go ahead” (Sandberg in Stewart and Wearden 2013, 2) In a more just society, it would be the harassers and the institutions that tolerate them that would be worried about being sued, not the people being harrassed. But in the context of CSE sites of knowledge production, Eva, a white CSE undergraduate student, notes: “talking about gender makes social life with men harder.” This speaks volumes not only about the violent backlash women face for raising awareness about gender politics in CSE but also about the arrogance of male hegemony in this field.

Glass Ceiling

At her talk at a 2013 event jointly sponsored by Google and IEEE, Megan Smith, a white senior CSE professional and the vice president of Google[x], noted that even though women are 10 – 20 percent of the CSE workforce, they do not have this type of representation at technology conferences and in leadership positions. This data is evidence of the glass ceiling, a term used to describe the process whereby male organization leaders close ranks and deny women entrance to boardrooms and leadership and senior faculty positions. For example, since the 1990s, MIT has enrolled a much higher than average number of female students in its CSE department but the number of women in its faculty positions has held steady at 15 percent. Only nine percent of all chief information officers in IT organizations in the US are women (Zieminski 2012).

The glass ceiling is a metaphor for the experiences of women in male-dominated organizations and results from myriad informal and formal processes that limit women’s advancement and promotion. It denies women power in the organizations in which they

labor. Margaret, a white senior CSE professional and technical fellow in academia, describes an experience of aging that helps me interpret the function of the glass ceiling as a way for male executives to avoid powerful women:

Women gain power as they age. Getting older is hard on faculty, especially men in their 50s. They have a mid-life crisis and this can lead them to resent females. As a woman, mid-life, menopause is fabulous, tremendously freeing. You stop caring about what men think, your horizons expand, your mind is freed up, you lose the 'cuddle' hormone and this frees up aspects of your personality. You fear less.

Women in the training and early career stages of CSE are younger and less experienced, which, in combination with patriarchal norms, allow senior men power over them. Tammy, a Latina CSE undergraduate student, connects age and the workplace environment at her internship in the IT department for a power company:

I was treated well at my internship but the senior women there were really unhappy ... probably because I was no threat, I was just there for the summer.

Once women equal their male peers in wisdom, experience, *and* confidence, they become a greater threat to male hegemony. The metaphor of the glass ceiling is similar to Tara's description (quoted above) of the communication style common in CSE: "beating [one's] head against a wall." In both metaphors, women confront formidable barriers that obstruct their path. My embodied experience of the glass ceiling was physically sickening and categorically infuriating. In 2001, I wrote a legal brief to the Human Rights Commission documenting my experiences of illegal discrimination under Washington State and Federal law that occurred while I beat my head against a ceiling while my male colleagues sailed up the ranks of power at Amazon.com:

On Wednesday, November 5th, my boss Jane [last name removed] informed me that I did not receive a second interview for the job I have been performing for free for the last seven months: Senior Manager of Global Expansion. She told me that, although I had a good understanding of what the position entailed and I had been performing well in many aspects of the job, I did not have an MBA and lacked finance experience In this brief, I intend to document that I was denied a promotion because of my sex. The same week I was turned down [for] this promotion, Rob [last name removed] was promoted to a director-level position. Rob and I were hired as managers on the same day and thus have the same length of service at Amazon, and the same level of education and yet he is being promoted to this senior level, highly paid position. Promotions from within to senior management positions over the past year have happened for my male colleagues - Rob [last name removed], Dave [last name removed], Tom [last name removed], Aaron [last name removed], and Brad [last name removed], – none of whom have an MBA. Jane states that the reason I did not receive the job was because "You are missing a small slice of what I need for this position - finance experience." This "small slice" is not even listed in the position plan. The duties that *are* listed the position plan are ones I have been performing to great reviews. When I asked her how I could be mentored, how this lack could be changed into an opportunity for growth and career development, she said this slice however was "very deep, beyond mentoring." She assured me that being turned down from this job did not mean that I was hitting a "ceiling." Funny you should mention that term, I said, because I think I am hitting up against the Glass Ceiling. I enumerated the men promoted from within, some of whom are replacing female managers that were fired in the last round of mass layoffs. She told me that I chose to go into strategy rather than operations, where there are less opportunities for growth. She said that there are many more operations positions than strategy positions, and the need to fill those positions is great. When I reminded her that the need to fill this senior management position was great, that, in fact, I was getting tired of doing it for free, she dismissed me. She told me that I would have to move to other departments for career growth.

My former boss epitomizes what I call “Ladder Kickers,” women in male-dominated workplaces who pull the ladder up behind them as they climb higher in an organization. I discuss this category of people who matter in CSE careers in the Conclusion Chapter and how they are motivated to impede the success of other women in their male-dominated environments (Parks-Stamm et al. 2008).

Technical Females: Visibility and Invisibility

As evidenced in the sections above, men get preferential treatment in CSE. In addition, by virtue of having critical mass in CSE production sites, they can also act like “un-gendered representatives of humanity” (Lohan 2000, 896). In other words, their presence in CSE and their experiences in CSE work and workplaces are the norm, whereas women’s presence and experiences are conspicuously the “Other.” Male hegemony is encoded into language used in high-tech circles to refer to women computer scientists and engineers. One of my participants sent me an email:

[H]i coleen, [I] met the 2 guys from [I]ntel today. They kept using the acronym “TF. ” [I] asked “[W]hat does TF stand for?” [S]ure enough, it stands for Technical Female!! [I] asked them if they have the acronym "TM" for technical male. Sheesh!!

The term “Technical Female” calls attention to women’s presence in the CSE workforce and makes their status exceptional. Simultaneously, it indirectly frames the CSE field as a male homosocial space. I use the term homosocial because I regard the overrepresentation of white males in CSE as intentional rather than merely coincidental. Unlike religious sects like the catholic church, sites of CSE knowledge production do not explicitly bar women from participating in their rites but instead consolidate male power through hegemonic labor value and practices. Men regard women as interlopers who

brazenly dare to tread in this homosocial space of male bonding. For example, at my former job, I was meeting with the vice president of IT, an ex-Marine. He directed me to go into his office and use his phone to call the vice president of Customer Service (my boss once removed) to get his buy-in on a high-priority issue. The phone had caller identification and Bill, also an ex-Navy man, picked up the phone and greeted me: “Hello Captain Boss Man – how are ya, Jughead?” When I introduced myself, he yelled at me: “What are you doing using Gary’s phone?” He resented that I had caught a glimpse of male camaraderie and interrupted the ease of male homosocial bonding that he took for granted in male-dominated institutions like the military and high-tech corporations. This interaction made me resentful and made me feel like I did not belong in the organization simply because of my gender and lack of military service.

Julie, the white mid-career CSE professional and user experience designer quoted above, has also been made to feel like a gendered transgressor. She reflected on her male peers’ homosocial behavior: “Nine out of ten people in the room look like them and they still single out difference.” In the ritual of CSE production, the dominant model of the computer scientist is male and women’s presence is an exception that often elicits comments. Jenny, an Asian American CSE undergraduate student, describes how her professor put her on the spot by calling attention to the women in the class:

Jenny: Some of my professors have been like, “Oh – oh, there are – there are six girls in this class. That’s an increase from the last quarter I taught this.” And then you suddenly look around and are like, “Oh, what’s up?” You’re all of – one, two, three, four, five six – yeah, okay, six.

Coleen: So drawing attention to it made you feel conspicuous?

Jenny: Yeah. It's like, "Oh, yeah." All the other guys turned, and they're like, "Oh, female."

Jenny imitated her male classmates' reaction to female presence as a curious phenomenon. However, gender in homosocial spaces is unremarkable. Throughout CSE knowledge production – in faculty meetings, conference panels, boardrooms, and labs – when women are not there, they are not missed. "To the boys club of Chief Information Officers in America, women are not around and nobody seems to have a problem with it" (Casserly 2012, 3). Gender homogeneity is then naturalized through the myth of meritocracy. In Chapter 2, I defined meritocracy as a myth that mystifies dominant groups' privileged access to resources and power. Cass, an out lesbian white CSE professional and a feminist open-source programmer, helped me better understand meritocracy and male overrepresentation in CSE:

Have you ever heard the term meritocracy? That's why more women aren't in computing. It's a "rock star" culture where folks in that community believe whoever is there made it there by their individual merits, intelligence and efforts, so the social make-up of the group is an objective outcome of who deserves to be there.

Meritocracy functions not only to justify the preference for same-sex company but also to rationalize the reproduction of women's invisibility, marginality, lack of advancement, and lack of acknowledgment of their contributions and innovations. For example, how did Microsoft rationalize awarding Microsoft Technical Recognition Awards to male employees, and male employees only, the majority of whom were white, for two years in a row? To celebrate these *twenty-two* male employees, Microsoft took out full-page ads in the Seattle Times, lauding them for changing the world and creating "revolutionary" innovations with global impact (Seattle Times February 12, 2012, News

A9; Seattle Times March 10, 2013, Business D3). Given how Microsoft failed to celebrate even one female employee for two years in a row, did women's absence merit any analysis at all from the Microsoft leadership team who chose the award recipients upon whom to bestow these public accolades? Companies use advertisements to convince consumers to invest in their products and this public display of male hegemony at Microsoft is an embarrassing gaffe that demonstrates the corporation's lack of commitment to inclusivity.

Some women maintain their self-efficacy in a field rife with displays of male hegemony by seeking out the company of other female CSE knowledge laborers. During my participant observation at the 2011 Grace Hopper Celebration of Women in Computing, I was one of three thousand attendees, the majority of whom were women. After the keynote speakers Sheryl Sandberg and Shirley Ann Jackson, a white senior CSE professional and an African American physicist and president of Rensselaer Polytechnic Institute, finished their talks, the conference organizers led all three thousand of us in a chant: "We are technical females!" The chant was long and loud and it seemed to empower participants. When used by dominant group members, the term "technical female" works to signal women's exceptional status within the CSE field, but in a women-dominated space, the term "technical female" became a rallying cry, much like the LGBT community has reclaimed the slur "queer."

EVALUATING THE COSTS OF BEING OUTNUMBERED

Senior women with whom I conducted life history interviews frequently mentioned weariness or told stories of peers' and mentees' exhaustion. Listening to their reflections on critical phases of their careers, I got the sense that the transition from

academia to the professional world was particularly stressful. In other words, for women CSE workers, the early-career stage is particularly perilous. Proving oneself and finding new networks of support after leaving others behind is difficult enough without the additional taxation of being a member of an underrepresented group in a field that prizes aggressive critiques. Diane, the foreign national from Europe senior CSE professional working in academia quoted earlier in this chapter, explained:

It's not that people are bad, or people are negative, or people want to put you down – it's just the way we think, and the way we behave, and the way we're trained. And it's just wearying after a certain point, but it's especially wearying if you're a woman and you're not really ever getting any good validation, and criticism is all you're hearing ever. It's very wearying. I'm getting really tired of it. You know, critique is formative, it's good, it's constructive, it's intended that way but it's wearying, you get tired eventually.

Women's attrition from CSE fields in the early- to mid-career stages is often explained as the woeful overlapping of the tenure clock and the biological clock (Xie and Shannon 2003; Williams 2000). But we cannot assume that this stage of a CSE career is perilous solely because of women's dependent care responsibilities. This assumes only one model of maturing as a woman in our culture and overlooks many others. Regardless of whether a woman CSE professional wants to bear children, she must still confront dominant gender norms that reward women for some behaviors and punish them for others. In her Anita Borg Institute newsletter interview, Eleni Stroulia, a white senior CSE professional and the NSERC/iCORE Industrial Research Chair at the University of Alberta, , offered an analysis of how gender norms devalue women's contributions to computing organizations:

I think that the problem is more general than “women leaders are not likable;” it is more that “women in non-female positions are not likable!” The crux of it, in my mind, is that society expects women to be in “nurturing” or “sexy” or “ethereal muse” roles and only appreciates and validates them when they succeed in such roles.

Susan Landau, a white senior CSE professional and a fellow at the Radcliffe Institute for Advanced Study at Harvard University, augments Diane’s discussion of women’s exhaustion in CSE, connecting it with epistemic violence:

It seems that we still have to prove ourselves more than the men do, still have to show we’re just as smart as everyone else in the room. For many of us, over time that effort simply gets exhausting, and we leave the profession. Society has to do better.

Susan describes how women’s capacity as knowers is doubted in CSE, an injustice which seeks to denigrate women’s intelligence and constrain them from articulating, and perhaps even consciously understanding, their experiences within male hegemonic modes of knowledge production (Fricker 2007).

Carol, the white senior CSE professional and software engineer quoted above, told me the two greatest barriers she faced in her career. The first barrier she named was the Imposter Syndrome, which I discuss at length in Chapter 6. Her second barrier illustrates how epistemic violence works not only to disqualify women’s scholastic, strategic, and creative contributions, but also our lived experiences. Carol explained:

Carol: Number two is I’m gonna say is being a guy – having to be a guy.

Coleen: You have to act like a man?

Carol: Yeah ... You know, you're surrounded –you're surrounded by guys. You want to fit in. You don't want them to see you as different because as soon as you're different you don't belong. You wanna be able to communicate with them. You're outnumbered in terms of the modalities for how to describe things, and how to, uh, how to think about things and analogies to use and ways to approach problems. Meanwhile you really don't want to spend any time talking about the fact that you're different. Because that's not what you're there for, but you *are* different.

At first I interpreted Carol's narrative as a desire to assimilate with her peers, to avoid being detected as different in order to achieve a sense of belonging. While assimilation is part of her story, her use of the word "outnumbered" caught my attention. Upon further rumination, I find this analytical reconceptualization of "underrepresented" refreshingly useful. Jocelyn Goldstein, a white senior CSE professional and the Director of Engineering at Facebook, also used the term outnumbered in her Anita Borg Institute interview: "The biggest issues [facing women] are the side effects of being so outnumbered." Describing women as "outnumbered" in CSE has a different connotation than describing them as "underrepresented" in CSE; it conveys a sense of threat. Carol worries that speaking from her standpoint as a woman and using her own "modalities" to describe things would violate gender norms proscribed in her CSE workplaces. To minimize being different, she not only adopts male-centered modalities of thinking, she also censors herself:

Carol: I just found after decades that to be just exhausting. I think it grew on me on ways that I didn't expect it to you know. It's not a huge obvious thing. It's not anything I can point to. And it's just little things, right. It's just like all – there's just probably a thousand different little things that you would do different like lunchtime conversation. All the things you can't say, you know, "Oh my God, I have cramps today." Or ... "Goddamn, I forgot my

earrings this morning.” You know, I mean [those things are] just irrelevant but you’re running this filter all the time. As long as you’re running that filter you’re not just you but they are themselves, they are comfortable.

Coleen: So say you did bring up something that, something that goes beyond “the filter.” What would be the consequences?

Carol: Uh, you get marked as being different ... You know, you're different – you're different. And different isn't free.

Carol suppresses her emotions at work and feels it necessary to hide elements of her personality related to her female identity. If Carol’s “outsider within” (Collins 2004) perspective equates difference with oppression, then it makes sense why some women strive to “pass” as gender-neutral engineers. Much like Theresa (quoted above) felt she had lost her sense of self in her workplace, Carol filters out part of her authentic, embodied self, which over time has taken a toll on her energetically. Her individual experience of feeling exhausted from filtering out the feminine elements of her being and behaviors helps to illuminate the social relations of power embedded in the social body of the CSE community. These relations of power reinforce the ideological bind between CSE competency and male gender identity and constrain possible threats to this union through cultural norms that penalize individuals who express embodied experiences of femaleness.

Gender norms, via structures of dominance, equivocate the male standpoint and its interpretations with ontological and epistemological reality (Lugones 2008; Smith 1987; Harding 2004). To persist, “outnumbered” members of CSE communities must accept this equivocation and minimize expressions stemming from alternate standpoints. In this way, CSE communities function much like other male supremacist fundamentalist

faiths that claim there is one “Truth,” one path to freedom and knowledge, and that those who do not follow the path are unworthy.

Shona Brown, a white senior CSE professional and the senior vice president of Business Operations at Google, epitomizes a commitment to assimilation. In her Anita Borg Institute newsletter interview, she says that it is *the* most important thing to women’s success in CSE:

With regards to being technical, my advice is to be gender agnostic. I didn’t realize engineering was male dominated until I walked into my first class at the university and saw 300 males and six females in the auditorium. I noted it, but I didn’t think much of it. That has remained my attitude.

By Brown’s definition, gender agnostics do not think about being outnumbered. Her religious metaphor of agnosticism fits into the framework of this chapter in which I have analyzed the cultural rituals in CSE organizations used to augment dominant systems of power. If a religious agnostic believes that the existence of a higher power is unknowable, then can we assume that Brown believes that the existence of gender dynamics in a CSE culture rife with masculine symbols, values, and behaviors is similarly unknowable? To hold this belief, she likely has to discount her own perspectives and feelings and dismiss her capacity for critical social analysis.

Instead, gender agnosticism appears to be a commonly used mechanism to project competence to one’s male colleagues. Sylvia, an African American CSE Ph.D. student, and Jocelyn, a white senior CSE professional working in academia, have had similar experiences that support my hypothesis:

Sylvia: I remember when I joined computer science it was just me, I was the only girl ... yeah, I was just the only girl, so like, I don't know I just became one of the guys.

Coleen: What does that involve?

Sylvia: Well, so I guess sometimes they forget that you're a girl, so they would be just talking guys stuff and so forth. And the good thing was that they never looked at me like I won't be able to do this program, do this major because I'm a girl.

And...

Jocelyn: Women are usually assumed to be non-technical until proven otherwise. When you're the only one in the room, you may feel self-conscious or singled out; certainly, there's subtle social pressure to try to be "one of the guys."

Initiation into sites of CSE knowledge production is not gender-neutral and labor values, practices, language, symbols, and relations work to form members of unrepresented groups into "social subjects, who, in absence of resistant consciousness and actions, fortify and reproduce the status quo" (Essed and Goldberg 2001, 55).

Theresa, the white mid-career CSE professional working in academia who worked at Microsoft for many years before transitioning to academia, gives us further insight into how anxiety regarding gender may be a factor in the reproduction of the geek stereotype:

I talk to so many young women who don't want to be singled out for their gender at all. They're like, "I'm not a female. I'm not a male. I'm a computer scientist." I think people sort of out-guy the nerdy guys ... The boys and the girls wear the Atari shirt. I think you just sort of lose your sexuality, but probably not your gender.

Assimilating into male hegemonic practices, epistemologies, and behaviors as a gender agnostic does not necessarily mean that you pass as male but may mean that you successfully avoid "being singled out." As we have seen throughout this chapter, when

male CSE workers draw attention to female coworker's gender, it can serve to maintain male hegemony and valorize homosociality as a measure of prestige and competency. The often violent "other-ing" of femaleness in CSE signals the "fragility" of male gender identity in CSE sites of knowledge production and acquiescence to and the revitalization of sexist labor practices and assignments of social status in broader US culture (Harding 1986, 67).

CONCLUSION: BEYOND THE GEEK MYSTIQUE

In this chapter I have used women's and their male allies' stories to illuminate *practices of power* that uphold dominant class rule in CSE and the structural, epistemological, and interpersonal conditions within which gender dynamics unfold in sites of CSE knowledge production. I aimed to make plain the means, method, and scope of male hegemony. I suggest that participants' private moments of reflection and reckoning, where they feel a conflict between their own personal values and their organizations' values, illuminate sites of rupture that may be usefully employed by diversity in STEM activists to transform CSE culture from hostile and aggressive to welcoming and collegial. What emerged strikingly from the data I present in this chapter was that dominant group members silence marginalized group members in order to reproduce their rule. My research is an effort to break the silence of women's experiences of male hegemony and expose the pain that CSE workers of both genders experience when trying to reconcile their personal values with officially-sanctioned CSE values which are enforced through rites of passage characterized by precision, aggression, hysteria, and the eschewing of reproductive activities.

“Women’s lives make available a particular and privileged vantage point on male supremacy, a vantage point which can ground a powerful critique of the phallographic institutions and ideology which constitute the capitalist form of patriarchy” (Hartsock 1999, 107). Women who have undergone CSE rites of passage have a unique social identity. The contradictions that spring from their double consciousness borne from an “outsider within” standpoint make the violence of the dominants’ rule visible. I hope to make permanent the visibility of violence and the cultural rituals of male hegemony that work to exclude, silence, and exploit those who may disrupt the reproduction of dominant class rule in CSE. The superiority of neither geeks nor priests can be taken on faith. In the next chapter, I hope to illuminate and ferment a yearning for justice and resistive consciousness among CSE laborers that seeks to undo the larceny of women’s labor value.

Chapter Six: Women Making Culture: Profiles of Persistence in Computer Science and Engineering

INTRODUCTION

The majority of the participants I interviewed for this project are women who have persisted in the CSE labor force. In this chapter, I present profiles of their persistence: the stories of those women who have overcome cultural and interpersonal barriers to make significant contributions to US culture as CSE professionals. Women who dare to compete as equals of men in arenas where they are not supposed to be important to investigate, for their universal and particular circumstances in CSE fields yields potentially useful efforts to desegregate it.

Leith Mullings (1995), an intersectional theorist and anthropologist, coined the term “transformative work” to refer to everyday work that can lay the foundation for larger social movements. I interpret Mulling’s theoretical construction of transformative work as everyday navigations through lived experiences of social inequalities, enacted both individually and collectively, which help to sustain communities under siege by oppressive structural and interpersonal circumstances. Mullings developed this concept while doing fieldwork on women’s reproductive strategies in Central Harlem. The concept offers insights for studies in other social contexts, for example, understanding women’s lives in the domain of CSE knowledge production. Viewing the work that women do in this male-dominated field as potentially transformative means more than just striving to desegregate CSE; it also requires unpacking critical elements in a CSE career that limit or impede efforts to use CSE skills and technologies to advance social justice.

In this chapter, I explore three dimensions of the lives of women who persist in CSE: personal, interactional, and institutional participation. I highlight participants' personal characteristics, aspirations, emotions, and participants' stories of the people who made a difference in their careers. I employ the term "affective aspirations" to refer to: 1) reproductive aspirations and 2) social aspirations, two areas that social science research suggests may influence why men greatly outnumber women in CSE. I explored reproductive aspirations in Chapter 4. In this chapter, I investigate social aspirations and ask what can we learn from women's narratives to transform CSE technology and its applications. All of my participants credited their successes to a great satisfaction and success in math, logic, and problem-solving and to systems of support. I want to celebrate the efforts and emotions of women who persist despite formidable odds and emphasize my participants' efforts to not only transform their own lives and workplaces but also to use their CSE skills to transform our culture through social change efforts.

Below, I illustrate how women's strategies for persistence can differ along lines of race/ethnicity and career stage. For example, a significant gender norm, the Imposter Syndrome, a presumption of incompetency internalized by some practitioners, emerged in my data as specific to white women. My positionality as a white woman and a student may have influenced the stories participants told me and how they framed these stories, especially stories of hardships. For example, while I argue below that women of color more consistently displayed a confidence and inner resolve than white women, it is possible that they were less comfortable telling me about their failures and doubts. Likewise, because I am a student and thus not on equal footing with senior women in

CSE, they were very candid about interpersonal and institutional violence. Their length of service in CSE brings a longitudinal perspective about ways to persist in CSE.

“Women in engineering live on the boundary between two different worlds. One is the world of engineering ruled by men – invented by fathers and built along patriarchal rule, the other is womanhood” (Chu 2011, 57). Women living on the boundary between CSE knowledge production and womanhood must transgress the social dictates of two very different worlds. They struggle to negotiate demands and contradictions in the workplace and to reconcile CSE organizational and disciplinary values with their personal values. Stories gleaned from my research on these transgressors offer an interpretative framework through which we gain a broader understanding of how gender, race, class, and technology are co-constituted and how they interact to produce the CSE field as we know it. These stories may also help elucidate what changes can transform the practices, demographics, products, and applications of CSE technology.

MAVENS OF METTLE

Passion, Grit and Creative Costs

Over 90 percent of my forty-two interview participants expressed proficiency at math and science and credited this talent for their participation in CSE. Julie, the white early-career CSE professional working as a software developer in industry quoted in Chapter 5 is a prime example: “I got into engineering because I had strong math and science scores, I mean, consistently.” Kelly, the white senior CSE professional and a technical fellow in the corporate sector quoted in Chapter 4, told me she “loved science and math” and that this passion formed her occupational aspirations early:

At six, I knew I wanted to be an engineer. My neighbor, a guy, laughed at me when I told him I wanted to be chief engineer on the Star Trek Enterprise. At 26 I had my doctorate in engineering and met him again ... and it was my turn to laugh.

Hacker (1990) drew my attention to the intense pleasure and “exhilaration technologists feel for their work” (p. 210). When I asked Julie (quoted above) what she enjoyed most about programming, she became brightly animated: “I loved learning how to test and fix and try and find which switch is the one that’s off—a ha!! It’s cool.” Paying attention to participants’ emotions about the work they do demonstrates the part of their labor in which they feel engaged rather than estranged. Some aspects of computer programming that participants enjoyed relate to analytical challenges:

Alisha, an African American CSE Ph.D student: I enjoyed computers and I enjoyed mathematics and that’s the way I can put the two together.

CC: What do you enjoy about computers?

Alisha: I just enjoy the intricate nature of computers, the speed that you can do with the computer and now they’re getting smaller and smaller and you can do much more with what you could do maybe five or ten years ago.

and:

Brandy, an Asian American CSE Ph.D student: I worked hard in math and science. In high school, robotics sparked my interest. I liked the logical and creative thinking programming required ... I like the problem-solving part but not the building part ... so I’m sticking with the research side [of CSE].

and:

Regina, a foreign national from Asia CSE Ph.D student: I like programming. Like I actually like to write code. I might not be the best one, but I like thinking about it. And I wonder if it's a particular kind of organizational skill that you need that maybe guys tend to like. So when I write code, I like to think about it as it's a structure; it's a way of structuring different – like being able to separate independent components and see how they're interacting with each other, right?

and:

Diane, a foreign national from Europe senior CSE professional and leader in academia: When I got to college and learned how to program, I loved it, I knew I was in the right field, right away. Yeah, so that was nice. I love to program. I really enjoy it.

Others were drawn to the material aspects and creative outcomes:

Carol, the white senior CSE professional and software engineer working in industry quoted in Chapters 4 and 5: There are people who like to work on end products and there [are] people who like to work on tools and I am definitely a tools gal ... I got really lucky. I found this process that pays obscene amounts of money that I find deeply satisfying.

and:

Sylvia, the African American CSE Ph.D student quoted in Chapter 5: I thought I would be an accountant, but then when I went to university I took a computer science class just to see how it would be. It was Intro to Visual Basic and I was just in love with it, I loved programming and we had to create like this, your own program. I loved it, so then I just switched to computer science ... you had to start writing codes and it was intimidating but then when she [the professor] taught you how to do it and then you'd see

the actual results. I just found it was so fun and I fell in love with that creative thing that I did.

These narratives reflect participants' passion for what they do and challenge tropes that suggest women are not capable or interested in programming. This emotional connection with computers motivated participants' career aspirations and works to support their persistence in CSE.

In the spring of 2011, I was moved by the emotional engagement that I witnessed during participant observation at a small civic-minded CSE start-up. I observed a six-person team launch a new product. An authentication password was crashing the server. The team was in a flurry of activity. The team leader, an expressive, jovial fellow, opined: "[It's] Murphy's Law; right before a launch, something will go wrong!" As he returned furrow-browed to his computer, his colleague Joe's face lit up and a satisfied grin crept across his face. I knew even before he announced it that he had fixed the problem. He was keenly emotive but shared his success in an off-hand manner. I learned later in an informal chat with his colleague, outside their workplace setting, that Joe is fairly social awkward and very stoic. I was lucky to witness the pleasure he derived from his programming skills and this gave me insight that some programmers can express stronger emotions about computers than they can with other people.

Perhaps a greater comfort with machines than with people can explain why some programming workplaces are hostile environments. Tony, the white male mid-career CSE professional and manager in industry quoted in Chapter 5, laments that the hostile culture in CSE can interfere with the emotion and pleasure derived from the work:

[There's a] culture of workaholism. Culture of abrasiveness. Culture of like hierarchy where people treat

you like shit if they can – if they're higher than you. And I don't see why the work has to be that way. I mean some programmers are in love with the creativity of a creation. They think of themselves as makers. Sort of like a maker of culture.

It makes sense that CSE professionals perceive themselves as makers of culture. People in the US live in a world mediated by CSE workers' creations. CSE laborers hold cultural significance in the 21st century as bearers of technical knowledge and makers of culture (Oldenziel 1999). Within this broader social narrative defining technology and its makers, Tony juxtaposes combativeness and love, the former an external attribute of CSE work and the latter an internal motivator. Combativeness and “workaholicism” are the price CSE workers pay to do what they love and to reap financial reward. I want to be mindful of this conflict between internal and external factors in the work of CSE, especially when considering the multiple social identities some practitioners must navigate in order to persist. It is these moments of contradiction that hold potential for a rupture (Smith 1990) in a CSE worker's consciousness which causes her or him to recognize that labor relations within the culture of their prestigious CSE organizations denigrate her or his creativity and contributions. Rupture and the connection between love and creativity will be important when discussing self-efficacy and affective aspirations among underrepresented CSE practitioners. These are key factors that play a role in women's ability to enact cultural and material practices that both resist marginalization in CSE fields and assert the right to be makers of culture.

Grit

Evidence emerged in my data which suggests that women who persist in CSE are extremely driven to succeed. Within the context of the workaholic culture that I described

in Chapter 4, the drive to exceed expectations in an already intense field concerns me. Joe, a white male CSE undergraduate student who is also pursuing both CSE and an Electrical Engineering degree, noticed:

Girls within the department tend to be at the top of the department. Like if they're in there, they tend to be at the level of – I don't know – awesomeness. Yeah, and they're more involved with getting internships. They tend to take heavier class loads. They tend to, you know, focus more on their schoolwork. They're much more driven.

Regina, the foreign national CSE Ph.D student quoted above, describes how she supplements her CSE graduate education at a top-tier university with on-line classes:

Regina: I think it's really important to notice what your weaknesses are. I don't think I'm that good with machinery; I really want to improve my skills on it. So, there was this Stanford online class that was offered last quarter, and I took it, and I'm like, "Hey, I can still follow" – it was simple, but I could still follow it.

Coleen: Nice! So you took an extra course while writing your dissertation?

Regina: Yeah ... I really liked it because as a somewhat busy grad student I can no longer afford to go to regular classes, but I can do this, you know, at 8:00 p.m. at night.

Coleen: That's amazing! So even though you're still in grad school, and you're pursuing this other – this acrobatic performing training, you're also continuing to brush up on other [CSE] skills to keep competitive? So I'm hearing you say that you're trying to boost your confidence, you're trying to boost the amount of skills that you have – the breadth of your skills. Is that due to an environment that's sort of competitive here? Or is that just your own drive?

Regina: I think academia is always like that. You're always comparing yourself to other people, and if you're not you wouldn't be in grad school, right?

Female students' commitment to the CSE field and intense grit to succeed could be a way of finding a sense of belonging, or it could reflect their understanding of something Anita, a professor of color in computer engineering told me: "[Female students] have to be twice as good to feel like they're half as good."

The Imposter Syndrome

If comparing yourself to others is endemic in the training phase of a CSE career, how does this influence female students in a field that fosters and rewards what Janice, the white senior CSE professional working in academia calls "macho behavior:

Macho behavior is the experience you have when you go into a class – it particularly happens in early computer science courses. Where there are one or two people in the class – almost always male – who have been working with computers since an early age. And they are just so excited to meet a computer scientist – a real one – that they can't stop talking about their skills. "Oh, I did this when I was twelve."

Janice considers this macho, braggart behavior one of the most significant barriers to women's persistence in CSE undergraduate training because it is intimidating to those who did not have the inclination or the social resources to tinker with computers in childhood. Becca, the white Ph.D CSE student quoted in Chapter 5, describes being turned off from CSE because of this phenomenon:

I love math. Computer science is like the most evil thing and I never wanted to do it. What happened was there were a lot of people that were more technically inclined than me

I guess. I had the math background, but a lot of them had the CSE background and it was really daunting that other people were just kinda like whipping through these assignments. You're like, "Whoa, yeah, you just do this," and I'm like, "Huh?" You know, like you never heard the terms before and it – I just felt really left behind.

Senior women in CSE who serve as mentors to younger women in CSE admit to struggling with the same issues. They define their internalization of sexism within their field as the Imposter Syndrome, the struggle that underrepresented group members have in accepting their successes. Lori Pollack, a white mid-career CSE professional working in academia, admits in her Anita Borg Institute newsletter interview that: "I'm in good company with all the successful women who have talked about experiencing the imposter syndrome." Maria Klawe (2011), a white senior CSE professional and mathematician who was appointed a dean at two North American institutions of higher education and is now the president of Harvey Mudd Technical College, describes this phenomenon as follows:

The Imposter Syndrome is just the feeling you have that everyone else but you thinks you're really successful. I suffer from this big time. And yet deep in your heart, you just don't think you're that successful and you just feel like you're going through the motions ... you feel like a failure.... [Women] are more likely to suffer from imposter syndrome. Let's suppose they've been getting As in most of their classes and for the first time they get a B or a B- on an exam, whereas the guy next to them has gotten C, C, C, C. And the guy next to them is going, "I rock. I'm doing really well. I'm going to get a great job in the software industry." And the female has gotten the first B and is going, "I knew I wasn't really good at this. I knew I didn't belong here. I understand I should go do something that

I'm actually good at like economics or English or political science, or whatever.”

What Klawe refers to here also relates to the above-and-beyond grit that female CSE students display when persisting in the field by setting incredibly high standards for themselves in search of a sense of belonging and reassurances of success. Tara, the white early-career CSE professional working in academia, describes her simultaneous experience of success and failure:

I took computer science [in high school] because I thought it might be interesting, and I hated it. And the reason that I hated it is because I thought that I wasn't any good at it. And the reason that I thought that I wasn't any good at it was because there was sort of a guy who was across the way from me, and I mean, he knew exactly what he was doing with the coding, you know, he could code it all instantly. And it took me a really long time, and I really felt bad at it. And, in fact, I was not [bad at it], because we took these exams – the class was affiliated with a local university, and we took their exams – and I was the only person in the class to get any sort of “A” on the exams, but I didn't feel like I knew what I was doing.

I argue that a culture of isolation and competitiveness tends to foster the Imposter Syndrome. Shawna, the transgendered white early-career CSE professional working in academia quoted in Chapter 5, describes how male professors can exacerbate difficulties faced by female students:

Shawna: I had some official mentees; we had set up a first-year mentoring program, and my mentee was really having difficulties working with her advisor ... and she was having some difficulties in some classes. There was one day in particular where I had five female grad students come by

my office [to] talk about how they were the only one who had done really, really poorly in this class.

Coleen: Oh, they all thought they were the only one, too.

Shawna: The instructor had pretty much taken care to suggest that it was only their problem; [he] did not mention that it was common. [By] the third one I'm like going, "Wait a minute, you do know that there are other people in class who didn't do as well as you." They had no idea!

Women's feelings of insecurity are fostered not only by the "macho" behavior of their peers but also by the weed-out approach that some professors enact in their pedagogy:

Coleen: What's a weed out course?

Joy, an Asian American CSE undergraduate student: Our professor like finds joy in just seeing the crying faces of the students. Seriously, our final – so out of the six questions, people barely could do two. Okay, the average for our final was a 33 percent ... that teacher is like a weed-out professor, I swear.

So in addition to assigning exceedingly difficult course work, a "weed out" professor fosters little unity between classroom peers. The individualization that students experience under demanding circumstances is symptomatic of the competitive environments in CSE undergraduate classrooms that disproportionately affect female students (Barker and Garvin-Doxas 2004). Joy notes that her professor took pleasure in the students' pain, leading me to wonder if this pedagogical approach could also be a mild form of erotic domination, an imposition similar to hazing whereby students are prepares to assimilate into a bureaucratic CSE workforce characterized by power

relations between subordinate acolytes and dominant male leaders (Hacker 1990). The term “culture of hierarchy” that Tony (quoted above) used to describe workplace environments in CSE organizations is premised on “relations of dominance and submission” embedded in the practice of engineering (Hacker 1990, 209). Perhaps part of what contributes to women’s underrepresentation in CSE relates to these dynamics of eroticism. Perhaps women do not experience the erotic charge in masculine cultures of hierarchy. Women experience a sense of lack, of missing out on the rewards of these eroticized power relations, and internalize these feelings and define them as the Imposter Syndrome. Stated another way, women may feel like they are pretending in games of domination in CSE workplaces and the Imposter Syndrome is a way to talk openly about faking it.

In my data analysis, participants with a feminist standpoint appeared to have robust skills coping with hostility and the ability to analyze individual experiences within the context of structural constraints. For example, Theresa, the white mid-career CSE professional working in academia, identified herself to me as a feminist and expressed a strong dislike for the Imposter Syndrome concept. She felt the Imposter Syndrome kept the focus on individual women’s struggles and dangerously framed male hostility as an internal barrier to overcome rather than as a symptom of an environmental problem within CSE culture. “One day,” she remarked, “I will have the balls to do an anti-imposter syndrome workshop at Grace Hopper [Celebration of Women in Computing conference].” Theresa’s critique of the Imposter Syndrome prompted me to examine who among my participants raised the Imposter Syndrome issue. In this study, white females at all stages of a CSE career raised the fear of merely simulating the role of a competent

computer scientist. Though several women of color were candid with me about their pain caused by white supremacist patriarchy, none mentioned nor displayed the self-doubt characteristic of the Imposter Syndrome. Neither did any male or foreign national participants. Moreton Robertson (2009) reminds feminists to keep in mind “the way in which white women derive power from their race privilege through an association with white men” (p. 39). This leads me to hypothesize that white American women have a different relationship with dominant group members in CSE and possess implicit expectations of acceptance based on race privilege that fail to materialize in CSE. Perhaps they are subconsciously disappointed by this failed bid for racial privilege and internalize white males’ rejection and lack of acceptance of them, making them more susceptible to self-doubt. Characterizing the Imposter Syndrome as specifically a white gender norm could destabilize its reproduction and transform it instead as a site from which to collectively challenge both white and male supremacy in CSE sites of knowledge production.

Self-Efficacy: The Antidote to the Imposter Syndrome

Self-efficacy – how you feel about the tasks you do, their value, and your ability to successfully complete them – plays a significant role in women’s persistence in engineering (Marra 2009). All of the historically underrepresented women of color in this study displayed attitudes reflecting high self-efficacy despite multiple non-traditional aspects to their social identities in CSE, including race, class, and gender. Sylvia, the African American CSE Ph.D student quoted above, shares how she overcame her self-doubt: “I had this one class that was really difficult, which made me think, ‘Why did I commit to computer science?’ but then I found that everyone was having the same

problem with the class then I didn't feel too crazy." This experience shows the wisdom of Shawna's intervention technique (discussed above) of letting women know that they are not the only one struggling with the complexity of course material.

Other participants also expressed high self-efficacy. Olivia, an African American CSE Ph.D with extensive experience in industry, takes great pride in her accomplishments and finds overcoming barriers rewarding. When I asked her what other women can learn from her example, she declared: "Hey – I can do anything – kids should see that!" Regina, the foreign national CSE Ph.D student quoted above, stated: "I do want the image of computer geeks to be overthrown. This is why I like being a [athletic] performer. I'm like, "Hey, I can kick your ass physically, and I can also sit in front of a Mac."

I was especially impressed with the self-assuredness expressed by Alisha, the African American CSE Ph.D student quoted above, and her ability to self-advocate:

Alisha: Coming from my background I didn't, even to get into this program it wasn't easy. I knew I wanted to get into this program but I had to you know, talk to the advisor, let him know, "Hey, I'm a hard worker. I can get in there and do the work." But my background is so much different from a lot of students that come here.

Coleen: Oh, really?

Alisha: Yes, some of the classes they've taken I may have not taken.

Coleen: Oh, prerequisites then?

Alisha: Right. Well no, I didn't have to take prerequisites, just a difference in education, that's all I can say. But, I still had to get in and work hard and I did a very good job.

Alisha's statements of assuredness like the one quoted above moved me and our conversation resonated with me for a long time. Alisha reported bridging gaps in academic preparedness and moving from the South to the North and from a predominantly African-American community to an prestigious CSE program with only one other African American student. Then, she gives herself credit for navigating these circumstances with aplomb. When I pressed Alisha on what motivated her to overcome challenges, like, for example, successfully networking with her predominately white and Asian American peers even when she felt out of place, she stated firmly: "You just have to." Later in our conversation, she recalled a period where her motivation to finish her dissertation research lagged and stated that what spurred her to continue on was "the accountability factor, because I have people counting on me."

In November 2012, I presented a lecture with the preliminary data findings of this research and wondered why women of color in this study appeared to have higher levels of self-efficacy. A Latina audience member suggested that this may be due to different enactments of gender relations within communities of color that help inoculate women of color from broader social stereotypes of labor value. This explanation makes sense, especially in light of feminist anthropologists' findings that cultural factors promote historically underrepresented women's ability to act as agents of their own destiny (Browner 2001; Maternowska 2006). Alisha's illumination of the "accountability factor" is important too. I am currently collaborating on an ethnographic study investigating the experiences of CSE students from lower socioeconomic backgrounds and many participants of both genders and from a range of racial/ethnic backgrounds cite accountability as a reason for persisting. This leads me to conclude that students who

have overcome obstacles in the pursuit of educational achievements are motivated not only by individual personal gains but also by commitments to family and/or community members. The “accountability factor” signals that persistence in CSE for those who have faced social disadvantage is an investment in a collective identity and community.

Susceptibility to the Imposter Syndrome can impact women not only individually but also collectively. For example, Lynn, the white early-career CSE professional working at a prominent CSE corporation quoted in Chapter 5, advocates for the participation of women in her field, but describes how she transfers her own self-doubt onto other women in CSE when she evaluates them:

When I see a woman’s name on a paper, I wonder: “How did she get into the field? Did she get in on merit? Or did she get in because of other privileges that were given to her, like me?” I’m serious. And it makes me doubt stuff here, too. Like how did I get in here, this crazy prestigious ticket? To get a job at Google is amazingly competitive. How much of it was because somebody had an agenda? It makes you doubt yourself, and women are already such doubters anyways.

Low self-efficacy in male-dominated fields is a gender issue (Marra 2009), and while many women leaders in CSE recognize this, gender agnostics often do not. Shona Brown, the white senior CSE professional and senior vice president of Business Operations at Google quoted in Chapter 5, coined the term “gender agnostic” to describe how not thinking about gender is a critical component to women’s advancement in CSE. Yvonne, a foreign national CSE professional, a full professor at a top-tier CSE department, and a recipient of a prestigious technical award, is a good example of a

gender agnostic. She interpreted a student's doubt as an individual problem issue, rather than a political one:

Coleen: Why do you think women are underrepresented in CSE?

Yvonne: Like any STEM field, women ... uh, I don't know.... I don't know. It's hard to know.

Coleen: Do you have women graduate students and do they confide their experiences with you?

Yvonne: Just one who recently told me she was thinking of quitting. She was discouraged and felt a lack of confidence. But that's not gender-based but rather her internal barrier to success.

Yvonne has no hypotheses on gender dynamics in her field and frames her student's insecurity as an internal barrier to overcome rather than as a symptom of an environmental problem within the CSE field.

Women who claim not to see gender in CSE are often self-assured and very successful. For example, during participant observation at the small civic-minded CSE start-up discussed above, I noticed that Agnes, a white early-career CSE professional, a professed gender agnostic, and the only woman on her six-person team, possessed a very confident work style. After fixing a bug during a big launch, she stood up, flexed both her arm muscles, and declared: "I'm unstoppable!" Agnes' and Yvonne's stories lead me to argue that gender agnosticism is an individual persistence strategy and one that may help inoculate women practitioners from internalizing stereotypes of women's lower competency in technology. It is one way that women reconcile the tensions emanating from the rupture (Smith 1990) of being both a ruling class member in an elite field and a

marginalized member within this field. However, it is a coping mechanism that reflects a lack of desire to be a change agent. I argue below that other women with social change aspirations can experience ruptures that result in the blossoming of feminist consciousness and activism.

SPONSORS: TALK BACK AND PASS IT ON

Women rely on more than their internal resources to persist in CSE. My data revealed a consistent pattern whereby the positive influence of others' support and encouragement is crucial to my participants' success. All participants were sure to tell me about the people who have supported them in their career path and have helped them navigate hidden rules, avoid pitfalls, improve skills (both technical and social), minimize stress, and advocate for advancement. These "sponsors" had a significant impact on my participants' aspirations, networks of access, and strategies for persistence. A sponsor differs from a mentor in that his or her support is highly visible and they use their authority to actively advocate for those they sponsor. Sponsors take mentorship to another level: they not only give advice to their mentees, but they actively support them, go out of their way to help them avoid pitfalls, and invest in their mentees in a holistic sense. "Where a mentor might help you envision your next position, a sponsor will lever that position for you ... a sponsor believes in you more than you believe in yourself" (Hewlett 2010, 5).

Same Sex Sponsors

A growing body of evidence suggests that women CSE faculty have a positive impact on women's persistence in the training stages of CSE careers (Diekmann 2010; Price 2010). My research supports these findings. For example, Whitney, a Latina CSE graduate student, told me how she is inspired by women faculty in CSE: "It feels really

great to take classes with female professors. It makes me feel proud and I want to be as accomplished as them.” Becca, the white Ph.D CSE student quoted in Chapter 5 and above, spoke highly and frequently of her sponsor: “Both she and I label her as like my academic mom ... She just basically opened all these doors for me ... she’s a blessing, seriously.”

Alisha, the African American CSE Ph.D student quoted above, described how her sponsor outlined a long-term career path for her:

There is a very influential person from my career environment, her name is Dr. Meredith Brent [name changed]. And she is the deputy director of the laboratory that I work in. My research center has seven labs. The lab that I worked in is the Information Technology Lab, and she was the one that kind of got me along this path, “Hey, you need to get your master’s, you need to get your Ph.D,” you know, putting me in different leadership development courses, leadership development programs. So, I give her a lot of credit for the place that I’m in right now.

Sylvia, the African American CSE Ph.D student quoted in Chapter 5 and above, also described the importance of her sponsor in her career choices:

Dr. Keller was amazing because she is the one who got me into Minority Access in Research Careers. She would tell me I should apply to this program and I didn’t, I just didn’t and so she called my dad, and told him I would be amazing for the program. So, oh my gosh I applied, I got in, and even now she still encourages me.

Carol, the white senior CSE professional and software engineer working in industry quoted in Chapters 4 and 5 and above, describes how her sponsor’s support inspired her to do the same for other women:

[My sponsor] was just completely awesome and I was this young woman in her purview, and she scooped me up. Now, whenever there's a young women in my field of vision, I scoop her up. It is just that culture matters and if you care about culture then it behooves you to pass it on ... I have my ideas of what culture should look like ... probably more now that I'm more senior and definitely old enough as the saying goes, to wear purple. I really don't give a rat's ass what you think.... I know what culture should feel like. I know how we could treat each other.

Carol's sponsor, a legend in the history of US computer technology, gave concrete practical advice that released Carol from an on-going burden:

It's like these guys, they're always talking about [how] they're working on this really important thing and this other guy's working on this, you know, seriously important thing. I asked my mentor, how do they know that this stuff is so important. She said, "They're making it up." And it was so helpful; it's like this huge load off my shoulder like, it was such a boost of confidence [for] me ... to know the stuff that you think is bullshit, you might be right.

The burden Carol describes relates to the Imposter Syndrome and what Janice (quoted above) calls "macho behavior." It is a micro-level cultural norm in CSE, which mirrors institutional public relations campaigns proliferating "mythinformation."

Same-sex sponsors can also make crucial interventions that increase persistence in CSE. Shawna, the transgendered white early-career CSE professional working in academia, describes how a female CSE full professor kept her from dropping out of her graduate program:

[The toxic relationship] with my advisor just kept getting worse and worse.... And eventually it lead to a point

where I was on the verge of a mental breakdown from all this ... I had given up. Rebecca [name changed] came into my office one day and said, "I'll help you find a new advisor." Honestly, I am saying that moment was the whole reason why I stuck it out in grad school. I actually called her out with a special acknowledgement at the end of my defense, because I can honestly say I would not be here without her.

Shawna's sponsor Rebecca not only provided individual support to Shawna and other female students in need, but also spearheaded systematic networks of support:

Shawna: I will say that [my school has] improved the safety nets quite a bit, and that's all Rebecca's work.

Coleen: Can you be more specific, what safety nets?

Shawna: So basically what Rebecca does is, you have a review of progress every year. Before no one really paid attention to it. Now, both our graduate advisor and Rebecca go through each of those reviews of progress and identify potential at-risk students.

Coleen: Oh, wow!

Shawna: So then they reach out to those students, in particular, Rebecca reaches out.

There are, however, some draw backs to same-sex, same-race mentoring. Alisha, the African American CSE Ph.D student quoted above, described being frustrated by her African American female professor's efforts to protect her from the challenges of navigating a male- dominated and predominantly white institution:

Women are harder on other women to get you ready to fight in your field. It's too intensive ... my advisor loses

track of being supportive. I've seen some students leave because of this approach – women being too tough on their mentees. As children, boys got intellectual and engineering toys and my mom wanted me to stay home to protect me. My advisor is doing the same thing, trying to protect me but instead [limits and discourages me]. I know women of color have to work twice as hard, I know that, but a pat on the back would be better than a slap on the back.

Alisha's advisor has overcome adversity to persist in a field with very few women of color and is preparing Alisha to fight because she knows Alisha will face both racist and sexism in her career. But Alisha wishes she could find more solace and support in her sponsorship.

Cross-Gender Sponsorship

Given the low numbers of women in CSE, and especially in senior leadership positions, women often have to enter into cross-gender and cross-race advising relationships. For example, Wendy Rannenber, a white senior CSE professional and the director of Technology at MicroLan Systems, spoke fondly of her male mentor in her Anita Borg Institute newsletter interview:

In my case, I had a male Engineering Fellow who was very supportive of women engineers and worked hard to make sure we had opportunities. He understood the importance of the technologies I worked on and asked challenging questions. I also had a woman VP who was quite skilled at working the system and sometimes felt pressured to give up her own technical career. She knew where the roadblocks were. Both listened well, offered great advice and a shoulder to lean on when things were not going too well.

Diane, a senior CSE professional and leader in academia quoted above, also stressed the supportiveness of her male graduate advisor and connected it to her persistence in CSE despite the high rate of attrition among her female peers:

Well, I was lucky. I had a great advisor. He was incredibly supportive – I mean, there were women dropping out around me, and I don't think I had the awareness to really understand, as well as I do now, the dynamics of why. So it wasn't good for everyone, is what I'm trying to say, and maybe I didn't appreciate how good I had it at the time.

After Olivia, the African American CSE Ph.D with extensive experience in industry quoted above, finished her Masters in CSE, she decided she “was done with school.” After seven years of working in in industry, however, she grew tired of working only to expand Hewitt Packard's bottom line. She returned to school to get her Ph.D in part because of the impact of one of her professors:

Dr. Dave had great classes, he brought industry to classes, most of the other professors were dull. Dr. Dave made CSE part of the real world and made me want to teach. He inspired me to become a professor.

Kin

It is well known that many engineers have a parent who is an engineer; engineers beget engineers (Seymour-Hewitt 1997). In this dissertation study, kin (both people's first family and chosen family), play a role in female CSE professionals' interest and persistence in the field:

Alisha, the African American CSE Ph.D student quoted above: My father has been a great influence in my life and he told me a long time ago, if I could understand science and math that I could basically do or be whatever I wanted

to do – whatever I wanted to be in life. So, I took that to heart.

and:

Olivia, the African American CSE Ph.D.: My uncle is an electrical engineer, a genius and he introduced me to a new side of things. He would explain things in 2-3 different ways, tell me another way to approach the problem until I got it. I admire that he could teach me all these different ways and in school there was only one way explained and I felt lost. My uncle opened these doors for me ... that was the engineer in him. I wanted to be like my uncle. I have friends that get stuck all the time and I can teach them what my uncle taught me. He said: “Don’t let anyone call you stupid.” He often said: “We can do it.”

and:

Coleen: You said, “My parents said I had to get an engineering degree.” Why do you think that is?

Cynthia, the white CSE undergraduate student quoted in Chapter 5: Well, my parents are set in their ways of what they believe is a worthy degree, and they’re paying for my college. And so like they feel like they get to decide what degree I get. So they gave me three choices: I could be a doctor; I could be a lawyer; I could be an engineer. But I could kind of tell they really wanted me to an engineer. Because my mom’s an engineer and kept saying, you know, “Engineers just think right. They just think right.”

I asked Cynthia to explain what her mother meant by “think right.” She explained that engineers tackle problems without “getting heated” about politics and are optimistic about their ability to solve social problems. Cynthia’s story of her prescribed options in college is an indication of her upper middle class status and highlights how an engineering career is a professional track that parents view as a path to class mobility in the US. “Thinking right” is living right.

Parents and close family members are not the only people who inspired women to invest in a CSE career. In the course of this study, I found that male partners also encourage women to take up CSE as a career and persist. In fact, every woman in this study who was at the mid-career or senior stage of her CSE career had a male partner who prioritized her career over his. Cecilia, an Asian American graduate advisor in CSE academia, first clued me into the influence of partners on women in CSE. She keeps in touch with women long after they leave the program. She talked about her students, both present and former, in terms of genealogy and likens them to her “grandchildren ... a family tree.” She observed that the majority of women who persist in CSE have steady male partners who support their careers.

Tara, the white early-career CSE professional working in academia, told me that her male partner suggested she take CSE classes. She said: “He definitely helped me a lot, especially in the early classes.”

Carol, the white senior CSE professional and software engineer working in industry quoted in Chapters 4 and 5 and above, also described the role a male partner played in her becoming interested in technology:

It was the very early eighties and there was a very big recession. I got laid off and I tried so hard to find another job in that field and there was just nothing, nothing. And one day I was home doing nothing and my boyfriend at the time who worked at Data General ... he had a book, a manual that he had brought home on microcode.... I was sitting in the living room, my legs over the side of the easy chair and I picked up his manual because I was bored and read it and when I was done I tossed it over the side of the chair and said, “Well that’s trivial.” And my boyfriend at the time said, “Are you serious?” And I said, “Well, yes.” And he said “Well, if that looks really easy to you then you

should consider doing this” because there were not a lot of people who had degrees in Computer Science at that time.

Thirty years later, Carol still credits her ex-partner with helping her find a lucrative job that she loves.

When I asked Jessica, an Asian Canadian CSE undergraduate student, if she had a mentor, she thought it about for a minute and said: “My partner is in tech also and helps me regularly ... perhaps he would come closest as a mentor.”

In her Anita Borg Institute interview, Eleni Stroulia, the white senior CSE professional and the NSERC/iCORE Industrial Research Chair at the University of Alberta quoted in Chapter 5, credits her male partner with her ability to maintain a work/life balance: “My husband and I work well as a team sharing the responsibilities and the joys of our children. I feel like my husband and I balance our professional and private lives quite well.”

Other senior women in CSE collaborate with their male partners in both their personal and professional lives:

Dr. Cecilia Aragon’s husband was and is another significant part of her support system. Beyond helping with home and child care, he shares her interest in algorithms and software. He’s written papers and secured patents, so the partners are both involved in creative research and understand each other’s work. “Both of us find that the work the other person has done has helped in our own work,” she says.

(Aragon in Willard-Hendrichs 2009, 2).

Janice, the white senior CSE professional working in academia, told me about being recruited for an executive position in academia and how her daughter Fiona and

husband Phil supported not only her autonomy in decision-making, but also her non-rational approach to this life-changing choice:

I kept on trying to drop out of the search 'cause I really was not interested in moving. And [the Search Committee] kept on saying, "Just come to the Search Committee, 'cause we want to calibrate other candidates against you." And then, "Just come and do the on campus interviews," et cetera, et cetera. So, they make me the offer and I say, "I'm not coming if I have to make the decision quickly...." And by this time, Phil, my husband, was probably more in favor of going than staying. Because he found the school we were at really quite arrogant. It really is quite arrogant.... So we're having lunch in the airport. And my daughter Fiona says, "Mom, I know what you're going to decide." And I said, "So tell me." She says, "No, I'm not willing to take that kind of responsibility for your life." I said, "Fine. Tell Dad I'm going to go off and find a ladies room. But as soon as I make the decision I want to be able to check with you if you knew or not." So anyway she told him. And then the next day at 3:00 PM is the phone call when I have to make a decision. And I'm sitting looking out, you know, it's a gray, drizzly day. I'm looking out at the water and I'm painting. And, all of the sudden, literally, the clouds part, and a shaft of light hits the water and it's a quarter to 3:00. And I went over to Phil and I said, "Phil, could I choose to go to [the new university] just 'cause it's this magical thing that we're going to miss if we don't go ... even if I don't have any rational reason to choose to go?" And he said, "Sure."

Coleen: For magical reasons, he supported you?

Janice: Yeah, ... then I ask Phil what Fiona said I was gonna do. And he says, "Oh, she knew you were going to move. She's watched you for the last three weeks, and you were trying really hard to find a rational reason to go. But she knew you'd figure out some reason or other to go."

Coleen: She knows you well.

Janice: Yeah, she does.

Janice's kinscript is a testament to how women's intimate relationships influence their CSE career trajectories. I love this story because it involves family but does not relate directly to the female protagonist's childrearing responsibilities. Also, it is a positive example of Smith's (1990) concept of "rupture," moments in women's lives where they feel the tension between their own consciousness and the reigning ideological and cultural norms of their society. Janice had reached an ascendant position of leadership in a field that values formal hyper-rationality when, with the support of her family, she can make decisions using a non-rational process. Janice's story of her career path decision speaks to a yearning to follow one's heart that only loved ones could empathize with and support. One of the difficult parts of this research was listening to women describe having to make difficult choices between socioeconomic well-being, the work they love and their heart's desire to make the world a better place.

Leaving Home

Other difficult choices that some participants had to make in order to advance their careers related to place. An important element of pursuing a CSE career trajectory is the willingness to move for a degree program or job opportunity. The theme of transitioning from one place to another frequently came up in my interviews. Race emerged as an important factor in this theme. Participants from historically underrepresented racial/ethnic backgrounds described their transitions away from their homes and away from their kin with varying degrees of pain and discomfort. Alisha, the

African American CSE Ph.D student quoted above, describes her experience moving away from home to attend school:

Alisha: So coming from the environment that I come from, I guess it's home because I'm from Mississippi so I already knew a lot of people in my work environment before I even got there, just on a personal level, just knowing them because I'm from Mississippi. And coming [to Pennsylvania], just not really knowing anyone, um, really I'm the minority either way you look at it. I go to class with a lot of Asians. The first time I came here I kind of felt like an outsider and as the semester progressed, and even in that second semester I got more comfortable, I met more students, and the second time around since I'm back this semester it's like I've made a few friends and I feel more comfortable in this environment.

Coleen: So why did you return to Mississippi?

Alisha: Well, I always said that um, even when I took the job in Pennsylvania I gave myself, you know, five years, you know to like, hey, I just really love home, you know, I like to travel but I really love the South. So, when that opportunity came to return home, I jumped on it.

Sylvia, the African American CSE Ph.D student, also notes the shock of homogeneity that greeted her at her predominately white institution:

Sylvia: I went to Minnesota and I'm African American, there's not [many] African Americans there. So I went from seeing you know, everyone like me, to like, aw! I'm just seeing everyone of [a] different culture!

Coleen: That must have been a big shock too!

Sylvia: It was! At first you start feeling self-conscious about yourself, wondering "Huh? Everyone else looks the same way." Everyone started looking the same way, and I

was just like self-conscious, like there's something wrong with you. I think over time it helped work through that.

Olivia, the African American CSE Ph.D student, took some time to acclimate to her new community:

After graduation, I decided to go into industry. I was a little burnt out on academia. Hewitt Packard was awesome. I moved to Seattle (from the South). [Seattle is] a predominately white area – at first it was tough to socialize outside of work. But I started to get close to people.

Gia, a foreign national mid-career CSE professional, also spoke of the differences between her CSE experience and her experience of home:

Like when I go home to [South America], to my family, to my thousands of cousins, they all see me as kind of weird – right – and there's this barrier. And so I've given up that, and in the Latina culture the families are important, and that bond, and we get a lot of support from that, and that's something that we've all sacrificed some to be in a position here in the United States, and to be in a [career] where we had to put ourselves forward.

These stories of transitioning from one's home to being a solo member of one's race and ethnicity in predominately white communities testify to the price of pursuing a CSE career as a minority woman (Malcolm 1976). When considering the social impact of CSE technology, the disciplinary norm requiring practitioners to move does not allow women, and particularly minority women, to practice their skills in their chosen communities and provides additional evidence that rituals in CSE divorce CSE producers from their social fabrics and privilege the global, the virtual, and the ideals of the ruling class.

Allies

Men in CSE need to join efforts to desegregate the field of CSE and destabilize the imposed dominance of the white male standpoint that I explored in Chapter 5. The best way to foster support for diversity in STEM from dominant group members is to create, recognize, encourage, and recruit allies. An ally is someone who advocates for underrepresented group members but does not share their social identity. Male allies are needed at all stages of CSE careers, from peers in the training stages of CSE through the senior levels of leadership.

A 2012 study by the National Center on Women in Information Technology (NCWIT) explores the characteristics that foster male allies in CSE fields. The study finds that men who are underrepresented in other identity aspects, have a female partner who works in CSE, and who share equally in domestic responsibilities or have a daughter make effective allies to their female CSE co-workers. Julie, the white early-career CSE professional working as a software developer in industry quoted in Chapter 5 and above, gave me examples of this kind of support:

With my current co-workers, they are a lot more socially adept [than past colleagues] – they're not hard core academics, they're studied more like art and design, but they're kind of still dudes' dudes ... they played sports, and they like to party a lot, but they're all married and have daughters, which is something that's really cute. It is cute. And I think it makes men a little bit cooler to work with when they have a daughter and they're close to their wife. It makes a huge difference – or if they have sisters that they really like.

Joy and Kara, two Asian American CSE undergraduate students, explain more about what it is like to have male allies who “are cool to work with:”

Joy: Just because I also have guys who are in my group, I feel like they're just – they're just gentlemen.

Coleen: Okay. So then you feel respected?

Joy: I do. I mean, a couple of people, they're definitely a little more self-absorbed, and they don't like to interact as much with me. But, I mean, like I want to say like maybe five out of the seven people in my group, they've treated me pretty well. Maybe I've just been lucky and I've been sort of just working with really sort of stand-up guys, but I don't know, they're always just kind of, you know, like, "Oh, it's a woman. Let's be nice to her." It probably does help that I'm usually the one who knows what I'm doing, too.

and:

Kara: The only professor who I think kind of noticed females for a second was an ally, 'cause he sent out emails to a few of us [women] saying, "Hey, I just want to let you know, congratulations on doing really well in my class." And he's just sort of a sweet guy.

In the spring of 2011, during my participant observation of the small civic-minded CSE start-up discussed above, I observed Agnes, the white early-career CSE professional quoted above, interact with three male coworkers who displayed ally behavior:

Agnes: Thanks for holding my hand Ken. I feel safe here with all you smart people. I learned two new shortcuts.

Aaron: Now you are around other tech people all day. You'll learn lots of shortcuts instead of languishing in isolation!

Tony: Yea – and thanks for fixing my mistake Agnes – you get an eagle-eye badge!

These narratives share a common theme: women CSE professionals appreciate being welcomed, respected, and valued by their male peers. Males in CSE leadership positions have the opportunity to make institutional contributions to inclusivity. For example, Mark Bregman, a white male senior CSE professional and the former chief technology officer at Symantec, described his hiring policy at his new start-up. With the goal of hiring more women, he requires hiring managers to interview women for engineering jobs even if “on paper” they do not appear as strong. In the interviews, the women often impress the search committee and are hired (Kaufman 2011). I saw Bregman speak at the 2011 Grace Hopper conference about his experiences at Cisco Inc. His analysis of gender politics was nuanced and astute, especially his anecdotes about how some male CSE professional not only self-promote but also manufacture drama for attention and accolades. In my eyes, Bregman cemented his status as an ally when he implicated his own behavior in his critique, making transparent the self-reflection and self-growth required if men are to become part of the solution to underrepresentation of women in CSE fields. Perhaps he will follow in Sheryl Sandberg’s steps and write a book outlining individual steps men in CSE can take to become successful allies.

STRATEGIES FOR PERSISTENCE

In the sections above, I reported the personal characteristics and interpersonal relationships that are crucial to women participants’ successes and advancements in CSE. In this section, I share persistence strategies that women CSE professionals learned “on the job,” not because they are fool proof or even desirable courses of action, but because they can shed light on the social dynamics in CSE cultures that marginalized CSE workers must navigate to persist.

Thick Skin and Dark Hair

At the conference today, Kate, an assistant professor, told me she had a student ask her how to handle sexist bias in labs. Kate asked me – “What do I tell her? It doesn’t get better and to complain is dangerous.” I told her to legally document every incident of sexism, no matter how subtle, by sending an email to yourself. Emboldened by Joan Williams’ (2000) message in “Unbending Gender,” I said, “Don’t be afraid to get litigious; documentation over time is the best offense.” However, later that night at dinner with Linda, a senior academic CSE woman, I asked what her advice to this assistant professor would have been. She said the only thing to do to persist in academic technology is toughen your skin and learn productive ways to vent.

In reviewing this field note of mine, it is important to note that I did not persist in CSE and Linda has persisted in the field for over thirty years. Getting litigious on one’s own, like I did, may not be the best strategy for someone who wants to remain in the field long-term because it will likely impact one’s ability to remain welcome in high-tech communities. After our dinner conversation, I thought more about what Linda meant by “vent.” I thought of group interviews where women discussed sexual and gender harassment and bias with levity and humor. I remembered Diane’s smile when she discussed her female colleagues who helped her get through graduate school. I saw how the impressive extracurricular activities in which many of my participants engaged – poetry, race car driving, flying planes, performance art, marathon running, sculpture, and volunteering with underprivileged children – were perhaps ways to “vent” and thereby relieve the strains of working in an intense field with accepted norms of hostility.

Eleni Stroulia, the white senior CSE professional and the NSERC/iCORE Industrial Research Chair at the University of Alberta quoted in Chapter 5 and above, agrees that there is a certain amount of tolerance required in persisting. In her Anita Borg Institute newsletter interview she said:

In addition to the knowledge and skills required by their profession, I think that women in technical fields should have a bit of thick skin, to not be impacted by how different they may look in meetings, to ignore comments (sometimes intentional and sometimes accidental) about their not belonging, and to (gently) interrupt to take their turn in discussions.

Stroulia's "turn-the-other-cheek" advice worries me because it encourages passivity in the face of violence, but I concede that women on the front lines of desegregating CSE fields must employ a range of strategies to order to persist. Many women in the training phase of a CSE career have taken this advice to heart. Corrine, a white early-career CSE professional, identifies as "a social person" and was one of three women in her undergraduate CSE classes of sixty students. Early in her undergraduate career, she dyed her blonde hair black and continues to do so five years later: "Being known as both talkative *and* blonde isn't what I need." Joy, the Asian American CSE undergraduate student quoted earlier in this chapter, also drives home the importance of "tough skin" and connects it to hair color:

Joy: I guess if you're going into any of the STEM majors, you kind of have to have a tough skin.

Coleen: Yeah. And how do you develop tough skin?

Joy: Kind of have to be manly, if you will. I don't want to say "manly." I feel like we're just adopting – male characteristics.

Coleen: Which are?

Joy: Not like the – not stereotypical like girly-girl stuff. Limit the blonde moments.

It appears Corrine follows this norm literally. Blonde hair within the cultural domain of US society can denote a lack of intelligence and sexual availability (Urla 1995), both of which can be dangerous to marginalized community members struggling to prove their competence.

Break the Rules

Conforming is not always the best strategy of persistence. Sometimes not following the rules works too. Sylvia, the African American CSE Ph.D student, explains:

Sylvia: You can do other things besides what they teach you. Like for me, even though as an undergrad we would go in the classroom and [the professors would] be like "Okay, create this project," and then they would give you this really boring thing, but what you can do [is] go to the professor and be like, "Can I do something else?"

Coleen: Oh, good for you! And what did they say? What was their reaction?

Sylvia: They used to always be like "Sure, you can do whatever project you want."

Janice, the white senior CSE professional working in academia, describes how she and her colleagues were able to significantly increase the number of women in her department:

Janice: So [we] changed the intro course to CS, both in terms in the way it was taught and how the material was framed. The contents of the material provided more choice. So, for instance, we knew that women liked to have a sense of control over what they were doing. Actually, men do too. And so instead of getting only one homework assignment, you can pick either of two problems to work one. Of course they have exactly the same content in them. But one of them is a biology problem and one of them is a robot [problem], for example.

Coleen: Oh, I see. So they can choose [the] context and the content remains the same?

Janice: Exactly.

Coleen: And it's the same problem solving.

Janice: Yes.

Like Sylvia, Janice demonstrates that when women are given more choice in the problems they solve, they are more likely to persist in CSE.

Independence of mind also benefited Tara, the white early-career CSE professional working in academia, in persisting in CSE:

Tara: The reason that I did not drop out is because I realized early-on that one of the really important things in my graduate career was that you can't expect your supervisor to be everything ... you need to figure out where you are going to get various [networks of support] from ... I spent a lot of time figuring out what I wanted to do, and where that diverged from what my advisor wanted me to do – what I should do anyway.

Coleen: So sometimes you pursued your own path against the advice of your advisor?

Tara: Yeah...[M]y advisor at one point literally said that he thought that getting a Ph.D should be one student all sitting alone in a cubicle doing their work, and I firmly rejected that notion.

Coleen: Oh, geez, that is the stereotype of the little geek.

Tara: Right. So, you know, I said no, and I went out and I found support there, I rallied the other students and we went out and we had breakfast every other week at IHop because that's how it worked out for us.

Tara's rejects not only her advisor's advice but also the "lone genius" myth of scientific knowledge production (which I suspect is her advisor's idea of the best way to earn a Ph.D. in CSE), a relic from the "Enlightenment" era long left behind in post-World War II scientific industry in the US. Tara's collective, cooperative approach to her education proved to be critical to her persistence.

Putting Our Minds Together: Collective Organizing and Succession Planning

I stand to reproduce Bachofen's error of reifying women as cultural heroes if I limit my analysis to transformative work performed by individual women alone (Sacks 1979). The power of women's collective organizing was evident in my data. For example, there was great levity in my group interview with women CSE undergraduates; epistemic and euphemized violence was shared and received with humor and a confidence born of belonging. Diane, the senior CSE professional and leader in academia quoted above, moved to the US from Europe for a graduate program in CSE with four other women from her undergrad program. They all lived together, studied together, persisted together, and graduated together in five years. Diane's self-efficacy was especially high when she talked about her and her cohorts' skills and successes: "We just felt like we were in charge of the rest of the class!" Much like the transformative work

performed by the women Mullings (1995) describes in her work on reproduction in Harlem, women in the training, early- and mid-career stages of a CSE career depend on their female cohorts to survive in their male-dominated field. Anita, a professor of computer engineering, suggests that CSE organizations provide funding to bring women together:

There should be more money for mentoring – women mentoring other women. I’ll tell you, just something as simple – one thing that made a difference, even at Stanford, was that it had a small amount of funding for lunch for female graduate students, so [Stanford] paid for lunch, once a week. That made the difference, because we just – we had – you had to eat. And if there’s a place where it’s just women ... where there’s no men, you know, and you can just gripe and support each other, it turns out we all had the same problems.

Coleen: It’s not an individual problem, you’re all experiencing similar circumstances– it’s a consciousness-raising thing.

Anita: Yeah. I would love to see more lunch programs just for women.

Cynthia, the white CSE undergraduate student quoted in Chapter 5 and above, joined a sorority for women in engineering majors because she was the only one of her existing friends who was “science-minded” and felt welcomed by other science-minded women:

What’s great about the engineering sorority is you have that camaraderie where you meet once a week, and you just need to like bitch about some teacher or some class, like everyone else knows what you went through, they all were like, “Yeah, I totally understand. You know, it sucks now, but just wait a little bit, you’re going to be fine.” They’ll

give you hints, teachers to avoid, or hints on homework – they’ll give you homework help. If you’re struggling, we have what we call a scholarship chair – you go to her and [say], “Hey, I’m in this class. I am sucking at it right now. Is there anyone who like can help me?” And then she goes and talks to people who took that class, or who are in the class right now. They’re like, “Hey, so and so’s struggling. Do you think you can like help her out?” And we set up study sessions. And we have an old scholarship binder where whenever we feel like donating, we just donate our old homework, or practice exams for future generations to go through and be able to benefit from.

I asked Cynthia whether her woman-centered network of support functioned much like the “old boys club” in terms of succession planning:

Coleen: Oh, my goodness. So there’s a legacy that you’re putting in place for succession, for more women engineers to come behind you.

Cynthia: Yeah.

Coleen: So do you think that helps other women persist as well, in engineering?

Cynthia: I think it really does. Kind of just knowing that you have a group of girls, that you’ll go have fun with, we try to take classes together. A lot of our newer pledge classes have been a lot more – they’ve been bigger groups, for one: I was with a group of three. So we’ve had up to like eleven girls in one pledge class like recently. They become really, really close with each other, and really good friends, and so they all plan their schedules around each other.... *They just all put their minds together. And it just fosters this more collaborative thinking, where everyone gets to the right answer faster, rather than all of them separately struggling.*

I stress the last part of Cynthia's comment to bring attention to the cognitive effects of women cooperating in CSE, which augment the social support these women-centered collaborations provide. In an article in *Diversity/Careers in Engineering and Information Technology*, Willard-Heinrichs (2009, 1) describes the impetus and impact of the formation of the Latinas in Computing group:

Being both a woman and Hispanic can make it difficult for an IT pro to fit in, even with really great qualifications. Professional women as a group are nearly all white and non-Hispanic. Hispanics in technical fields are nearly all men. So what's a Latina to do? Two-plus years ago a group of female Hispanic techies found each other, put together their own group and came out fighting! It happened at the 2006 Grace Hopper Celebration put on by the Anita Borg Institute (ABI). A Hopper "birds of a feather" session brought together about twenty Latinas, and the Latinas in Computing (LIC) was born.

I like how Willard-Heinrichs stresses that the LIC brought out the fighting spirit in its members.

Carol, the white senior CSE professional and software engineer working in industry quoted in Chapters 4 and 5 and above, took part in a study of women engineers in the early 1980s. Her participation included weekly meetings with women in systems, hardware, and design engineering fields. She credits this group mentorship with her career success, because she had "that place where I was me, where I didn't have to be anyone else. I was with my homies and this had a profound effect on my life." Recall that in Chapter 5, Carol discussed being exhausted by having to assimilate as one of the guys. Having the opportunity to be in same-sex company prepared her for the barriers she would face and thus, helped her persist. Anita Borg, a pioneer in CSE, started a women's

group in the women's bathroom at a conference on operating systems in 1987 in order to gather scattered, isolated women into a community with a collective identity (Abbate 2012). Fostering women's collective identity both in the CSE discipline as a whole and in individual sites of CSE knowledge production is critical to subverting the cultural imposition of the male standpoint in the practice, production, and application of CSE technology.

Flexing communication

One technique that women use to navigate male culture in CSE is to "flex" their communication style depending on their audience (Merrill and Reed 1981). Julie, the white early-career CSE professional working as a software developer in industry quoted in Chapter 5 and above, illustrates how "the oppressed" navigate communication with dominant group members:

The challenge I find is [that] I definitely change my behavior, depending on where I'm working and who I'm working with,; who I'm meeting with; and most people do, to some degree. But I feel like if it's you being part of the oppressed, ... you learn to do it yourself, and how you present to who you're presenting to in power situations, you know. Like I know there's a lot of reasonable men that are great to work with, but then there's ones that if they have issues with girls and dating, and you dress to provocatively, it will interfere with your ability to get work done.

Janice, the white senior CSE professional working in academia, described flexing her communication style not just in the moment, but over the course of her career trajectory:

I have this friend, Dawn Star [name changed], who's the founder of [a corporate lab]. We have very similar personalities in that we – for the first ten to 15 years in our career, we survived and got heard by being really strong. Really willing to stand up for ourselves and, you know, not getting beaten down by anyone. And then both of us have gone on to management and leadership positions and we've had to unlearn that behavior. Because it's okay. I mean, it's almost necessary ... when you're a beginner in the field. But even though men are allowed to get away with it when they rise, women can't.

Janice had one communication style in her early- and mid-career to survive working with men who had the same or more power than her. Now that she is often the person with the most power in the room, she employs a very complex communication strategy that involves listening, diffusing anger calmly, sharing power, avoiding being pressured into making decisions too quickly, and above all, practicing collegiality. “Never lose it,” she emphasized. In Chapter 5, Theresa, white mid-career CSE professional working in academia, observed that hostility is how “people see passion” in high-tech. The fact that Janice had to revamp her communication style as she gained power suggests that the “passion” of “losing it” is an act reserved for male CSE leaders.

SOCIAL BENEFIT: “LEAVING THE WORLD A BETTER PLACE”

Emerging evidence suggests that social justice aspirations play a role in the underrepresentation of women in CSE (Diekman 2010; Cuny and Aspray 2001; Margolis et al. 2000). To summarize this research, high-aptitude, educated women perceive CSE as detached from real-world problems and lacking meaningful purpose and therefore chose to invest their talent in other fields. To build on this research, I made special note of my participants’ discourses and narratives on the social benefit of technology and their desires for the just application of their technical knowledge. In this section, I discuss two kinds of

social justice aspirations expressed by participants: 1) the desire for socially meaningful work, which causes women not to enter or not to persist in CSE, or shapes the sort of work that women in CSE do; and 2) the way in which supporting others, and particularly young women, in CSE is *itself* a social benefit that helps women overcome their insecurities, persist in CSE and feel they are making positive contributions to the world.

Becca, the white Ph.D CSE student quoted in Chapter 5 and above, recounted feeling left behind in her introductory CSE class explained that this caused her to believe the field was “evil.” Once her sponsor helped her see the social applications of programming, she pursued CSE as a career:

I ended up working with this professor for four and a half years. I started by winter term of freshman year and worked with her all the way to the end and slowly, but surely, I realized that computer science is really what I wanted. Conducting [gender human computer interaction] research in computer science made me realize that there were some really cool things about computer science I had never thought of ... it's not just syntax and debugging, it was real, you know, real applications like it can make a difference. You can make cool products that people would be affected by and that excited me. And because of that bigger picture I actually thought the stupid little things like syntax and all that stuff became exciting too.

The main reason why Olivia, a African American CSE Ph.D student, decided to pursue a Ph.D. in the Human Computer Interaction subfield of CSE was because she questioned how she was benefiting society by working as a software engineer at Hewitt Packard. She didn't know how the products she created were benefitting customers: “Are we giving them what they need? What is the benefit of all this – there's no social impact. I'm just helping to make Hewitt Packard money. Helping the customer is not enough,

because it's all about the bottom line – only Hewitt Packard benefits.” She believes in “the importance of giving back. It's a huge part of my story.” When she moved to Seattle to work at Hewitt Packard, she didn't know people and spent every weekend doing community service. In graduate school, she didn't have the time and she “yearned to give back.” Therefore, she chose a Ph.D. topic where she could combine work and service to benefit society.

Lynn, the white early-career CSE professional working at a prominent CSE corporation quoted in Chapter 5 and above,, describes how CSE lacks a reputation for contributing to the social good:

Lynn: CSE doesn't look like a glamorous job. Part of it is the fear that I'm going to be doing something that I can't explain, and for some women [being able to explain what they do] is appealing somehow.

Coleen: What do you mean, you can't explain to lay people?

Lynn: Yeah, like explain to my mom what I do. I mean, in the field of medicine you can say, “I'm working on a cure for cancer,” or something. Or, “I'm helping people” – and people might not know the details, they might not know the science behind it, but they understand the goal.

Coleen: Right, right. Which is ...?

Lynn: Some kind of social good, or leaving the world a better place...

Coleen: So computer science doesn't have that?

Lynn: It does, it's just that it's not advertised; people don't know about it.

Lynn makes an important point that many women not only want to lend their talents to a cause that serves the higher social good, but also want to be able to explain this to others. They want social recognition for caretaking contributions at a structural level. Perhaps the clear social contribution of the medical field explains why many of the participants who expressed social justice aspirations saw the biomedical field as a viable avenue to which they can contribute:

Eleni Stroulia, the white senior CSE professional and the NSERC/iCORE Industrial Research Chair at the University of Alberta quoted in Chapter 5 and above: Medicine appealed to me for its social value, ... choosing computers allowed me to delay committing to a single field, and today I can bring my expertise and knowledge to bear in a variety of fields, working with colleagues from business, health and education.

and:

Regina, the foreign national CSE Ph.D student quoted above: But right now that's why I want to go into bio-tech, because I want to see what the industry is like. I think I'm really like interested in biology, so if I do a start-up, I think it will be related to nutrition, or just biology, because I'm working with a nutritional lab right now, and I don't know, I like to eat, and I really like to see what people eat, how it changes their system, and how that turns into diseases. So if I ever do a start-up, I think it will be something related to biology.

and:

Becca, the white Ph.D CSE student quoted in Chapter 5 and above: What I'm excited about the, um – I want to do accessible health stuff and I feel like the technology there has more potential with people who are blind and low vision. Also on another project I ended up doing – I learned

American Sign Language two summers ago now. I wanted to do something that I thought would be helpful ... enabling people who have an impairment to have easier access to health. (Becca, a white CSE doctoral student)

and:

Sylvia, the African American CSE Ph.D student: What I'm trying to do is basically trying to enhance public health surveillance infrastructure. If you're able to put infrastructure where you can integrate all these [interstate] systems, it would help surveillance on a larger scale.

Coleen: Can you tell me more about that, that goal, those goals of helping?

Sylvia: Well, I think it all started, I think first of all it all started with me because that's kind of just who I am. But it's also with my mentor back in undergrad, she always talked about "You really need to do something that would affect everyone, you don't want to just do something and then it just stays there; and you just write it in the paper and then nothing happens." So I always take that to heart, like you need to do something where, yes, you do something in the research field but you need to apply it and you need just to be helpful. That's why I've been working with the Public Health Department also.

Sylvia had both a yearning to give back and the encouragement from a trusted, same sex, same race sponsor to do so. I interpret Sylvia's sponsor's heartfelt advice as an investment in a female student's persistence that paid off.

All of these stories demonstrate that the difficulties of persisting as a marginalized community member may be mitigated if one feels that one's career is more than a personal drive for success but a commitment to the greater good. Many women who

persist in CSE careers yearn to use their technical skills in service of social change, both in their CSE communities and in the world at large.

Social change aspirations help Maria Klawe, the white senior CSE professional and president of Harvey Mudd Technical College quoted above, mitigate her feelings of being an imposter. In a 2012 lecture at the University of Washington, Seattle campus, she said:

I get up every morning feeling like a total failure. I also get up every morning with this concurrent thought in my head that I can change the world. And I live with those two parts of myself day in and day out.

Dr. Klawe's admission is a poignant expression of the double consciousness of an "outsider within" perspective (Collins 2004), a woman's standpoint in a technical field that conflates technical competency with masculinity. It is important that she contradicts her feeling of failure with social change aspirations. Her social change activism in CSE is her way of contributing to the social reproduction of women workers' collective well-being. In her lecture, she goes on to describe how she also silences her self-doubt by encouraging other women.

I will always live with the part of me that feels I'm a total failure no matter what I do. But I know that I can walk up to Anna and I can [talk to] Anna and I can make her feel better about herself: "You're capable of doing pretty much anything you want with your life. You are extraordinary." ... So encouragement. Everybody can do it. You don't have to be female. You can encourage people older than you.

Dr. Klawe mitigates the cost of living with a bifurcated consciousness by actively supporting and encouraging other women and sees this as part of her effort to change the world. Like Alisha's sponsor (discussed above), and the members of the Latinas in Computing, she teaches other women in CSE to fight sexism in the field and to fight against an erosion of confidence. This encouragement is not only an external affair, but also an internal fight for a wholeness of consciousness that Dr. Klawe indicates she may never experience herself.

The motivations behind Dr. Klawe's feminist activity in CSE (discussed above) speak to the theme of "rupture" (Smith 1990) that has emerged in my data. Her woman-centered activism is both an attempt to reconcile her yearning to make social change with CSE individualistic norms and an attempt to reconcile being part of the ruling, privileged class and, as a woman, being ruled by dominant group members. Navigating the terrain of rupture, combined with a yearning for transformative action, may be the incendiary combination that ignites feminist consciousness, which can lead to collective action in pursuit not just of gender parity in CSE but social justice in broader cultural domains.

Conclusion

A significant finding of this research is that a majority of my participants have social justice aspirations – almost uniformly, they want to leave the world a better place. I found a strong correlation between these social justice aspirations, participants' persistence in CSE and a commitment to supporting other women in CSE.

My findings related to participants' social justice aspirations lead me to propose a "third path" by which women CSE professionals can navigate the reproductive politics I discussed in Chapter 4 and the "programmer" norms and epistemic and euphemized

violence I discussed in Chapter 5 to persist, and support other women, in CSE. Those politics, norms, and violence limit one's ability to see beyond the binary of capitalist relations – the wage labor of the productive CSE laborer (and corresponding massive profits for CSE corporations) vs. the unwaged labor of the reproductive laborer. In my study, my participants' reproductive aspirations transgressed the constraints of this binary to reveal a yearning to contribute to the reproduction of the collective well being of society and each other by transforming those politics, norms, and violence *by persisting in CSE and using CSE to further the social good*. This collective form of reproductive aspirations is a consciousness in opposition to the capitalist economic system and therefore is a more radical recommendation than liberal feminists and work/life balance scholars offer. Instead of asking women to choose between their CSE jobs (and with them, their financial independence) and their yearning to give back to society, this option allows, and even asks, women to use their CSE skills *for* society.

To illuminate the ways in which participants navigate the tensions between career aspirations and social change aspirations, I use the concept of transformative work - everyday work that can be the impetus for larger social movements - to strike a balance between exalting the grit, brilliance, and savvy of women who persist in CSE and resisting the urge to romanticize their aspirations or overstate the broader social impacts of any one woman's experience. Women working in CSE are following a non-traditional life course motivated by personal aspirations and talents, interpersonal relationships with people who matter to them and who encourage and support them, and affective aspirations to benefit society. They navigate their career trajectories by drawing support from other women, male allies, and most importantly, from their sponsors.

When people who are far outnumbered in their CSE organizations find ways to connect with one another, this communion can interrupt the process of internalizing one's toxic environment. When Diane, the foreign national senior CSE professional and leader in academia quoted above, was unhappy in her first tenure-track job, her friend helped her to critically examine the situation and shift her criticism away from herself and to her institutional environment: "It took me a while to figure out that it was the environment and it wasn't me or the job itself." Some women develop a critical stance on gender when they attempt to navigate their marginalized positions in CSE while also pursuing their yearning for social justice. "The shared space and feeling of yearning opens up the possibility of common ground where differences [of class, race, and gender] might meet and engage one another" (hooks 1990, 13). Gender agnosticism and women-centered activity both seem to contribute to individual women's persistence in CSE but the latter contributes to the transformative work required to increase diversity in the CSE field.

The transformative work women-centered women do every day to persist in CSE operates not only to transform individuals and individual sites of CSE knowledge production, but also to transform the CSE field as a whole and US society. However, my finding that these structural and political transformations were possible was complicated by my finding that women's narratives on transition, on needing to leave home in order to advance their careers, disproportionately affect women of color. While I agree with Ong et al. (2011) that increasing women of color's presence in STEM will have positive impacts on a national level, especially in underserved communities, I wonder how this will affect women of color. If CSE workers are serious about helping people and leaving the world a better place, then it must provide opportunities for CSE practitioners to give

back to their communities of origin, should they choose to do so. Given that CSE work largely takes place in US industrial, commercial, or military domains (Pawley 2012), social justice efforts in CSE fields stand to dismantle some of the most powerful institutions in the world. Therefore, CSE must not only “welcome people on the margins” to better align the field with social justice (Pawley 2012, 80), it must also support the local efforts of grassroots communities who are challenging hegemonic social relations and environmental degradation.

CONCLUSION: Transforming the CSE Workforce and Its Social Applications

INTRODUCTION: COLLECTIVIZING WOMEN'S LABOR VALUE IN CSE

In this dissertation I have woven together diverse threads of social science methods and theory with my own ethnographic data to wrestle with questions of equality and justice in a field that has brought into being a world of social relations mediated by CSE technology and centralized systems of information management. I looked at the intersection of the internal and external influences of social, ideological, and biological reproductive processes on the culture of CSE, a field that was historically and remains today significantly segregated by race and gender. I designed my research so as to map and anticipate the scope of women's trajectories within CSE careers and the applications of the technologies CSE produces. I argue that gender in sites of CSE is an advantageous standpoint by which to examine broader cultural values that shape the practice, production, and applications of CSE technology, modes of reproduction, and economic labor relations. In analyzing my findings from my ethnographic fieldwork – specifically, the use of autoethnography, participant-observation, interviews, and media content analysis – I have contributed to four main areas of scholarship: feminist anthropology, feminist science and technology studies (FSTS), critical methodologies, and Marxist feminism.

By reflecting on the perspectives and experiences of individuals within CSE organizations and institutions, I have crafted an ethnography grounded in the disciplinary community of CSE knowledge production that breathes life into the practices and politics of social structures related to, and the institutions that are involved in, CSE work. I sought to map the material, ideological, and political systems that reproduce dominant

class rule in CSE and the domains on which it impinges. I theorize that certain values – precision, abstraction, aggression, and a faith in the transcendental power of computing machines – are imposed and inculcated as the core principles of CSE production and that these values reflect and reproduce broader cultural norms governing the politics of gender, race, reproduction, and labor relations. Together, these social forces create structural patterns of exclusion and the racist and sexist commodification of labor to degrade social reproduction and exploit the people who perform CSE labor.

My research demonstrates that women generally respond to marginalization, bias, and sexual and gender harassment in CSE in four ways: they internalize, desensitize, criticize, or collectivize, and some employ a combination of these strategies. I list these navigational strategies in order of high to low risk of attrition from CSE. *Internalizing* hostile environments manifests in the Imposter Syndrome, discussed in Chapter 6. *Desensitizing* is reflected in attitudes described in Chapters 5 and 6 as “gender agnostic.” In Chapters 4 through 6, I describe how many participants *criticize* inequitable labor relations in CSE. Finally, in Chapter 6, I suggest, based on participants’ testimonies and the demonstrable successes of women-centered groups in CSE, that women’s efforts to *collectivize* – to organize as women for women – support and advance women in CSE and destabilize the imposition of the dominant class standpoint.

These four types of responses have much to tell us about the co-construction of gender, race, and technology within capitalist economic formations. In Chapter 1, I introduced standpoint theory as a methodological framework for this study. Standpoint theory claims that marginalized group members have a privileged epistemic orientation because they bring a new and different perspective on power relations. This perspective

can generate new knowledge practices overlooked by dominant group members and new applications for existing tools. Including people with privileged standpoints on power relations in the creation of CSE technologies – critical tools of social control – interrupts dominant class rule in CSE and destabilizes the reproduction of profitable artifacts and obedient participants in the technocratic neoliberal order. It is exactly this interruption and destabilization that I want to ferment by documenting the lives and aspirations of “outsider within:” members of underrepresented groups in the CSE field (Collins 2004). The narratives my participants shared with me traverse a wide terrain, from intimate portraits of moments of self-reckoning to birds-eye views of interconnected systems of social control in CSE, and suggest the possibilities of both grassroots and top-down interventions aimed at subverting dominant class rule in CSE knowledge production.

CONSTRAINTS AND OPPORTUNITIES FOR TRANSFORMATIONAL CHANGE

My research is meant to inform strategies that eradicate the barriers excluding women from CSE and transform the powers of CSE technology to advance social justice. Before I enumerate suggestions for improving the representation of women in CSE, allow me to contextualize these ideas in my own standpoint and given my own political orientations.

Some of My Best Friends Are Liberal Feminists

The concerns that motivated early 1970s debates about women and work have not abated. Regardless of their workplace responsibilities, the ideology that women should assume primary care responsibility for the next generation persists. Despite the fact that women now outnumber men in the US labor force (Shriver 2009), women are still conscripted to perform the labor required to maintain and reproduce the labor force, both

on a day-to-day basis and generationally. This limits the majority of the population from pursuing rewarding and lucrative career opportunities (Acker 1990).

Calls and efforts to advance women in the specialized, high-trained workforce often overlook the ways in which increased opportunities for women come at the expense of workers with less formal education and less privileged positions in the US (Kleinman and Vallas 2001; Nakano-Glenn 1992). Many have documented how women are segregated to lower-paying, service-oriented professions in the US economy (Shriver 2009; Greenberger et al. 2005; Nakano-Glenn 1992; Spaights 1995); I have used the studying up and standpoint methodologies to examine this phenomenon in the CSE environment. My study prioritizes women as a class and analyzes race, sexuality, and socioeconomic class as intersectional identities that mediate gender politics. I designed my study this way in order to anthropologically understand women's place, role, and value in US society and the mechanisms of violence that help to divest women of the power to make culture.

16 of my 42 participants were white, heterosexual women. While I spoke with a number of women of color and several LGBT people, I want in future research to make race and sexual identity more central to my inquiry into the social construction of labor value in CSE.

My study of elite women working in CSE is aimed at ameliorating unjust conditions for all women workers – waged and unwaged – in the US. The structural relationships that privilege the standpoint of white, heterosexual women from upper- or middle- class backgrounds motivate me to make recommendations that expand on liberal feminists' efforts to desegregate male-dominated fields. Liberal feminists call for

institutional reforms that strive to eliminate gender inequalities but do not seek to change the very structures in which men control women. Nor do they sufficiently address the differences between women (Moreton-Robertson 2009). They argue for women's equality with men and for the end of sexist discrimination, but fail to challenge the tenets of positivism and the broader social conditions influencing gender relations, race, class, sexuality, and nationality (Rosser 2012). In short, liberal feminists aim to integrate women into the political and ideological structures that oppress large numbers of people.

Discourses on women's equal representation in public spheres of power often devolve into women criticizing each other instead of the power structures in which they operate. For example, Sandberg's class position is used to dismiss her proposals for social change. Faludi (2013) reminds us that women must not criticize each other but the economic system that reproduces the labor force through unpaid labor and masks this exploitation through racist and sexist ideologies disseminated via ideological state apparatus. Faludi (2013) elevates the debate from an individual critique to a structural analysis of class: "We won't ever confront women's secondary status without confronting class. Our economic framework is founded on women's subjugation" (p. 2). Throughout my dissertation, I have critiqued Sandberg not based on her life choices but as a liberal feminist who fails to question how computers are implicated in the gross and growing inequalities that result from the US political movement that privileges corporate sovereignty over people. As I demonstrated in Chapters 3 and 4, CSE corporations are a critical apparatus in divorcing the US from social realities and promoting the cultural acceptance of neoliberal austerity measures that shift the burden of social reproduction from the state to individual households.

Entreating more women to lend their talent to these corporations gives me pause. On one hand, we need women working in CSE to make change from within. A *critical mass* of women in male-dominated STEM arenas influences design outcomes and organizational culture, resulting in more egalitarian outcomes (Margolis and Fisher 2002; Etkowitz et al. 2000; Carrigan et al. 2011). Women's economic independence hinges on women earning viable paychecks, something that is made infinitely easier as a CSE professional. I deeply admire the women (and men) who took the time to share their experiences with me for this research. They are trailblazers in CSE and have more courage and grit than I. I am a non-persister, a leak in the "leadership" pipeline; unlike them, I leaned out, I quit. On the other hand, given the current state of our technocracy, how can I advocate for women to make tools that further extract labor value from historically marginalized groups for the enrichment of a powerful elite?

Sheryl Sandberg is not alone in her liberal feminist approach to diversifying the CSE field. The two most prominent organizations for advancing women in computing – the Anita Borg Institute and the National Center for Women in Information Technology (NCWIT) – rely heavily on corporate sponsors and encourage young CSE knowledge workers to enter into political economic institutions that perpetuate structural violence through economically driven processes that cause suffering to the majority of people of this planet (Farmer 2005). In May 2012, at NCWIT's social science advisory board meeting in Chicago, I voiced my concern about NCWIT's collaboration with corporations, citing Bank of America specifically for its role in the meltdown of the US housing market in 2008. Made up of prominent CSE professionals, many of whom are cited in this dissertation, the NCWIT advisory board was debating why, when women are

consuming CSE technology and its applications at near equal rates as men, we are not even close to reaching parity as CSEknowledge producers. During the discussion, I raised my hand and noted that the laws of capitalism dictate that the consumer and the producer be alienated. If the consumer and the producer were the same person, then the commodity produced would have *use value* but not *exchange value*. *Exchange value* is the source of profit for the owners of the means of production. Therefore, the chasm between women consuming technology and producing technology actually makes sense according to the logics of capitalism, because its very existence depends on the alienation of the consumer and the producer. I concluded by suggesting that we rethink relying on corporate sponsors for solutions to women's underrepresentation.

The silence that followed was one of the most uncomfortable moments of this ethnographic research and an example of some of the difficulties of studying up. I was speaking up to tenured professors as a student, to people who may one day evaluate my work and hold sway over my career. Finally, Dr. Mary Frank Fox (Co-Director, Center for Study of Women, Science and Technology at Georgia Institute of Technology) responded that corporate gender politics are both a cause and effect of larger social problems. I was grateful for her diplomatic response when the rest of the room felt chilly.

This experience reminded me of the time I was at a meeting at the Fred Hutchinson Cancer Center and I asked a dozen esteemed breast cancer oncologists why, when 70% of cancers are caused by environmental pollutants, oncologists focus solely on drug and gene allopathic therapies rather than more proactive measures to prevent disease through environmental regulations? Again, the room fell silent. After a pause, a senior female oncologist raised an unrelated question and the meeting moved on like I had not

spoken. The mystification of the influence of dominant economic models in the biomedical field has parallels in CSE fields. These parallels motivate me to use medical anthropology theory to analyze and interpret the meaning of my ethnographic data.

The forces guiding and benefiting from structural violence are deftly masked via CSE technology. Robbie E. Davis Floyd's (1992) and Althusser's (1970) research demonstrate that computer technology is an ideological apparatus of the neoliberalist state. I intend for my research to "move beyond sentiment to action" (Farmer 2005, 230). By this, I mean that the idealism underlying the call for gender equity in CSE is useful only if society's dominant ideological and political systems come under critical scrutiny as well.⁷

In Chapter 3, I argued that corporate interests were driving the production, design, and applications of computer technology. I also documented how CSE corporations collaborate with the US military to conduct surveillance of the US population. CSE, like other engineering fields, grew out of military initiatives (Abbate 2012; Ensmenger 2010). Kelly, the white senior CSE professional and a technical fellow in the corporate sector quoted in Chapters 4 and 6, explains: "Growing up during the Cold War, science and engineering was well-funded by the military – probably 80% of all engineering was military funded." Without public funding from military initiatives, many high-tech corporations, including Microsoft and Apple, would not exist. The Advanced Research Projects Agency Network (ARPANET), the original platform for the Internet, was a Department of Defense project (Abbate 1999). Siri, Apple's voice-activated command software which helps so many of us in our day-to-day lives, originated out of Pentagon

⁷ For example, I am a pacifist, and I would be sick at heart if the application of this research resulted in more women using their technical talents to make weapons of mass destruction.

research on artificial intelligence and machine learning (Lohr 2012). These examples evince that the theory for the applications of computing are often drawn from research funded by the military, with implications for the type of masculinities operating in CSE organizational cultures and the purposes of computers in society (Rosser 2013). Amanda Marcotte (2013) declared that “Siri Is Sexist” because it offers users a plethora of options for escort services and erectile dysfunction medication but could not return queries on women’s reproductive health services like birth control and abortion. Marcotte (2013) concluded that Apple, “the tech company that is the standard-bearer for ... innovative technology, can’t be bothered to care about the concerns of half the human race” (p. 3).

Apple created a sexist artifact not only because women were missing from the design and implementation phases of CSE production, but also because the tool is militaristic in origin. It is an example of how CSE technology is meant to serve existing power structures. The sites in which these artifacts are created reflect the paradigms underlying dominant worldviews, whether women are at the design table or not. Theresa, the white mid-career CSE professional working in academia who worked at Microsoft for many years before transitioning to academia and is quoted in Chapters 5 and 6, supports how these dominant paradigms can affect underrepresented group members:

I’d be in the bathroom crying ’cause I’m kind of like living against my values. And then being like: “Well, what the fuck is wrong with me? Like I need to toughen up. I need to, you know, just like the military, I got to get out there and do my job.”

How can CSE attract and retain women if they feel that their jobs ask them to live against their values? Over 85 percent of my participants yearn to use their skills in service of social justice. This yearning to create a better world is often in direct conflict

with the profit-motivated constraints of their positions in CSE corporations and the militaristic origins of many core dimensions of computer technology. When considering how CSE institutions can be part of the solution to ending men's privileged access to and acceptance in sites of CSE knowledge production, I recommend we hold that these institutions publicly accountable for being fair employers that contribute to their communities and the public at large. Tax dollars made high-tech corporations' existence possible and they should contribute their fair share. We also need to join privacy activists' call for CSE institutions to sever ties with the US military. Without these broader social transformations, women's activism within the CSE field will not have the institutional support needed to achieve gender parity and cultures of inclusivity.

“Nothing Has Changed:” Unctuous Efforts at Inclusion

Carol, the white senior CSE professional and software engineer working in industry quoted in Chapters 4 through 6, says that, thirty years after beginning her CSE career, “nothing's changed” for women in her field. She compares diversity efforts in CSE to the movie *Groundhog Day*, where the protagonist has a form of amnesia and starts each day with no memory of the day before:

Carol: It's like, you know, everyday is, “Oh, we need to retain more women, and we're going to focus on it this year.” Or they hire more women, and then make really moronic decisions about retention.

Coleen: Yeah - get 'em in the door and then they leave, like a revolving door.

Carol: And it's like, “How serious are you really about fixing this problem?” To me the answer is pretty clear: Not at all!

Coleen: Lip service.

Carol: Yeah, exactly. And so as long as that's – that's the level of attention it's getting, then that's the level of results you're going to get. It's pretty logical.

It is worth noting here that even in her most biting critique of CSE, Carol still relies on logic, a core value in her field integral to the identity of a programmer. Carol confirms what I observing over and over again during my research: most CSE organizations, if they care about diversity at all, do so very superficially. Many times, diversity efforts are an effort to proactively protect a CSE institution from civil rights lawsuits like the one I initiated. This was my assessment of diversity efforts at Microsoft Research. In early 2011, I was approached by Microsoft Research to conduct research to help promote diversity efforts at the company. This potential collaboration failed because the legal department would not let me use any of the data I collected for my own purposes, even though I was willing to give them ownership of the data and final approval authority over any data published. In terms of secrecy, Microsoft Research is no different from any other CSE corporation. As I noted in Chapter 5, Google representatives refuse to share data on the demographics of their workforce even at a conference they co-sponsored on diversity in CSE. My failed consultancy with Microsoft Research, however, proved to be a successful opportunity for participant observation: when designing my proposed research, its Diversity and Innovation team told me to find a way to answer the question that most preoccupies Steve Ballmer, a white senior CSE professional and CEO at Microsoft: “Why diversify? Apple is innovative and it's not diverse.”

Ballmer is largely right in his assessment, although he fails to question who benefits from Apple's innovations and whether Apple is innovative enough. Judging

from Apple's lack of participation in Anita Borg Institute and NCWIT, the company does not even feign interest in recruiting women. In contrast, Microsoft helps sponsor and sends employees to these women-centered organizations' conferences. The two women spearheading Microsoft's Diversity and Innovation team, one from Microsoft Research team and the other from the Start-up Business group, work on diversity for free as an occupational hobby. One of these women, Renee, a white mid-career CSE professional working at Microsoft Research told me, "I have two other jobs." When I asked why she did diversity work, she said she hoped to parlay it into a paying position and that she was passionate about recruiting and retaining women at Microsoft. In a more candid moment, she lamented the lack of measurable outcomes to track the success of Microsoft Research's diversity efforts: "We throw money at ABI and NCWIT, and I don't know what we get for it."

To technocratic leaders, workforce diversity is meaningless unless it increases "innovation" and profit. Jennifer Siebel-Newsom (2013) captured this sentiment perfectly when she imagined these leaders' rationale for doing little to combat male-dominance in CSE:

We've made billions of dollars while paying women less and with barely any women on our corporate boards, right? No one can deny that we've been leading the world in innovation ... while often *ignoring* women completely.

The pursuit of diversity is as much a cipher in CSE as is innovation – hype trumps reality. Temple (2013, 1) sums up The Age of Mythinformation perfectly:

Silicon Valley loves to talk big about innovation; it is just not as good at following through. "Innovation" is a magic word, shape-shifting to fit the speaker's needs ... Silicon

Valley ... concerns itself primarily with getting people to click on ads or buy slightly better gadgets than the ones they got last year ... lets drop the pretense that we're curing cancer.

Similarly, let us drop the pretense that women's contributions matter to CSE corporations. Feminist demands that CSE institutions desegregate and create tools that serve social justice cannot be met under capitalism as it exists in its current stratified, neoliberal state. Nor can academic departments that privilege quantitative, abstract rationality and denigrate research that has social applications and social justice aspirations meet these demands.

Solutions

Some social science research has offered suggestions on improving the undergraduate training phase of CSE for women (Margolis and Fisher 2003; Cuny and Aspray 2001). The leadership team at Harvey Mudd Technical College increased the number of female undergraduates majoring in CSE from ten to 40 percent in three years. The number of female undergraduates in CSE at Carnegie Mellon and MIT hover around 30 percent (Hafner 2012). Strategies for replicating these successes include offering introductory courses that appeal broadly (not just to those that already have computers at home and are seasoned programmers), shutting down bullies and braggarts in the classroom, and holding faculty and leaders accountable for institutional bias against women students (Klawe 2012). I think it is important that other schools replicate these schools' successes.

However, efforts to increase diversity in CSE remain frustratingly focused on the training phase of a CSE career. In the academia, institutions lack commitment to desegregating their faculty. In industry, from labs to boardrooms, the dominant class

rules. The Level Playing Field Institute (2011) produced an excellent report on the underrepresentation of women and people of color in the IT workforce called *The Tilted Playing Field: An Examination of Hidden Bias in the Information Technology Workforce*.

They make four recommendations for improving underrepresented group members' participation:

1. Develop a homegrown pool of diverse talent.
2. Address hidden biases and barriers within workplaces that disadvantage underrepresented groups.
3. Conduct research to both uncover hidden biases within the sector and examine efforts taken by companies to increase diversity.
4. Get the word out within your company, networks, and communities.

The first recommendation is excellent. Two of my female senior-level CSE participants learned programming on the job and one lamented how the trend of companies home-growing their talent has faded. As I discussed at length in Chapter 2, “hidden” unexamined bias is an important factor in labor segregation in CSE. However, on its own, bias decoupled from interventions combating epistemic violence and sexual and gender harassment is inadequate.

Faces of Discrimination

Unexamined bias studies are great pedagogical tools. I find them very useful when facilitating diversity workshops to help participants relax and understand that everyone harbors stereotypes and most people do not mean to discriminate. It levels the playing field so we can begin to work through the snarls of discrimination made covert by cultural norms. However, arguments justifying unexamined bias sometimes sounds like survivors in a violent partnership: “He doesn't/I don't really mean it when he acts/I act that way.” Therefore, in an effort to greater personalize sexist discrimination in CSE,

I share four characters amalgamated from the narratives that emerged from this research. I recommend that women who want to persist in CSE and their allies look out for and work to transform the following types of gatekeepers. These characters signal the presence of structural, epistemic, and sexual violence in CSE knowledge production. Based on my own experience and the sentiments of feminist legal scholar Joan Williams (2000), I recommend that, when women in CSE come across any or all of these characters, they send their selves an email documenting their experience in case one day a lawsuit becomes necessary to one's well-being and career.

The Obstructionist

Diane, the foreign national senior CSE professional and leader in academia quoted in Chapter 6: It was just very difficult; everything I did there were barriers, and there were a lot of things that went wrong. Yeah. But it was definitely, you know, it was the people who were overtly hostile in moments, but it was just barriers; it was just like every time you want to do something, or whatever, it was just difficult. Diane

Do you recall that in Chapter 5 Tara's metaphor for persisting in CSE was beating her head over and over against a wall? The Obstructionist is that wall. The Obstructionist uses the "Precision Questioning" technique, described by Tony in Chapter 5, to let women and other members of underrepresented groups in CSE know they are doing or might do something wrong. He laments that he cannot work with you because your ideas hold little value and, to quote Janice in Chapter 5, are "little pieces of shit rolled into a ball." Women in CSE will often encounter the Obstructionist in the mid-career stage of a CSE career trajectory, as Diane explains in the quote above. Variations of the Obstructionist include the "advocate" who stealthily impedes programmatic diversity

interventions with precision questioning techniques framed as truth-seeking and “law-abiding” managers like the woman I worked for at Amazon, who use complicated and contradictory “logic” to impede women’s career success and advancement in CSE.

The Creep

Becca, the white Ph.D CSE student quoted in Chapters 5 and 6: Some men are very, very cocky.

Coleen: I’ve noticed that with CSE. Some guys are really, really cocky. I went to interview some guy ... and he was like “I’ll tell you about the field and I’ll hook you up with other people to interview” and then we went out to lunch and he’s like, “This is a great date. You know this is a date, right?” And I was like, “What the ...?”

Becca: Wait, did that seriously happen?

Coleen: It seriously happened. And I was like, “Are you kidding me?” I was shocked – so when you talk about cocky ...

Becca: That does not surprise me at all.

Coleen: So, tell me why it doesn’t surprise you.

Becca: Um, well, especially with the, uh, I think the – just [the] sexualization of females.... When I came to grad school, I was a target, um, I’m not even kidding. I had advances like, full-on sexual advances by three guys.

Coleen: Oh my God.

Becca: Um, one guy tried twice, and, oh by the way, I had a boyfriend and had explained this. So, the guy who tried again knew I had a boyfriend. He tried one time, I said, “I have a boyfriend.” And he goes, “Oh, tell me about your boyfriend.” And I’m like, “What?” And then a couple of weeks later he tried again. So it’s just like – the guys are going after you.... You’re this new shiny thing.

Stephanie Shirley, one of the first woman in England to start her own software company in the 1960s, described the sexist dynamics of the CSE field in a similar terms:

“You were someone to be laughed at, flirted with, somebody whose bottom you could pinch” (Shirley in Abbate 2012, 139). Fifty years later, the Creep is still alive and well in CSE knowledge production. My own favorite story of the Creep will always be Tim, my “naked in the office” boss recounted in Chapter 5, whom the executive leadership at Amazon.com thought was qualified enough to serve as a vice president. Of course, this gaffe makes much more sense considering that Joe Galli, Amazon.com's COO at the time, was widely referred to by women employees as “King Leer.”

The Troglodyte

Louise, a professor of color in computer science:

I got my Ph.D in Computer Science from [a top five school in CSE], which is an extremely misogynist department [and] still is. They have almost no female professors, and they have – they have faculty members who are very outspoken about saying that women [shouldn't be computer scientists.]

The days of overt discrimination are not over and the Troglodyte is living proof.

The Troglodyte appeared several times in Chapter 5. Shawna recounted a story of a tenured professor in CSE who said it was okay she was switching to a “lesser” subfield of CSE because she was female and Julie connected the Troglodyte’s behavior to sexist males with “hate issues” toward women.

The High Priest of Tech

The High Priest is one who lords their technical skills over others. Like the priests from my childhood parish and my catholic college, they feel called to their work. This sense of calling makes them vulnerable to illusions of grandeur and pedantic communication styles. The High Priest often uses acronyms to demonstrate an insider’s

privileged knowledge and embraces the meritocratic philosophy that manifests in a belief that those who are around the table are the ones who deserve to be there. High Priests are found in classrooms, bragging about their long history of tinkering with computers to impress junior professors and intimidate classmates. They are also the “geek ruling class” (Hakken 2003, 5) in high-tech corporations and academic institutions who perpetuate microaggressions against their peers to intimidate them in the name of maintaining the mystical prestige of their ascendant profession.

“No, You Don’t Need People Like That:” The Ladder Kicker

The Ladder Kicker is a woman in CSE who purports not to see gender and emulates the norms and values of dominant group members, to the disadvantage of other women in CSE. Parks-Stammet et al. (2008) found that both men and women in male-dominated organizations penalize successful women, but women do so as a means to preserve their own perception of competency. More specifically, the Ladder Kicker understands that power relations in her organization can remain stable while allowing token participation of women in its ranks and leadership. She therefore seeks professional advancement by, at best, ignoring female colleagues, and, at worse, thwarting their advancement in the organization (like my female boss at Amazon.com, whom I refer to in Chapter 5). One example of the Ladder Kicker is blogger Penelope Trunk, a white early-career CSE professional and tech start-up entrepreneur, who admits: “I saw [that] women who had kids got very little respect at the office and I stayed away from them. I only hired men. Even after I had kids, I only worked with men” (Trunk 2013). She is now a homemaker who accuses Sheryl Sandberg of abandoning her children for her career.

Ladder Kickers respond to male-dominated cultural norms that reserve power for men and women who serve male hegemony. Unfortunately, they are often rewarded for kicking the ladder out from behind them as they rise. Their antitheses are women who lift other women as they climb. Anita, a professor of computer engineering, argues that women's advancement in CSE requires more lift and climb advocates, whom Cech and Blair-Loy (2010) define as women professionals who promote the development of women leaders as they advance in their own careers.

Anita: You have to get women into the field who are also advocates for women.

Coleen: Yeah. I've talked to other women of your stature or higher who are like, "I don't see a problem. I don't see gender."

Anita: Yeah – no, you don't need people like that. You need people who are actively promoting and helping other women.... [I]f I were in charge, what I would do is I would hire women who not only have a great technical track record and who are really smart, but who also have a record of doing volunteer work in diversity.

Anita is not just calling on women workers in CSE to advocate for other women, she is calling for CSE institutions to take responsibility for hiring, and advancing women who support the collective well being of all women in the field.

INSTITUTIONAL CHANGE IN CSE

My cross-sectional research provides a synchronic snapshot of different participants at three stages in a technology career. Therefore, my study offers strategies relevant not only to women in all stages of a CSE career, but also the institutions in which they labor. For example, Becca, the white Ph.D CSE student quoted in Chapters 5 and 6 and above, said she wants "more equality with technology." At first, I interpreted

Becca's desire as a call for equitable labor norms in sites of CSE training. But eventually, I came to understand it as a wider call for equality.

For example, the Obama administration claims that warrantless searches of US citizens with the cooperation of CSE corporations is necessary to national security, but that publicizing these activities is a violation of national law. This contradiction inspires me to take up Emily Martin's (1992) suggestion that we imagine using technology to constrain elites' power in order to bring into starker relief the power of controlling technology and the possible outcomes if this power were collectivized. What if the *body politic*, and political and capitalist institutions specifically, were put under institutional scrutiny? What if individual citizens' freedoms and privacies were preserved? What if a CSE corporation's policies, practices, demographics, and artifacts were open to public review and revisions? What if the government was accountable to its people and people's privacy was protected by a judicious balance of power?

These considerations cause me to reevaluate Becca's call for equality in technology as a large-scale concern over the increasingly unequal social relations that make possible US society's current production and applications of CSE technology. Her yearning for equality in CSE is an example of how women workers with a specialized, intellectual insight into the social system of knowledge underlying the production of computing commodities can make critical contributions not only to the valorization of women's labor value in the US but also to broad social justice causes like the preservation of civil liberties.

I do not conclude here with a *deus de machina*, but offer some strategies gleaned from my research. A champion of the individual, Sheryl Sandberg (2011), the white mid-

career CSE professional and COO of Facebook quoted throughout my study, has five recommendations for women persisting in IT:

Number One: Believe in yourself.

Number Two: Dream big.

Number Three: Make your partner a real partner.

Number Four: Don't leave before you leave.

Number Five: Start talking about being a woman and being outnumbered in tech.

Sandberg's advice to "start talking about being a woman" echoes standpoint theory and is therefore an entry point to making institutional change. I would like to take her advice one step further to add:

Number Six: Start organizing as women workers and confront institutional bias as a collective not as individuals.

Sandberg acknowledges the limitations of asking women to change themselves, and that she has been accused of letting "our institutions off the hook" (Sandberg 2013, 11). She welcomes other women to take up the cause of challenging institutional discrimination in CSE organizations. In this spirit, I have adapted Sandberg's five recommendations to address the male-dominated leadership ranks of CSE institutions:

Number One: Taxes. Pay your fair share. Close offices you possess in order to create tax havens and give up your offshore accounts.

Number Two: Prioritize Workers Instead of Banksters.⁸
Divest from Wall Street and refuse to cooperate with the

⁸ I borrow this term from a sign I saw at an Occupy Wall Street protest in downtown Seattle. It refers to the people who worked in the financial sector and who contributed, without punishment, to the US economic

National Security Agency and all other US military operatives. Do not interfere with workers' efforts to collectively organize and bargain fairly through unions.

Number Three: Reparations. Your tax-dodging has crippled local economies so it is time to invest in social reproduction, including education, land conservation, and other social services – especially in underserved communities.

Number Four: Fund and Support Inclusion. Spend one to three percent of your profits on diversity outreach efforts and worker benefits. Be transparent about your demographics – both real and aspirational. Express zero tolerance for sexism, racism, and homophobia. Proactively train all employees, and *senior leaders especially*, in best practices for fostering inclusivity every two years. Create diversity goals for teams and tie them to performance reviews.

Number Five: Use a Moral Compass. Limit the number of white men in all departments and leadership positions. Limit salary disparities between entry-level positions and executives.

Anita, a professor of color in computer engineering, states why morality is so important:

You have to follow a moral compass and that means a more diverse workforce. If you have an unbalanced scale – the only way to bring up to balance is going to be by putting disproportionate weight on the one half. So, yes, you're going to have favor women. You're going to have to favor minorities because they've been disfavored before.

Transforming CSE institutions will require greater transparency and public oversight to hold them accountable for their influence and impact on the world. These

crisis in 2008 and the subsequent Great Recession. The word play links these neoliberal industrialists to gangsters.

five recommendations address the broader social domains in which CSE is practiced and revered. Activism aimed at social change by CSE laborers, and particularly activism in coalition with other workers, can foster new paradigms for the design and use of CSE technology. In the next section, I elaborate on these recommendations with the perspectives and experiences of the women who inspired them.

Transparent Pathways for Advancement

Hiring, evaluating, and advancing people in academic and industry sites of CSE knowledge production are processes rife with hostility, bias, favoritism, and elitism. Anita, a professor of color in computer engineering, reflects on mechanisms of advancement, noting that government agencies are ahead of corporate and academic institutions:

The governments labs in computer science really have a lot of programs to encourage women to – I mean, they have explicit programs to bring women into leadership positions ... an overt ladder of how to promote people ... rather than just [the] subjective Old Boys' Network.

Here, Anita's experience supports my recommendation that transparency measures are critical to retaining and advancing women in CSE. Without them, the status quo is reproduced. The last question that Maria Klawe, the white senior CSE professional and president of Harvey Mudd Technical College quoted in Chapter 6, answered at a November 2012 lecture at the University Washington, Seattle Campus was from a woman who identified herself as "a software development engineer at Amazon.com." She asked, "What can we do to improve the gender ratio in industry?" Klawe's answer echoes Anita's:

I met a number of fairly junior people – females at Amazon at the [Grace] Hopper conference, and they were really unhappy. And I said to Jeff [Wilke, Senior Vice President of Amazon.com], “I met a number of junior” – I didn't mention their names but, you know. I didn't say where I met them because that might have, you know, outed them. But I just said, “They weren't very happy and they didn't really feel like the promotion process was merit-based.”

In Chapter 5 I argued that, based on my own experience as a knowledge worker at Amazon.com, the corporation relies on the Old Boys' Club as a tool for promotion. Eleven years later, it appears little has changed. The good news is that many best practices for creating transparent evaluation processes aimed at interrupting bias, diversifying technology, and retaining underrepresented group members are widely available.^{9, 10}

Funding Is Essential

Above, I discuss how too many diversity efforts are often window dressing, lacking real investment and impact. The easiest way to determine if this is the case or not is, in the words of Deep Throat of Watergate fame, to “follow the money.” Anita argues that:

Funding needs to be channeled to any program that supports women in computing. We need much more funding. That's maybe the – because it gives us the opportunities to meet and talk and get support for each other, and that's what we need, 'cause we're so isolated.

My interview with Anita was unique in that she did not wait for me to ask questions but rather started the conversation by explaining the structural elements in CSE knowledge production that need to be transformed. She was unapologetic about framing underrepresentation in CSE as a social justice issue that required heavy lifting from people

⁹ See <http://genderedinnovations.stanford.edu/>.

¹⁰ See <http://www.engr.washington.edu/lead/biasfilm/>.

living very comfortably. Anita inspired me to include reparations in my recommendations for CSE organizations. The ritual practices of CSE training and production have trained several generations of knowledge workers to discriminate against women and people of color in the US. Including these underrepresented knowledge workers in the CSE workforce requires not only tolerance but also a warm, thoughtful welcome. And this requires resources. In well-funded, profitable fields like CSE, there is no excuse not to solve the problem of dominant class rule in CSE. In a 2012 article, “*How to Solve the Tech Hiring Problem: Ask Women*,” Pam, a software developer, shared her frustration with the lip service CSE leaders pay to diversifying their ranks:

I can't tell you how many times I hear that, yes, they know there's a problem, but what's the point of talking about it before there's a solution. That's basically the stupidest shit I've ever heard. Aren't we engineers? Isn't finding solutions *what we do*?

(Pam in Fernholz, March 2012)

Anita and Pam tell us that a lack of financial resources and creative ingenuity for solving CSE's problem of diversity are symptoms of a larger problem: a commitment to maintaining dominant class rule through conventional ideologies of gender, meritocracy, and scientific objectivity.

Coalition Building

Stereotypes stemming from society's “collective imagination” define and require collective solutions (Fricker 2007). Help in combating epistemic violence in technical fields must be sought from outside STEM communities because a reallocation of resources and labor within CSE industrial, governmental, and academic institutions will only happen under the pressure of a major social change movement. This requires that the

gains made by the feminist and civil-rights movements not be ignored. As Wylie (2012) notes, many scientists who engage in studies of gender object to overtly feminist politics and marginalize the voices and contributions of scholars whose non-dominant standpoints and experiences make the study of gender in the academy possible. At the heart of these scholars' defensiveness to voices of feminists and people of color is a commitment to "conventional ideals of objectivity" (Wylie 2012, 65). My research and experience as a change agent in CSE communities supports Wylie's insight. In addition, my research demonstrates that defensiveness on the basis of meritocracy can prevent diversity in STEM scholars and equity-minded CSE professionals from embracing the historical and political dimensions of the movement to end segregation in CSE.

I have specifically framed my participants as cognitive laborers so as to make space for the potential of these workers to develop their social position in a dimension that is "subversive and anti-capitalist" (Beradi 2009, 70). Instigating a collective labor movement in CSE will require a coalition with other workers, particularly with those from underserved communities, and building alliances across social identities and differences, in academic communities and beyond. Building coalitions across social change movements is paramount to putting intersectional theory into action and addressing how multiple oppressions coalesce to reproduce inequitable relations of power in the US. This coalition building will be difficult and requires acknowledging imbalances of power relations stemming from male privilege, white privilege, class privilege, and heterosexual privilege.

We must also consider ways to foster mentors and sponsors to welcome and guide women and other underrepresented groups in STEM. Cech and Blair-Loy (2010) found

that women scientists and engineers who demonstrate “lift and climb” attitudes and who share their success and power with other women through mentorship are significantly more likely to recognize structural barriers than those women who use meritocracy and human capital explanations for inequality in STEM. This insight applies equally to male allies. In other words, the best mentors for women in STEM are those who disavow the ideologies of meritocracy. This seems like a potentially fruitful area for intervention, perhaps by encouraging mentorship programs that explicitly critique the tenets of meritocracy.

Across various permutations of feminist thought and practices, consciousness-raising efforts have had success in integrating STEM (Rosser 2012). Consciousness-raising groups were a cornerstone of the Women’s Liberation movement in the US and have proven effective for some women scientists and engineers (Danielle 2006). However, women in CSE who work with other women and their allies to integrate their field must be prepared to have the tenets of objectivity and meritocracy challenged in the course of their efforts. Once these elemental cornerstones of CSE are destabilized from within by practitioners who have a deep knowledge of the social system underlying CSE knowledge production, the potential for rupturing dominant class rule in the field is increased greatly.

CONCLUSION

CSE technology both reflects and manufactures social values and the reproduction of systems of power in the US. The homogenous make-up of our CSE labor force shapes what we as members of US culture, know, value, and consider important. My ethnographic analysis lends evidence to the influence of culture on gender diversity in CSE and suggests strategies and principles that could be employed to make a whole range

of STEM fields more attractive to a wider diversity of participants and to transform the powers of technology to advance social justice. Schiebinger (2008) asserts we must seek to understand the culture of STEM fields – the “daily day-to-day conformity, codes governing language, styles of interactions, modes of dress, [and] hierarchies of values and practices” – in order to transform them (p. 5). Connecting cultures of CSE production to broader social, economic, and political values is critical to the goal of creating welcoming and inclusive environments in one of the more powerful professions in our society. By focusing on the stories of women who hold “outsider within” status (Collins 2004) in CSE institutions, I trace the intersection of material, social, and cultural productions of CSE technology to explore power, social reproduction and labor value in US society.

If there is one take-away message from this research, it is that collectivity among women is essential, both politically and epistemically, and the most important way in which women are recruited and retained in sites of CSE knowledge production. I placed reproduction at the center of my analysis and found that participants’ reproductive aspirations exceed the bounds of the biological. In its proprietary, classified form, CSE knowledge production is a lucrative field that not only fails to contribute to the reproduction of the social collective but also operates in tandem with government and corporate interests to erode the social commons (Coleman 2013; Hakken 2003). I suggest that feminist discourse needs to shift beyond mediating women’s choice between work and family to acknowledge workers’ painful choice between job security and social aspirations. Let’s imagine the institutional transformations that are necessary for these highly trained workers to use their “mystical” geek powers in the service of the higher

good. To begin, let's create greater opportunities for women in CSE to organize as women so that women can enter into relations with CSE institutions as a collective group and not as isolated individuals. Perhaps this collective action will transform not only CSE culture, from exclusive to inclusive, but also the applications of computer technology, from tools of social control to tools of social liberation.

REFERENCES

- Abad-Santos, A. (2013). "Insider the Anonymous Hacking File of the Steubenville "Rape Crew"". <http://www.theatlanticwire.com/national/2013/01/inside-anonymous-hacking-file-steubenville-rape-crew/60502/> Retrieved: January 15, 2013.
- Abbate, J. (2012). *Recoding gender: women's changing participation in computing*. Cambridge, Mass.: MIT Press.
- Acker, J. (1990). Hierarchies, Jobs, Bodies: A Theory of Gendered Organizations. *Gender and Society*, 4(2), 139-158.
- Adams, Tony and Jones, Stacy. (2008) Autoethnography is Queer. *Handbook of Critical and Indigenous Methodologies*. Norman Denzin, Yvonna Lincoln and Linda Tuhiwai Smith, eds. Thousand Oaks: Sage Publications.
- Adams, G., Garcia, D. M., Purdie-Vaughns, V., & Steele, C. M. (2006). The detrimental effects of a suggestion of sexism in an instruction situation. *Journal of Experimental Social Psychology*, 42(5), 602-615.
- Aguirre, A. (2000). *Women and Minority Faculty in the Academic Workplace: Recruitment, Retention and Academic Culture*. San Francisco: Jossey-Bass.
- Allison, P. D., Long, J. S., & Krauze, T. K. (1982). Cumulative Advantage and Inequality in Science. *American Sociological Review*, 47(October), 615-625.
- Althusser, L. (1971). Ideology and Ideological State Apparatuses. *Lenin and Philosophy*. New York: New Left Books.
- Anderson, E., & Kim, D. (2006). *Increasing the Success of Minority Students in Science and Technology*. Washington D.C.: American Council on Education.
- Aquirre, A. (2000). *Women and Minority Faculty in the Academic Workplace*. New York: Jossey-Bass.
- Arendale, D. (2004). *Pathways of Persistence: A Review of Postsecondary Peer Cooperative Learning Programs*. Minneapolis: University of Minnesota.
- Aronson, J., Lustina, M., Good, C., Keough, K., Steele, C., & Brown, J. (1999). When White Men Can't Do Math: Necessary and Sufficient Factors in Stereotype Threat. *Journal of Experimental Social Psychology*, 35(1).
- Ashcraft, C., & Blithe, S. (2010). *Women in IT: The Facts*. Boulder: National Center for Women in Technology (NCWIT).

- Ashcraft, C., & Breitzman, A. (2007). *Who Invents It? An Analysis of Women's Participation in Information Technology Patenting*. Boulder, CO: National Center for Women and Information Technology.
- Bakker, I., & Stephen, G. (Eds.). (2003). *Power, production and social reproduction : human in/security in the global political economy*. New York: Palgrave Macmillan.
- Baldwin, T., Bedell, M., & Johnson, J. (1997). The Social Fabric of a Team-Based M.B.A. Program: Network Effects on Student Satisfaction and Performance. *The Academy of Management Journal*, 40(6), 1369-1397.
- Banerjee, D., & Pawley, A. Gender and Promotion: How Do STEM Faculty Members Survive a Foggy Climate? *In Review, Journal of Women and Minorities in Science and Engineering*.
- Barbara, E., & Hirschfeld, A. R. (Eds.). (2004). *Global Woman: Nannies, Maids, and Sex Workers in the New Economy*: Owl Books.
- Barker, L., & Garvin-Doxas, K. (2002). *Defensive Climate in the Computer Science Classroom*. Paper presented at the 33rd SIGCSE Technical Symposium on Computer Science Education, New York.
- Barker, L., & Garvin-Doxas, K. (2003). *Why Project Courses Sometimes Widen the Experience Gap Among Students*. Paper presented at the 8th Annual ITiCSE Conference on Innovation and Technology in Computer Science Education, Thessaloniki, Greece.
- Barker, L., & Garvin-Doxas, K. (2004). Making Visible the Behaviors that Influence Learning Environment: A Qualitative Exploration of Computer Science Classrooms. *Computer Science Education*, 14(2), 119-145.
- Barker, L., Garvin-Doxas, K., & Roberts, E. (2005). *What Can Computer Science Learn from a Fine Arts Approach to Teaching?* Paper presented at the 36th SIGCSE Technical Symposium on Computer Science Education, St. Louis, Missouri.
- Barker, L., McDowell, C., & Kalahar, K. (2009). Exploring Factors that Influence Computer Science Introductory Course Students to Persist in the Major. *ACM SIGCSE Bulletin*, 41(2), 282-286.
- Barlow, A. E. L., & Villarejo, M. (2004). Making a difference for minorities: Evaluation of an educational enrichment program. *Journal of research in science teaching.*, 41(9), 861-881.
- Barres, B. (2006). Does Gender Matter? *Nature*, 442, 133-136.

- Bart, J. (2000). *Women succeeding in the sciences : theories and practices across disciplines*. West Lafayette, Ind.: Purdue University Press.
- Beede, D., Julian, T., Langdon, D., McKittrick, G., Khan, B., & Doms, M. (2011). *Women in STEM: A Gender Gap to Innovation*. Retrieved from <http://www.esa.doc.gov/sites/default/files/reports/documents/womeninstemagaptoinnovation8311.pdf>.
- Belkin, L. (2011). Do Women Shun Science? *The New York Times*.
- Bellas, M., & Toutkoushian, R. (1999). Faculty Time Allocations and Research Productivity: Gender, Race and Family Effects. *The Review of Higher Education*, 22(4), 367-390.
- Beneria, L. (1979). Reproduction, Production and the Sexual Division of Labor. *Cambridge Journal of Economics*, 3, 203-225.
- Benería, L. (1999). The Enduring Debate Over Unpaid Labour. *International Labor Review*, 138(3), 287-309.
- Beoku-Betts, J. (2005). 'A Lot of Them Thought I Wouldn't Last There': African Women and Career Advancement. *Journal of Technology Transfer*, Vol 30, 397-407.
- Beradi, F. (2009). *The Soul at Work: From Alienation to Autonomy*. Los Angeles: Semiotext(e), Foreign Agents Series.
- Bernard, R. H. (2006). *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. Lanham: Altamira Press.
- Beutel, A., & Nelson, D. (2005). The Gender and Race-Ethnicity of Faculty in Top Science and Engineering Research Departments. *Journal of Women and Minorities in Science and Engineering*, 11, 389-402.
- Beverly, J. (2007). Supporting STE Careers From Cradle to Grave: An Interview with Shirley Malcom. *bridges*, 16. Retrieved from <http://www.ostina.org/content/view/2744/835/>
- Bielby, W. (1991). Sex Differences in Careers: Is Science a Special Case? In H. Zuckerman, J. Cole & J. Bruer (Eds.), *The Outer Circle: Women in the Scientific Community*. New York: W.W. Norton & Company.
- Bilimoria, D., & Stewart, A. (2009). "Don't Ask, Don't Tell": The Academic Climate for Lesbian, Gay, Bisexual and Transgender Faculty in Science and Engineering. *National Women's Studies Association Journal*, 21(2), 85-103.

- Blickenstaff, J. C. (2005). Women and Science Careers: Leaky Pipeline or Gender Filter. *Gender and Education, 17*(4), 369-386.
- Boellstorff, T. (2012a). *Emerging Socialities: Towards an Anthropology of Social Media*. Paper presented at the 111th Annual Meeting of the American Anthropological Association San Francisco.
- Boellstorff, T. (2012b). From the Editor: Visions of Government Funding for American Anthropology. *American Anthropologist, 114*(1), 1-4.
- Bonilla-Silva, E., & Forman, T. (2000). "I Am Not a Racist But..." mapping White College Students' Racial Ideology in the USA. *Discourse and Society, 11*(1), 50-85.
- Boske, B. (2011). Ruchi Sanghvi, Facebook's First Female Engineer: 'It Was Difficult To Break Into The Boys' Club'. *Huffington Post*. Retrieved from http://www.huffingtonpost.com/2011/09/13/ruchi-sanghvi-facebook-female-engineer_n_961148.html
- Bourdieu, P. (1991). *Language and Symbolic Power*. Boston: Harvard University Press.
- Bourdieu, P. (2003). *Firing back : against the tyranny of the market 2*. New York: New Press.
- Brainard, S., & Carlin, L. (1998). A Six-Year Longitudinal Study of Undergraduate Women in Engineering and Science. *Journal of Engineering Education, 87*(4).
- Branscombe, N. R., Ellemers, N., Spears, R., & Doosje, B. (1999). The context and content of social identity threat. In N. Ellemers & R. Spears (Eds.), *Social Identity: Context, commitment, content*. Oxford, England: Blackwell Science Ltd.
- Bray, F. (2007). Gender and Technology. *Annual Review of Anthropology, 36*, 37-53.
- Brewer, R., Conrad, A., C., & King, M. C. (2002). The Complexities and Potential of Theorizing Gender, Caste, Race and Class. *Feminist Economics, 8*(2), 3-18.
- Brines, J. (1994). Economic Dependency, Gender and the Division of Labor at Home. *The American Journal of Sociology, 100*(3), 652-688.
- Brodkin Sacks, K. (1979). *Sisters and Wives: The Past and Future of Sexual Equality*. Westport, Conn.: Greenwood Press.
- Brodkin Sacks, K. (1989). Toward a Unified Theory of Class, Race and Gender. *American Ethnologist, 16*(3), 534-550.

- Brown, M. K. (2003). *Whitewashing race: the myth of a color-blind society*. Berkeley: University of California Press.
- Browne, I., & Misra, J. (2003). The Intersection of Gender and Race in the Labor Market. *Annual Review of Sociology*, 29, 487-513.
- Browner, C. H. (2001). Situating Women's Reproductive Activities. *American Anthropologist*, 102(4), 773-788.
- Burack, C., & Franks, S. (2004). Telling Stories About Engineering: Group Dynamics and Resistance to Diversity. *National Women's Studies Association*, 16(1), 79-95.
- Burgoyne, R., Shaw, T. M., Dawson, R. C., Scheinkman, R., Coleman, A. L., Winnick, S. Y., et al. (2010). *Navigating A Complex Landscape To Foster Greater Faculty and Student Diversity In Higher Education*. Washington, DC: American Association for the Advancement of Science.
- Butler, S., & Kirwan, W. (2002). *Investing in People: Developing All of America's Talent on Campus and in the Workplace*. Washington D.C.: Business-Higher Education Forum.
- Bystydzienski, J. M., & Bird, S. R. (2006a). *Removing barriers : women in academic science, technology, engineering, and mathematics*. Bloomington: Indiana University Press.
- Cain Miller, C. (2010). Out of the Loop in Silicon Valley. *The New York Times*. Retrieved from <http://www.nytimes.com/2010/04/18/technology/18women.html>
- Campbell, N. D. (2009). Reconstructing Science and Technology Studies: Views from Feminist Standpoint Theory. *Frontiers*, 30(1), 1-29.
- Carlone, H., & Johnson, A. (2007). Understanding the Science Experiences of Successful Women of Color: Science Identity as an Analytic Lens. *Journal of Research in Science Teaching*, 44(8), 1187-1218.
- Carnes, M., Geller, S., Fine, E., Sheridan, J., & Handelsman, J. (2005). NIH Director's Pioneer Awards: Could the Selection Process Be Biased Against Women? *Journal of Women's Health*, 14(8), 684-691.
- Carrigan, C., Quinn, K., & Riskin, E. (2011). The Gendered Division of Labor Among STEM Faculty and the Effects of Critical Mass. *Journal of Diversity in Higher Education*, 4(3), 131-146.
- Casserly, M. (2013). How Women in Tech Are Losing From Top to Bottom. Forbes.com. <http://www.forbes.com/sites/megancasserly/2012/05/14/women-in-tech-are-losing-from-top-to-bottom.com> Retrieved May 5, 2013.

- Cech, E. (2007). Dilbert in Stilettos: The Deterrents Facing Women in Engineering. In I. Welpe, B. Reschka & J. Larkin (Eds.), *Gender and Engineering: Strategies and Possibilities* (pp. 36-50).
- Cech, E., & Blair-Loy, M. (2010). Perceived Glass Ceilings? Meritocratic versus Structural Explanations of Gender Inequality Among Women in Science and Technology. *Social Problems*, 57(3), 371-397.
- Cech, E., Rubineau, B., Silbey, S., & Seron, C. (2011). Professional Role Confidence and Gendered Persistence in Engineering. *American Sociological Review*, 76(5), 641-666.
- Cech, E., & Waidzunus, T. (2011). Navigating the heteronormativity of engineering: the experiences of lesbian, gay and bisexual students. *Engineering Studies*, 3(1), 1-24.
- Ceci, S., Williams, W., Barnett, & Susan. (2009). Women's Underrepresentation in Science: Sociocultural and Biological Considerations. *Psychological Bulletin*, 135(2), 218-261.
- Chachra, D. (2012). How Not To Think Like An Engineer. *ASEE Prism*. Retrieved from <http://www.prism-magazine.org/feb12/reinvention.cfm>
- Chapman, R. (2003). Endangering Safe Motherhood in Mozambique: Prenatal Care as Pregnancy Risk. *Social Science and Medicine*, 57, 355-374.
- Charusheela, S., & Danby, C. (2006). A Through-Time Framework for Producer Household. *Review of Political Economy*, 18(January), 29-48.
- Cheryan, S., & Plaut, V. (2010). Explaining Underrepresentation: A Theory of Precluded Interest. *Sex Roles*, 63, 475-488.
- Cheryan, S., Plaut, V. C., Davies, P. G., & Steele, C. M. (2009). Ambient belonging: How stereotypical cues impact gender participation in computer science. *Journal of Personality and Social Psychology*, 97(6), 1045-1060.
- Chesler, N. C., & Chesler, M. A. (2002). Gender-Informed Mentoring Strategies for Women Engineering Scholars: On Establishing a Caring Community. *Journal of Engineering Education*, Vol. 91(No. 1), pp. 49-55.
- Chowdhury, F., Hoo, K., & Pasik-Duncan, B. (2007). Innovative Strategies for Retention of Women Engineers in Academia: Conversation with Successful Role Models. In I. Welpe, B. Reschka & J. Larkin (Eds.), *Gender and Engineering: Strategies and Possibilities*. Frankfurt: Peter Lang.
- Chu, H. I. (2011). Masculine Engineering, Feminine Engineer: Women's Perception of Engineering and Engineering Identity. In I. Welpe, B. Reschka & J. Larkin (Eds.),

- Gender and Engineering: Strategies and Possibilities* (Vol. 3). Frankfurt: Peter Lang.
- Cohen, L., & Swim, J. (1995b). The Differential Impact of Gender Ratios on Women and Men: Tokenism, Self-Confidence, and Expectations. *Personality and Social Psychology Bulletin*, 21(9), 876-884.
- Cohoon, J. M. (2001). Toward Improving Female Retention in the Computer Science Major. *Communications of the ACM*, 44(5), 108-114.
- Cohoon, J. M. (2002). Recruiting and Retaining Women in Undergraduate Computing Majors. *SIGCSE Bulletin*, 34(2), 48-52.
- Cohoon, J. M. (2007). *Gendered Experiences of Computing Graduate Programs*. Paper presented at the 38th SIGCSE Technical Symposium on Computer Science Education, Covington, Kentucky.
- Cohoon, J. M., Wu, Z., & Chao, J. (2009). *Sexism: Toxic to Women's Persistence in CSE Doctoral Programs*. Paper presented at the 40th SIGCSE Technical Symposium on Computer Science Education, Chattanooga, Tennessee.
- Coleman, E. G. (2013). *Coding freedom : the ethics and aesthetics of hacking*. Princeton: Princeton University Press.
- Coleman, G. (2012). Our Weirdness Is Free, The logic of Anonymous—online army, agent of chaos, and seeker of justice. *Triple Canopy*.
- Collins, P. (2000). *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment* (Rev. 10th anniversary ed.). New York: Routledge.
- Collins, P. (2004). *Black sexual politics : African Americans, gender, and the new racism*. New York: Routledge.
- Collins, S. G. (1997). Working Knowledge: What Anthropologists of Science and Technology Can Do for an Anthropology of Work. *Anthropology of Work Review*, 18(1), 9-14.
- Combahee River Collective. (1981). The Combahee River Collective Statement. In C. Moraga & G. Anzaldúa (Eds.), *This Bridge Called My Back*. Watertown: Persephone Press.
- Cooley, M., & Cooley, S. (1980). *Architect or bee?: the human/technology relationship*. Slough, England: Langley Technical Services.
- Cooper, M. (2008). *Life as surplus: biotechnology and capitalism in the neoliberal era*. Seattle: University of Washington Press.

- Correll, S. (2004). Constraints into Preferences: Gender, Status and Emerging Career Aspirations. *American Sociological Review*, Feb(69), 93-113.
- COSEPUP (1998). *Biennial Report to United States Congress, The Committee on Equal Opportunities in Science and Engineering*. Retrieved from <http://www.nsf.gov/pubs/2000/ceose991/ceose991.html#TOP>.
- Crenshaw, T., Chambers, E. W., Metcalf, H., & Thakkar, U. (2008). *A Case Study of Retention Practices at the University of Illinois at Urbana-Champaign*. Paper presented at the 39th SIGCSE Technical Symposium on Computer Science Education, Portland Oregon.
- Crittenden, A. (2001). *The Price of Motherhood: Why The Most Important Job In The World Is Still The Least Valued*. New York: Henry Holt and Company.
- Cuny, J., & Aspray, W. (2001). *Recruitment and Retention of Women Graduate Students in Computer Science and Engineering*. Washington D.C.: Computer Research Association.
- Dalla Costa, M., & James, S. (1980). Politics of Housework. In E. Malos (Ed.). London: Allison and Busby.
- Dalla Costa, M., & Dalla Costa, G. F. (1995). *Paying the price : women and the politics of international economic strategy*. London ; Atlantic Highlands, N.J.: Zed Books.
- Daniell, E. (2006). *Every other Thursday: stories and strategies from successful women scientists*. New Haven [Conn.]: Yale University Press.
- Davies, P. G., Spencer, S. J., & Steele, C. M. (2005). Clearing the air: Identity safety moderates the effects of stereotype threat on women's leadership aspirations. *Journal of Personality and Social Psychology*, 88(2), 276-287.
- Davis Floyd, R. (1992). *Birth as an American Rite of Passage*. Berkeley: University of California Press.
- De Angelis, M., & Harvie, D. 'Cognitive Capitalism' and the Rat-Race: How Capital Measures Immaterial Labour in British Universities. *Historical Materialism*, 17(3), 3-30.
- Denman, W. (2010). "I Don't Feel Geeky". *The Daily of the University of Washington*. Retrieved from <http://dailyuw.com/archive/2010/01/12/imported/'i-don't-feel-geeky'#.UZPk3VHdBUQ>

- Diekman, A., Brown, E., Johnston, A., & Clark, E. (2010). Seeking Congruity Between Goals and Roles: A New Look at Why Women Opt Out of Science, Technology, Engineering and Mathematics Careers. *Psychological Science, 21*(8), 1051-1057.
- Denzin, N. K. (1997). *Interpretive ethnography: ethnographic practices for the 21st century*. Thousand Oaks, Calif.: Sage Publications.
- DiMaggio, P. (1991). The Macro-Micro Dilemma in Organizational Research: Implications of Role-System Theory. In J. Huber (Ed.), *Macro-Micro Linkages in Sociology* (pp. 76-98). Newbury Park, CA: Sage Publications.
- DiMaggio, P. (1997). Culture and Cognition. *Annual Review of Sociology, 23*, 263-287.
- DiMaggio, P., Hargittai, E., Celeste, C., & Shafer, S. (2004). Digital Inequality. In K. M. Neckerman (Ed.), *Social Inequality: From Unequal Access to Differentiated Use* (pp. 355-400). New York: Russell Sage Foundation.
- Downey, G. L. (1998). *The machine in me: an anthropologist sits among computer engineers*. New York: Routledge.
- Duffy, M. (2005). Reproducing Labor Inequalities: Challenges for Feminists Conceptualizing Care at the Intersections of Gender, Race and Class. *Gender & Society, 19*(1), 66-82.
- Duhigg, C. & Kocieniewski, D. (2012). How Apple Sidesteps Billions in Taxes. *The New York Times*. April 28, 2012.
- Dunbar-Hester, C. (2010). Beyond "Dudecore"? Challenging Gendered and "Raced" Technologies Through Media Activism. *Journal of Broadcasting and Electronic Media, 54*(1), 121-135.
- Edsall, T. (2012). The Reproduction of Privilege. *New York Times*. Retrieved from <http://campaignstops.blogs.nytimes.com/2012/03/12/the-reproduction-of-privilege/>
- Eisenstein, Z. (Ed.). (1979). *Capitalist Patriarchy and the Case for Socialist Feminism*. New York; London: Monthly Review Press.
- Emerson, R., Fretz, R., & Shaw, L. (1995). *Writing Ethnographic Fieldnotes*. Chicago: University of Chicago Press.
- Ensmenger, N. (2010). *The computer boys take over: computers, programmers, and the politics of technical expertise*. Cambridge, Mass.: MIT Press.
- Espinosa, L. (2011). Pipelines and Pathways: Women of Color in Undergraduate STEM Majors and the College Experiences That Contribute to Persistence. *Harvard Educational Review, 81*(2), 209-240.

- Essed, P., & Goldberg, D. T. (Eds.). (2001). *Race Critical Theories: Text and Context*. Blackwell Publishing.
- Etzkowitz, H., Kemelgor, C., & Uzzi, B. (2000). *Athena Unbound: The Advancement of Women in Science and Technology*. Cambridge, UK: Cambridge University Press.
- Everett Daily Herald. (2013). Now, How to Pay for STEM. *The HeraldNet*. Retrieved from <http://www.heraldnet.com/article/20130402/OPINION01/704029972/-1/opinion01#Now-how-to-pay-for-STEM>
- Faludi, S. (2013). Sandberg Left Single Mothers Behind. *CCN, March 13*. Retrieved from <http://www.cnn.com/2013/03/13/opinion/faludi-poor-single-mothers-sandberg>
- Faulkner, W. (2000a). Dualism, Hierarchies and Gender in Engineering. *Social Studies of Science, 30*(5), 759-792.
- Faulkner, W. (2000b). The Power and the Pleasure? A Research Agenda for "Making Gender Stick" to Engineers. *Science, Technology and Human Values, 25*(1), 87-119.
- Faulkner, W. (2007). 'Nuts and Bolts and People' Gender-Troubled Engineer Identities. *Social Studies of Science, 37*(3), 331-356.
- Federici, S. (2004). *Caliban and the Witch: Women, the Body and Primitive Accumulation*. New York: Autonomedia.
- Ferguson, J. (2006). *Global Shadows: Africa in the Neoliberal World Order*. Durham: Duke University Press.
- Fernholz, T. (2012). "How To Solve the Tech Problem: Ask Women." Good.is. March 5, 2012. <http://www.good.is/posts/how-to-solve-the-tech-hiring-problem-ask-women> Retrieved: August 7, 2012.
- Figueroa, R., & Harding, S. G. (2003). *Science and other cultures: issues in philosophies of science and technology*. New York, NY ; London: Routledge.
- Foucault, M. (1995). *Discipline and punish : the birth of the prison* (2nd Vintage Books ed.). New York: Vintage Books.
- Franklin, S., & Lock, M. M. (2003). *Remaking life & death : toward an anthropology of the biosciences* (1st ed.). Santa Fe Oxford: School of American Research Press ;
- Franzway, S., Sharp, R., Mills, J. E., & Judith, G. (2009). Engineering Ignorance: The Problem of Gender Equity in Engineering. *Frontiers: A Journal of Women Studies 30*, 89-106.

- Fraser, N. (1999). *Social Justice in the Age of Identity Politics*. In L. Ray & A. Sayer (Eds.), *Culture and Economy After the Cultural Turn*. Thousand Oaks: Sage.
- Freehill, L., Brandi, C., Lain, A., & Frampton, A. (2009). Women in Engineering: A Review of the 2009 Literature. In S. o. W. Engineers (Ed.), *A Compendium of Women Engineers Annual Literature Reviews on Women in Engineering*. Chicago: SWE Publishing.
- Freehill, L. (2007). The ADVANCE Institutional Transformation Research in the Natural Sciences and Engineering: A Question of Content. In I. Welpé, B. Reschka & J. Larkin (Eds.), *Gender and Engineering: Strategies and Possibilities*. Frankfurt: Peter Lang.
- Freehill, L., Javurek-Humig, A., & Jeser-Cannavale, C. (2006). Women in Engineering: A Review of the 2005 Literature. In S. o. W. Engineers (Ed.), *A Compendium of the Society of Women Engineers Annual Literature Reviews on Women in Engineering*. Chicago: SWE Publishing.
- Fricker, M. (2007). *Epistemic injustice : power and the ethics of knowing*. Oxford ; New York: Oxford University Press.
- Friedman, B. (2012). Privacy, Technology and Law. The New York Times. January 28, 2012. http://www.nytimes.com/2012/01/29/opinion/sunday/in-the-gps-case-issues-of-privacy-and-technology.html?_r=0 Retrieved: February 26, 2013.
- Garvin-Doxas, K., & Barker, L. (2004). Communication in Computer Science Classrooms: Understanding Defensive Climates as a Means of Creating Supportive Behaviors. *ACM Journal of Educational Resources in Computing*, 4(1), 1-18.
- Gibbons, M. (2009). Engineering By The Numbers. *American Society for Engineering Education*, June, 10-49.
- Gibson-Graham, J. K. (1996). *The end of capitalism (as we knew it) : a feminist critique of political economy*. Cambridge, Mass.: Blackwell Publishers.
- Gimenez, M. (1975). Marxism and Feminism. *Frontiers: A Journal of Women Studies*, 1(1), 61-80.
- Gimenez, M. (1991). The Mode of Reproduction: A Marxist-Feminist Analysis of the Effects of Reproductive Technologies. *Gender and Society*, 5(3), 334-350.
- Ginorio, A. B. (1995). *Warming the Climate for Women in Academic Science*. Washington D.C.: Association of American Colleges and Universities.

- Ginsburg, F., & Rapp, R. (1991). The Politics of Reproduction. *Annual Review of Anthropology*, 20, 311-343.
- Ginsburg, F., & Rapp, R. (1995). *Conceiving the new world order: the global politics of reproduction*. Berkeley: University of California Press.
- Ginsburg, F. (1998). *Contested Lives: The Abortion Debate in an American Community*. Berkley: University of California.
- Godfrey, E., & Parker, L. (2010). Mapping the Cultural Landscape in Engineering Education. *Journal of Engineering Education*, January, 5-22.
- Goodman, A. H., Heath, D., & Lindee, M. S. (2003). *Genetic nature/culture : anthropology and science beyond the two-culture divide*. Berkeley: University of California Press.
- Goodman, A. H., Heath, D., Lindee, M. S., & NetLibrary Inc. (2003). Genetic Nature/Culture: Anthropology and Science Beyond the Two-Culture Dividepp. xvii, 311 p.). Available from <http://www.netLibrary.com/urlapi.asp?action=summary&v=1&bookid=86127>
- Gramsci, A. (1971). *Prison Notebook*. New York: International Publishers.
- Greenberger, M., Samuels, J., Eardley, E., & Manvell, J. (2005). *Tools of the Trade: Using the Law to Address Sex Segregation in Career and Technical Education*. Washington D.C.: National Women's Law Center.
- Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review*, 102(1), 4-27.
- Gusterson, H. (1997). Studying Up Revisited. *PoLAR: Political and Legal Anthropology Review*, 20(1), 114-119.
- Gusterson, H. (2004). *People of the Bomb: Portraits of America's Nuclear Complex*. Minneapolis: University of Minnesota Press.
- Hacker, S., Smith, D. E., & Turner, S. M. (1990). *Doing it the hard way: investigations of gender and technology*. Boston: Unwin Hyman.
- Hackett, E. J., Amsterdamska, O., & Lynch Michael, W., Judy (Eds.). (2008). *The Handbook of Science and Technology Studies* (3rd ed.). Cambridge, Mass.: MIT Press : Published in cooperation with the Society for the Social Studies of Science.
- Hagerty, B. M. K., & Patusky, K. (1995). Developing a Measure of Sense of Belonging. *Nursing research.*, 44(1), 9-13.

- Hakken, D. (2003). *The Knowledge Landscapes of Cyberspace*. New York: Routledge.
- Hakken, D., & Andrews, B. (1993). *Computing myths, class realities: an ethnography of technology and working people in Sheffield, England*. Boulder: Westview Press.
- Hales, M. (1980). *Living thinkwork : where do labour processes come from?* London: CSE Books.
- Hall, R., & Sandler, B. (1984). Out of the Classroom: A Chilly Campus Climate for Women? *Association of American Colleges, Project on the Status and Education of Women*,
- Hamilton, K. (2005). Faculty Science Positions Continue to Elude Women of Color. *Black Issues in Higher Education*, 21(3), 36-39.
- Handelsman, J., Cantor, N., Carnes, M., Denton, D., Fine, E., Hinshaw, V., et al. (2005). More Women in Science. *Science*, 309(5738), 1190-1191.
- Hanson, S. L. (1996). *Lost Talent: Women in the Sciences*. Philadelphia: Temple University Press.
- Haraway, D. J. (1997). *Modest Witness@Second Millennium.FemaleMan b- sMeets b- OncoMouse : feminism and technoscience*. New York: Routledge.
- Harding, S. Rethinking Standpoint Epistemology: What is "Strong Objectivity"? In L. Alcoff & E. Potter (Eds.), *Feminist Epistemologies*. New York: Routledge.
- Harding, S. (1986). *The Science Question in Feminism*. Ithaca, NY: Cornell University Press.
- Harding, S. (1991). *Whose Science? Whose Knowledge? Thinking from Women's Lives*. Ithaca, NY: Cornell University Press.
- Harding, S. G. (2004). *The feminist standpoint theory reader : intellectual and political controversies*. New York: Routledge.
- Harding, S. (2006). *Science and social inequality: feminist and postcolonial issues*. Urbana: University of Illinois Press.
- Harding, S. G. (2008). *Sciences from below : feminisms, postcolonialities, and modernities*. Durham: Duke University Press.
- Hardt, M., & Negri, A. (2000). *Empire*. Cambridge, Mass.: Harvard University Press.
- Harper, J. (2007). Secrets Revealed, Revelations Concealed: A Secret City Confronts Its Environmental Legacy of Weapons Production. *Anthropological Quarterly*, 80(1), 39-64.

- Hartsock, N. (1985). *Money, Sex and Power: Toward a Feminist Historical Materialism*. Boston: Northeastern University Press.
- Hartsock, N. (1998). *The Feminist Standpoint Revisited and Other Essays*. Boulder: Westview Press.
- Hartsock, N. (2009). *Hypatia Founders Reflect on Rationality, Science, and Epistemic Humility*. Paper presented at the Feminist Legacies/Feminist Futures: Hypatia 25th Year Anniversary, Seattle, WA.
- Harvey, D. (2010). *The enigma of capital and the crises of capitalism*. New York: Oxford University Press.
- Hennessy, R., & Ingraham, C. (1997). *Materialist feminism: a reader in class, difference, and women's lives*. New York: Routledge.
- Henwood, F. (1996). WISE Choices? Understanding Occupational Decision-Making in a Climate of Equal Opportunities for Women in Science and Technology. *Gender and Education*, 8(2), 199-214.
- Henze, B. (2000). Who Says Who Says? The Epistemological Grounds for Agency in Liberatory Political Projects. In P. Moya & M. Hames-Garcia (Eds.), *Reclaiming Identity: Realist Theory and the Predicament of Postmodernism* (pp. 229-250). Berkeley: University of California Press.
- Herring, S., Ogan, C., Ahuja, M., & Robinson, J. (2006). Gender and the Culture of Computing in Applied IT Education. In E. Trauth (Ed.), *Encyclopedia of Gender and Information Technology* (pp. 474-481). Hershey, PA: Information Science Publishing.
- Hess, D. (2007). Crosscurrents: Social Movement and the Anthropology of Science and Technology. *American Anthropologist*, 109(3), 463-472.
- Hewlett, S. A. (2010). The Sponsor Effect: Breaking Through the Glass Ceiling. *Harvard Business Review Research Report*, December, 5-7.
- Hill, C., Corbett, C., & Rose, A. (2010). *Why So Few? Women in Science, Technology, Engineering and Mathematics*. Washington D.C.
- Hill, K. (2011). Siri Is Sexist. *Forbes.com*, <http://www.forbes.com/sites/kashmirhill/2011/12/01/siri-is-sexist/> Retrieved: January 2012.
- Hing, L., Bobocel, R., Zanna, M., Garcia, D., Gee, S., & Oraziotti, K. (2011). The Merit of Meritocracy. *Journal of Personality and Social Psychology*, 101(3), 433-450.

- Hirshman, L. (2005). Is Your Husband Worse Than Larry Summers? *Inside Higher Ed*. Retrieved from <http://www.insidehighered.com/views/2005/12/09/hirshman>
- Holvino, E. (2008). Intersections: The Simultaneity of Race, Gender and Class in Organization Studies. *Gender, Work & Organization*, May.
- Homans, M. (1994). "Women of Color" Writers and Feminist Theory. *New Literary History*, 25(1), 73-94.
- hooks, B. (1984). *Feminist theory from margin to center*. Boston: South End Press.
- hooks, B. (1990). *Yearning: Race, Gender and Cultural Politics*. Boston: South End Press.
- hooks, B. (2000). *All about love: new visions* (1st ed.). New York: William Morrow.
- Hull, G. T., Bell-Scott, P., & Smith, B. (1982). *All the women are white, all the Blacks are men, but some of us are brave : Black women's studies*. Old Westbury, N.Y.: Feminist Press.
- Hurston, Z. N. (1998). *Their eyes were watching God* (1st Perennial Classics ed.). New York: Perennial Classics.
- Hurtado, S., Milem, J. F., Clayton-Pedersen, A. R., & Alen, W. R. (1998). Enhancing Campus Climates for Racial/Ethnic Diversity: Educational Policy and Practice. *The Review of Higher Education*, 21(3), 279-302.
- Jolly, S. (2002). *Gender and Cultural Change - Overview Report*. Brighton: BRIDGE, Institute of Development Studies.
- Jorgenson, J. (2002). Engineering Selves Negotiating Gender and Identity in Technical Work. *Management Communications*, 15(3), 350-380.
- Kasmir, S., & Carbonella, A. Dispossession and the Anthropology of Labor. *Critique of Anthropology*, 28(1), 5-25.
- Kelly, A. (1985). The Construction of Masculine Science. *British Journal of Sociology of Education*, 6(2), 133-154.
- Kelly, E., Ammons, S., Chermack, K., & Moen, P. (2010). Gendered Challenge, Gendered Response: Confronting the Ideal Worker Norm in a White-Collar Organization. *Gender & Society*, 24(3), 281-303.
- Kirsch, G. (2005). Friendship, Friendliness and Feminist Fieldwork. *Signs*, 30(4), 2163-2172.

- Klawe, M. (2012). *From 10 percent to 40 percent female in computer science in three years*. Paper presented at the University of Washington CSE Distinguished Lecture Series, Seattle, WA.
- Klein, N. (2007). *The shock doctrine: the rise of disaster capitalism* (1st ed.). New York: Metropolitan Books/Henry Holt.
- Kleinman, D. L. (2005). *Science and technology in society: from biotechnology to the Internet*.
- Kraft, P. (1979). The Industrialization of Computer Programming: From "Programming" to Software Production. In A. S. Zimbalist (Ed.), *Case Studies on the Labor Process*: Monthly Review Press.
- Ladner, R. (2009). Broadening Participation: Opening Remarks. *Communications of the ACM*, 52(12), 22-24.
- Lagesen, V. A. (2007). The Strength of Numbers: Strategies to Include Women into Computer Science. *Social Studies of Science*, 37(1), 67-92.
- Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge, Mass.: Harvard University Press.
- Latour, B. (2007). *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford ; New York: Oxford University Press.
- Lazowska, E. (2002). Pale and Male: 19th Century Design in a 21st Century World. *SIGCSE Bulletin*, 34(2), 1-2.
- Leskinen, E., Cortina, L., & Kabat, D. (2011). Gender Harassment: Broadening Our Understanding of Sex-Based Harassment at Work. *Law and Human Behavior*, 35(1), 25-39.
- Level Playing Field Institute (2011). *The Tilted Playing Field: Hidden Bias in Information Technology Workforce*. San Francisco, CA.
- Lewis, R., & Mills, S. (2003). *Feminist postcolonial theory: a reader*. New York: Routledge.
- Lie, M. (1997). Technology and Gender versus Technology and Work: Social Work and Computers. *ACTA Sociologica*, 40(2), 123-141.
- Lohan, M. (2000). Constructive Tensions in Feminist Technology Studies. *Social Studies of Science*, 30(6), 895-916.

- Lois, J., Carter, N. M., Wagner, H. M., & Narayanan, S. (2007). *The Bottom Line: Corporate Performance and Women's Representation*. New York, NY: Catalyst.
- Long, J. (2000). *From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers*. Washington, D.C.: National Academy Press.
- Lorde, A. (1983). *Zami, a new spelling of my name*. Trumansburg, N.Y.: Crossing Press.
- Lorde, A. (1984). *Sister Outsider*. Freedom, CA: Crossing Press.
- Loustaunau, M. O., & Sobo, E. J. (1997). *The cultural context of health, illness, and medicine*. Westport, Conn.: Bergin & Garvey.
- Lugones, M. (1989). Playfulness, "World"-Traveling and Loving Perception. In A. Garry & M. Pearsall (Eds.), *Women, Knowledge and Reality: Explorations in Feminist Philosophy* (pp. 419-435). Boston: Unwin Hyman.
- Madison, D. S. (2005). *Critical Ethnography: Method, Ethics, and Performance*. Thousand Oaks, Calif.: Sage.
- Malcolm, S. (2011). *What Kinds of Skills are Needed to Address the Challenges of the Future and How Do We Enable Students to Acquire These?* Paper presented at the American Society for Engineering Education, Vancouver, BC.
- Mander, J. (1991). *In the absence of the sacred : the failure of technology and the survival of the Indian Nations*. San Francisco: Sierra Club Books.
- Marazzi, C. (2010). *The violence of financial capitalism*. Los Angeles, CA: Semiotext(e).
- Marschke, R., Laursen, S., Nielsen, J. M., & Rankin, P. (2007). Demographic Inertia Revisited: An Immodest Proposal to Achieve Equitable Gender Representation among Faculty in Higher Education. *The Journal of Higher Education*, 78(1), 1-26.
- Margolis, J., & Fisher, A. (2002). *Unlocking the Clubhouse: Women in Computing*. Cambridge, MA: The MIT Press.
- Margolis, J., Fisher, A., & Miller, F. (1999/2000). Caring About Connections: Gender and Computing. *IEEE Technology and Society Magazine*, Winter(13-20).
- Margolis, J., Fisher, A., & Miller, F. (2000). Caring About Connections: Gender and Computing. *IEEE Technology and Society Magazine*, Winter, 13-20.
- Marra, R., Rodgers, K., Shen, D., & Bogue, B. (2009). Women Engineering Students and Self-Efficacy: A Multi-Year, Multi-Institution Study of Women Engineering Student Self-Efficacy. *Journal of Engineering Education*, 98(1).

- Martin, E. (1994). *Flexible bodies: tracking immunity in American culture from the days of polio to the age of AIDS*. Boston: Beacon Press.
- Martin, E. (2000). The Rationality of Mania. In R. Reid & S. Traweek (Eds.), *Doing Science + Culture* (pp. 177-199). New York: Routledge.
- Marx, K. (1973 [1857-58]). *Grundrisse (Blueprint for the Critique of Political Economy, Rough Draft)*. London: Penguin Classics.
- Marx, K. (1976/1990 [1867]). *Capital, Volume I*. London: Penguin Classics.
- Maternowska, C. M. (2006). *Reproducing Inequities: Poverty and the Politics of Population in Haiti*. New Brunswick: Rutgers University Press.
- Matthaei, J. (1997). The Sexual Division of Labor, Sexuality, and Lesbian/Gay Liberation: Towards a Marxist-Feminist Analysis of Sexuality in US Capitalism. In A. Gluckman & B. Reed (Eds.), *Homo Economics: Capitalism, Community, and Lesbian and Gay Life* (pp. 135-165). New York: Routledge.
- Maxwell, J. A. (1996). *Qualitative Research Design :An Interactive Approach*. Thousand Oaks, Calif.: Sage Publications.
- Mayberry, M., Subramaniam, B., & Weasel, L. H. (2001). *Feminist science studies : a new generation*. New York: Routledge.
- McClaurin, I. (Ed.). (2001). *Black Feminist Anthropology: Theory, Politics, Praxis, and Poetics*. New Brunswick: Rutgers University Press.
- McNeil, M. (2007). *Feminist Cultural Studies of Science and Technology*. London ; New York: Routledge.
- Mead, P., Moore, D., Natishan, M., Schmidt, L., Brown, S., Lathan, C., et al. (1999). Faculty and Student Views on Engineering Student Team Effectiveness. *Journal of Women and Minorities in Science and Engineering*, 5, 351-363.
- Merchant, C. (1980). *The Death of Nature: Women, Ecology and the Scientific Revolution*. San Francisco: Harper Collins.
- Merrill, D. & Reed, R. (1981). *Personal Styles and Effective Performance*. New York: CRC Press.
- Mies, M. (1986). *Patriarchy and Accumulation on a World Scale*. London: Zed Books.
- Mills, M. B. (2003). Gender and Inequality in the Global Labor Force. *Annual Review of Anthropology*, 32, 41-62.

- Misa, T. (Ed.). (2010). *Gender Codes: Why Women Are Leaving Computing*. Hoboken: John Wiley and Sons, Inc.
- Mohanty, C. T. (1991). Under Western Eyes: Feminist Scholarship and Colonial Discourses. In C. T. Mohanty (Ed.), *Third World Women and the Politics of Feminism*. Bloomington: Indiana University Press.
- Mohanty, C. T. (2003). *Feminism without Borders: Decolonizing Theory, Practicing Solidarity*. Durham: Duke University Press.
- Money Magazine The 50 Best Jobs in America. (November 2009). *Money Magazine*, 38.
- Moody, J. (2004). *Faculty Diversity: Problems and Solutions*. New York, NY: RoutledgeFalmer.
- Moore, H. (1988). *Feminism and Anthropology*. Minneapolis: University of Minnesota Press.
- Moore, H. L. (1994). *A passion for difference : essays in anthropology and gender*. Cambridge: Polity.
- Moraga, C., & Anzaldúa, G. (1981). *This bridge called my back : writings by radical women of color*. Watertown, Mass.: Persephone Press.
- Moreton-Robinson, A (2000). *Talkin' Up To The White Woman: Indigenous Women and Feminism*. St. Lucia: University of Queensland Press.
- Morgan, C., Isaac, J. D., & Sansone, C. (2001). The role of interest in understanding the career choices of female and male college students. *Sex Roles*, 44(5-6), 295-320.
- Morley, L., & Lugg, R. (2009). Mapping Meritocracy: Intersecting Gender, Poverty and Higher Educational Opportunity Structures. *Higher Education Policy*, 22, 37-60.
- Moskal, B. (2002). Female Computer Science Doctorates: What Does the Survey of Earned Doctorates Reveal. *ACM SIGCSE Bulletin*, 34(2), 105-107.
- Moss-Racusin, C., Dovidio, John, Brescoll, V., Graham, m., & Handelsman, J. (2012). Science Faculty's Subtle Gender Biases Favor Male Students. *Proceedings of National Academy of Science*, 109(41), 1-6.
- Mullings, L. (1995). "Households Headed By Women: The Politics of Race, Class and Gender". In F. G. a. R. Rapp (Ed.), *Conceiving the New World Order: The Global Politics of Reproduction* (pp. 122-139). Berkeley and Los Angeles, CA: University of California Press.
- Mundie, C. & Hey, T. (2011). Microsoft Research Connections Brochure. Part No. 098-117497.

- Murphy, M. C., Steele, C. M., & Gross, J. J. (2007). Signaling threat: how situational cues affect women in math, science, and engineering settings. *Psychological science : a journal of the American Psychological Society / APS*, 18(10), 879-885.
- Nader, L. (Ed.). (1996). *Naked Science: Anthropological Inquiry in Boundaries, Power and Knowledge*. New York: Routledge.
- Nakano Glenn, E. (1992). From Servitude to Service Work: Historical Continuities in the Racial Division of Paid Reproductive Labor. *Signs*, 18(1), 1-43.
- National Science Foundation. (2007). *Women, minorities and people with disabilities in science and engineering*. Arlington, VA: National Science Foundation.
- NCWIT. (2012) NCWIT Pacesetters. Boulder, CO: National Center for Women and Information Technology.
- Nelson, D. J. (2007). *A National Analysis of Minorities in Science and Engineering Faculties at Research Universities*. Norman, Oklahoma: University of Oklahoma.
- Negri, A. (1991). *The savage anomaly: the power of Spinoza's metaphysics and politics*. Minneapolis: University of Minnesota Press.
- Ngai, P. (2005). *Made in China*. Durham and Hong Kong: Duke University Press and Hong Kong University Press.
- Niemeier, D. A., & Gonzalez, C. (2004). Breaking in the Guildmasters' Club: What We Know About Women Science and Engineering Chairs at AAU Universities. *NSWA Journal*, 16(1), 157-171.
- Niemeier, D. A., & Smith, V. (2005). Building Careers, Transforming Institutions: Underrepresented Women and Minorities, Leadership Opportunities and Inter-institutional Networking. *Journal of Women and Minorities in Science and Engineering*, 11, 181-196.
- Nora, A., & Cabrera, A. (1996). The Role of Perceptions of Prejudice and Discrimination on the Adjustment of Minority Students to College. *Journal of Higher Education*, 67(2), 119-148.
- Oldenziel, R. (1999). *Making technology masculine: men, women and modern machines in America, 1870-1945*. Amsterdam: Amsterdam University Press.
- Ong, M. (2005). "Body Projects of Young Women of Color in Physics: Intersections of Gender, Race, and Science." *Social Problems*, 52(4), 593-617.
- Ong, M., Wright, C., Espinoza, L., & Orfield, G. (2011). Inside the Double Bind: A Synthesis of Empirical Research on Undergraduate and Graduate Women of

- Color in Science, Technology, Engineering and Mathematics. *Harvard Educational Review*, 81(2), 172-208.
- Ortner, S. B. (1996). *Making gender : the politics and erotics of culture*. Boston, Mass.: Beacon Press.
- Ortner, S. B. (2006). *Anthropology and social theory: culture, power, and the acting subject*. Durham: Duke University Press.
- Oyserman, D., Brickman, D., Bybee, D., & Celious, A. (2006). Fitting in Matters: Markers of In-Group Belonging and Academic Outcomes. *Psychological Science*, 17, 854-861.
- Parks-Stamm, E., Heilman, M. E., & Hearn, K. (2008). Motivated to Penalize: Women's Strategic Rejection of Successful Women. *Perspectives on Social Psychology Bulletin*, 34(2), 237-247.
- Partovi, A., & Partovi, H. (2013). Leaders and Trendsetters Agree More Students Should Learn to Code. Retrieved March 21, 2013, from <http://www.code.org/>
- Pawley, A. L. (2011). "CAREER: Learning from Small Numbers: Using Personal Narratives by Underrepresented Undergraduate Students to Promote Institutional Change in Engineering." Poster presented at the Engineering Education and Centers Grantees meeting March 13-15, 2011, Reston VA
- Pawley, A. L. (2012) What Counts as 'Engineering'? Towards a Redefinition. In C. Baille, A. L. Pawley & D. Riley (Eds.), *Engineering and Social Justice: In the University and Beyond* (pp. 59-85).
- Peterson, V. S. (2003). *A Critical Rewriting of Global Political Economy*. London; New York: Routledge.
- Pewewardy, C., & Frey, B. (2002). Surveying the Landscape: Perceptions of Multicultural Support Services and Racial Climate at a Predominantly White University. *The Journal of Negro Education*, 71(1/2), 77-95.
- Peña, D. G. (1997). *The terror of the machine : technology, work, gender, and ecology on the U.S.-Mexico border* (1st ed.). Austin, Tex.: Center for Mexican American Studies, University of Texas at Austin.
- Pilkington, E. (2013). WikiLeaks Activist in New York to Protest US Whistleblowers Clampdown. *The Guardian*. April 5, 2013. <http://www.theguardian.com/media/2013/apr/05/birgitta-jonsdottir-wikileaks-new-york-protest>. Retrieved: April 5, 2013.

- Pinel, E. C. (1999). Stigma consciousness: the psychological legacy of social stereotypes. *Journal of Personality & Social Psychology*, 76(1), 114-128.
- Plaut, V. (2010). Diversity Science: Why and How Difference Makes a Difference. *Psychological Inquiry: An International Journal for the Advancement of Psychological Theory*, 21(2), 77-99.
- Potter, E. F., & Rosser, S. V. (1992). Factors in life science textbooks that may deter girls' interest in science. *Journal of Research in Science Teaching*, 29(7), 669-686.
- Quizon, N. (2010). Social Change: Women, Networks and Technology. *Interactions: Societal/Cultural Consciousness and Change*, January + February.
- Raja, T. (2012). "Gangbang Interviews" and "Bikini Shots": Silicon Valley's Brogrammer Problem. *Mother Jones*. Retrieved from <http://www.motherjones.com/media/2012/04/silicon-valley-brogrammer-culture-sexist-sxsw>
- Reid, R., & Traweek, S. (2000). *Doing Science + Culture: How Cultural and Interdisciplinary Studies Are Changing the Way We Look at Science and Medicine*. London: Routledge.
- Reifman, J. (2012). "Microsoft Tax Dodge: How Microsoft Shareholders Saved \$6.1 Billion in Washington State"
- Ridgeway, C., & Correll, S. (2004). Unpacking the Gender System: A Theoretical Perspective on Gender Beliefs and Social Relations. *Gender & Society*, 18(4), 510-531.
- Riley, D., Pawley, A., & Baillie, C. (2012). Engineering and social justice in the university and beyondpp. 1 online resource (320 p.)). Available from <http://muse.jhu.edu/books/9781612491561/>
- Riley, D., Pawley, A., Tucker, J., & Catalano, G. (2009). Feminisms in Engineering Education: Transformative Possibilities. *NWSA Journal*, 21(2), 21-40.
- Rivlin-Nadler, M. (2013). Facebook Will Pay No Taxes, Get Huge Refund Instead. On <http://gawker.com/5984831/facebook-will-pay-no-taxes-get-huge-refund-instead.com> Retrieved February 26, 2013.
- Rosser, S. (1998). Group Work in Science, Engineering and Mathematics: Consequences of Ignoring Gender and Race. *College Teaching*, 46(3), 82-88.

- Rosser, S. V. (1995). *Teaching the Majority: Breaking the Gender Barrier in Science, Mathematics, and Engineering*. New York: Teachers College, Columbia University.
- Rosser, S. V. (2004). *The Science Glass Ceiling: Academic Women Scientists and the Struggle to Succeed*. New York: Routledge.
- Rosser, S. V. (2005). Through the Lenses of Feminist Theory: Focus on Women and Information Technology. *Frontiers: A Journal of Women Studies*, 26(1), 1-23.
- Rosser, S. V. (2012). *Breaking into the lab: engineering progress for women in science*. New York, NY: New York University Press.
- Rosser, S. V., & Zieseniss, M. (2000). Career issues and laboratory climates: different challenges and opportunities for women engineers and scientists (survey of fiscal year 1997 POWRE awardees). *Journal of Women and Minorities in Science and Engineering*, 6(2), 1-20.
- Sandberg, S. (2013). *Lean in: women, work, and the will to lead* (First edition. ed.). New York: Alfred A Knopf.
- Sandberg, S. (2011). *Keynote Address*. Paper presented at the Grace Hopper Celebration of Women in Computing, Portland.
- Sandler, B., & Hall, R. (1986). *The Campus Climate Revisited: Chilly for Women Faculty, Administrators and Graduate Students*. Washington DC: Association of American Colleges.
- Sandoval, Chela. *Methodology of the Oppressed*, Minneapolis: University of Minnesota Press, 2000.
- Sanger, P. C. (2003). Living and Writing Feminist Ethnographies. In R. P. Clair (Ed.), *Expressions of Ethnography: Novel Approaches to Ethnographic Methods*. Albany: State University of New York Press.
- Schaffhauser, D. (2010). Computer Science Major Counts Up Second Year in A Row. *Campus Technology*. Retrieved from <http://campustechnology.com/articles/2010/03/29/computer-science-major-counts-up-second-year-in-a-row.aspx>
- Scheper-Hughes, N., & Lock, M. (1997). The Mindful Body: A Prolegomenon to Future Work in Medical Anthropology. *Medical Anthropology Quarterly*, 1(1), 6-41.
- Schiebinger, L. L. (2008). *Gendered Innovations in Science and Engineering*. Stanford, Calif.: Stanford University Press.

- Schneier, B. (2013). The Internet Is A Surveillance State. CCN Opinion. March 16, 2013. <http://edition.cnn.com/2013/03/16/opinion/schneier-internet-surveillance/index.html> Retrieved: March 16, 2013.
- Sellers, R., & Shelton, J. N. (2003). Personality Processes and Individual Differences - The Role of Racial Identity on Perceived Racial Discrimination. *Journal of Personality and Social Psychology*, 84(5), 1079-1192.
- Settles, I., Cortina, L., Malley, Janet, & Stewart, A. (2006). The Climate for Women in Academic Science: The Good, The Bad and The Changeable. *Psychology of Women Quarterly*, Vol 30, pp. 47-58.
- Seymour, E., & Hewitt, N. (1997). *Talking about leaving: why undergraduates leave the sciences*. Boulder, Colo.: Westview Press.
- Seymour, E., & Hewitt, N. M. (1997b). *Talking About Leaving: Why Undergraduates Leave the Sciences*. Boulder: Westview Press.
- SGISA. (2003). The Survival Guide for Iowa School Administrators. Retrieved May 3, 2010, from <http://resources.sai-iowa.org/>
- Shelton, B. A., & John, D. (1996). The Division of Household Labor. *Annual Review of Sociology*, 22, 299-322.
- Sherwin, S. (1998). Introduction. In S. Sherwin (Ed.), *The Politics of Women's Health: Exploring Agency and Autonomy*. Philadelphia: Temple University Press.
- Shriver, M. (2009). *The Shriver Report*. Washington D.C.: Center for American Progress.
- Siebel Newsom, J. and Kilbourne, J. (2013) "VOCO's Sexist Ad Demonstrates That the Tech Industry Badly Needs Women." *The Daily Beast*. thedailybest.com. Retrieved February 4, 2013.
- Sismondo, S. (2010). *An Introduction to Science and Technology Studies* (2nd ed.). Chichester, West Sussex, U.K. ; Malden, MA: Wiley-Blackwell.
- Smith, D. E. (1987). *The everyday world as problematic : a feminist sociology*. Boston: Northeastern University Press.
- Smith, D.E. (1990). *The Conceptual Practices of Power: A Feminist Sociology of Knowledge*. Toronto: University of Toronto Press.
- Snyder, T. D., & Dillow, S. A. (2009). Chapter 3: Postsecondary Education Degrees *Digest of Education Statistics, 2009* (Vol. 45, pp. 269-526). Alexandria, VA: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education Sciences.

- Solmon, P. (2013). Silicon Valley Discriminates Against Women, Even If They are Better. *The Business Desk: PBS News Hour*. March 22, 2013. Retrieved April 10, 2013. <http://www.pbs.org/newshour/businessdesk/2013/03/silicon-valleys-war-against-wo.html>
- Soe, L., & Yakura, E. (2008). What's Wrong with the Pipeline? Assumptions About Gender and Culture in IT Work. *Women's Studies*, 37, 176-201.
- Spaights, E., & Whitaker, A. (1995). Black Women In the Workforce: A New Look at an Old Problem. *Journal of Black Studies: Sage Publications*, Vol. 25(No. 3), 283-296.
- Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). An integrated process model of stereotype threat effects on performance. *Psychological Review*, 115(2), 4-28.
- Steinpreis, R., Anders, K. A., & Ritzke, D. (1999). The Impact of Gender on the Review of the Curricula Vitae of Job Applicants and Tenure Candidates: A National Empirical Study. *Sex Roles*, 41, 509-528.
- Stewart, A., LaVaque-Manty, D., & Malley, J. (2004). Recruiting Female Faculty Members in Science and Engineering: Preliminary Evaluation of One Intervention Model. *Journal of Women and Minorities in Science and Engineering*, 10, 361-375.
- Stewart, A., Malley, J., & LaVaque-Manty, D. (Eds.). (2007). *Transforming Science and Engineering: Advancing Academic Women*. Ann Arbor: University of Michigan Press.
- Stewart, A. J., Malley, J. E., & LaVaque-Manty, D. (Eds.). (2007). *Faculty Recruitment: Mobilizing Science and Engineering Faculty*. Ann Arbor: University of Michigan Press.
- Stewart, H., & Wearden, G. (2013). Facebook's Sheryl Sandberg Attacks Gender Stereotypes At Work. *The Guardian*, January 25. Retrieved from <http://www.guardian.co.uk/business/2013/jan/25/facebook-sheryl-sandberg-gender-stereotypes>
- Stock, K. (2011). Women Unplug From the Tech Industry. *Technology and IT Jobs News and Advice*. Retrieved from <http://it-jobs.fins.com/Articles/SB130080246443096737/Women-Unplug-From-the-Tech-Industry>
- Stoddard, J. D., & Marcus, A. S. (2010). More Than "Showing What Happened": Exploring the Potential of Teaching History with Film. *HIGH SCHOOL JOURNAL*, 93(2), 83-90.

- Stolte-Heiskanen, V., First-Dili*c, R. z., & European Coordination Centre for Research and Documentation in Social Sciences. (1991). *Women in science : token women or gender equality?* Oxford New York: Berg : Distributed exclusively in the U.S.A. and Canada by St. Martin's Press.
- Stout, J., Dasgupta, N., Hunsinger, M., & McManus, M. (2011). STEMing the Tide: Using Ingroup Experts to Inoculate Women's Self-Concept in Science, Technology, Engineering and Mathematics (STEM). *Journal of Personality and Social Psychology*, 100(2), 255-270.
- Strike, B., Garner, B., Witt, C., Corson, D., & Feldmann, A. The Survival Guide for Iowa School Administrators: Equity Vocabulary. *The Survival Guide for Iowa School Administrators*, 2010, from http://resources.sai-iowa.org/diversity/equity_vocabulary.pdf
- Sue, D. W. (2010). *Microaggressions in everyday life : race, gender, and sexual orientation*. Hoboken, N.J.: Wiley.
- Summers, L. (2005). Remarks at NBER Conference on Diversifying the Science & Engineering Workforce. Cambridge, Mass.
- Sunder Rajan, K. (2006). *Biocapital : the constitution of postgenomic life*. Durham: Duke University Press.
- Swail, W. S., Redd, K. E., & Perna, L. W. (2003). *Retaining Minority Students in Higher Education: A Framework for Success*. San Francisco: Association for the Study of Higher Education.
- Swim, J., Aikin, K., Hall, W., & Hunter, B. (1995). Sexism and Racism: Old-Fashioned and Modern Prejudices. *Journal of Personality and Social Psychology*, 68(2), 199.
- Tahmincioglu, E. (2010). Tech Industry Searching for Girls Gone Geek. *MSNBC*, February 21st. Retrieved from <http://www.msnbc.msn.com/id/35460968/ns/business-careers/>
- Taibbi, M. (2013). Wikileaks Was Just a Preview: We're Headed for an Even Bigger Showdown Over Secrets. *Rolling Stone Magazine*. <http://www.rollingstone.com/politics/blogs/taibblog/wikileaks-was-just-a-preview-were-headed-for-an-even-bigger-showdown-over-secrets-20130322> Retrieved: April 4, 2013.
- Tan, D. L. (2002b). *Majors in Science, Technology, Engineering, and Mathematics: Gender and Ethnic Differences in Persistence and Graduation*. Paper presented at the Annual Association for Institutional Research.

- Tatar, N., Chachra, D., Zastavker, Y., & Stolk, J. (2010). *Work in Progress: Using Video and Self-Reflection to Enhance Undergraduate Teams*. Paper presented at the 40th Annual ASEE/IEEE Frontiers in Education Conference, Washington, D.C.
- Tate, R. (2013). Sergey Brin: Smartphones Are 'Emasculating.' *Wired*. February 28, 2013. <http://edition.cnn.com/2013/02/28/tech/innovation/brin-google-glass/>. Retrieved March 12, 2013.
- Temple, J. (2013). The Hypocrisy in Silicon Valley's Big Talk on Innovation. *San Francisco Chronicle*, (March 10). Retrieved from <http://www.sfgate.com/technology/dotcommentary/article/Innovation-and-the-face-of-capitalism-4342160.php>
- Traweek, S. (1992). *Beamtimes and lifetimes: the world of high energy physicists* pp. 1 online resource (xv, 187 p.). Available from <http://site.ebrary.com/lib/uwash/Top?layout=document&id=10314296>
- Treas, J., & Drobnic, S. (2010). *Dividing the domestic : men, women, and household work in cross-national perspective*. Stanford, Calif.: Stanford University Press.
- Trower, C., & Chait, R. (2002). Faculty Diversity: Too Little for Too Long. *Harvard Magazine*, 104(March-April), 33-37.
- Trunk, P. (2013). "I Had To Take a Xanax to Read Time Magazine This Week." March 10, 2013. <http://blog.penelopetrunk.com/2013/03/10/i-had-to-take-a-xanax-to-read-time-magazine-this-week/>. Retrieved March 10, 2013.
- Turkle and Papert (1990). Epistemological Pluralism: Styles and Voices Within the Computer Culture. *Signs: A Journal of Women in Culture and Society* (16) 1, 128-157.
- Ungerleider, N. (2012). Occupy Sites Help Cops, Corps Track Occupiers. *Fast Company*, April 25, 2012. <http://www.fastcompany.com/1835202/occupy-sites-help-cops-corps-track-occupiers>. Retrieved: February 22, 2013.
- Urla, J., & Swedlund, A. (1995). The Anthropology of barbie: Unsettling Ideals of the Feminine Body in Popular Culture. In J. Terry & J. Urla (Eds.), *Deviant Bodies: Critical Perspectives on Difference in Science and Popular Culture* (pp. 277-313). Bloomington: Indiana University Press.
- USA Quickfacts. (2008). *State and County QuickFacts* Retrieved April 22, 2010, from <http://quickfacts.census.gov/qfd/states/00000.html>
- Valian, V. (1998). *Why So Slow? The Advancement of Women*. Cambridge, MA: The MIT Press.

- van Anders, S. M. (2004). Why the Academic Pipeline Leaks: Fewer Men Than Women Perceive Barriers to Becoming Professors. *Sex Roles*, 51(9/10), 511-521.
- Vespa, J. (2009). Gender Ideology Construction: A Life Course and Intersectional Approach. *Gender & Society*, 23(3), 363-387.
- Vizenor, G. R. (1998). *Fugitive poses: Native American Indian scenes of absence and presence*. Lincoln, Neb.: University of Nebraska Press.
- Waite, W., & Leonardi, P. (2004). *Student Culture vs Group Work in Computer Science*. Paper presented at the SIGCSE.
- Wajcman, J. (1991). *Feminism Confronts Technology*. Cambridge, UK: Polity Press in association with B. Blackwell.
- Walby, S. (2007). *Gendering the knowledge economy : comparative perspectives*. Basingstoke [England] ; New York: Palgrave Macmillan.
- Watt, H. M. G., & Eccles, J. S. (2008). *Gender and occupational outcomes : longitudinal assessments of individual, social, and cultural influences* (1st ed.). Washington, DC: American Psychological Association.
- Weber, M. (1930). *The Protestant Ethic and the Spirit of Capitalism*. London: Routledge.
- Willard-Heinrichs, C. (2009). Dr. Cecilia Aragon and Friends Launch Latinas in Computing. *Diversity/Careers in Engineering and Information Technology*, (June/July). Retrieved from http://www.diversitycareers.com/articles/pro/09-junjul/mentors_latinas_computing.htm
- Williams, J. (2000). *Unbending Gender: Why Family and Work Conflict and What to Do About It*. Oxford, UK: Oxford University Press.
- Williams, J., Manvell, J., & Bornstein, S. (2006). *"Opt Out" or Pushed Out?: How the Press Covers Work/Family Conflict - The Untold Story of Why Women Leave the Workforce*. San Francisco: University of California, Hasting College of the Law.
- Wing, A. K. (2000a). Introduction. In A. K. Wing (Ed.), *Global Critical Race Feminism: An International Reader*. New York: New York University Press.
- Wyer, M. (2009). *Women, Science, and Technology: A Reader in Feminist Science Studies* (2nd ed.). New York: Routledge.
- Wylie, A. (2003). Why Standpoint Matters. In R. Figueroa & S. Harding (Eds.), *Science and Other Cultures: Issues in Philosophies of Science and Technology* (pp. 26-48). New York: Routledge.
- Wylie, A. (2012). "Feminist Philosophy of Science: Standpoint Matters." Presidential

Address: Annual Meeting of the Pacific Division of The American Philosophical Society, Seattle, WA, 47-73.

Xie, Y., & Shauman, K. A. (2003). *Women in Science: Career Processes and Outcomes*. Cambridge, Mass.: Harvard University Press.

Zemike, K. (2001). The Reluctant Feminist. The New York Times.
<http://www.nytimes.com/2001/04/08/education/the-reluctant-feminist.html?pagewanted=all&src=pm> Retrieved April 20, 2009.

Zieminski, N. (2012). CORRECTED (OFFICIAL)- Fewer Women in Top U.S. Tech Jobs Since 2010-Survey. Reuters.com (US Edition). Accessed November 5, 2012:
<http://www.reuters.com/article/2012/05/14/HARVEYNASH-WOMEN-TECHNOLOGY-IDUSLIE8G3>