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From Where I Stand: An Analysis of Female Software Engineers Struggling for Acceptance in I.T. Careers

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From Where I Stand: An Analysis of Female Software Engineers

Struggling for Acceptance in I.T. Careers

A DISSERTATION SUBMITTED TO THE FACULTY OF THE
SCHOOL OF EDUCATION OF THE UNIVERSITY OF ST. THOMAS

ST. PAUL, MN

By David R. McKoskey

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF EDUCATION

2019

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UNIVERSITY OF ST. THOMAS, MINNESOTA

From Where I Stand: An Analysis of Female Software Engineers
Struggling for Acceptance in I.T. Careers

We certify that we have read this dissertation and approved it as adequate in scope and quality. We have found that it is complete and satisfactory in all respects, and that any and all revisions required by the final examining committee have been made.

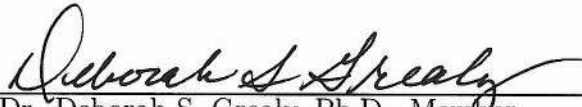
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Finally, to my wife and forever love, Avisia Whiteman, my greatest thanks is to you. I love you.

Dedication

For my father, Richard McKoskey. I love you, Dad.

Contents

Acknowledgements	3
Dedication	4
1 Introduction	10
My I.T. Story	10
A Brief Reflection	11
A Roadmap	12
A Career in Software Engineering	13
Significance of the Issue	15
2 Literature Review	17
Topical Literature	17
The Issue's Historical Significance	17
Mainframe Computing	17
Evolution to Personal Computing	20
Major Contemporary Themes and Tensions	21
Women's Preparation for I.T.	21
The I.T. Work Environment	23
Gaps and Disagreements	24
Theoretical Framework	25
Relevant Analytic Theory	25
Weber: Three-Component Theory of Stratification	26
Abbott: Professional Association and Professionalization	28
Wenger: Communities of Practice	28
Bourdieu's Theory of Habitus	30
Symbolic Capital	30
Cultural Capital	31
Social Capital	32
Symbolic Violence	33
Pedagogic Action	34
Pedagogic Authority	35
Pedagogic Work	36
3 Methodology	37
Grounded Theory	37
Normative Case Study	38
Previous Studies	39
Data Collection and Analysis	40
Types of Data	40
Participants	40
Interview Content and Discussion	41
Data Acquisition	42

Validity	43
Generalizability	44
Nuances	44
4 Findings	46
Data Patterns	46
Early Influences	49
Family and Friends	49
Education	52
Seminal Mentoring / Mentorship	55
Career Appeal	57
Curiosity and Play	57
Work / Task Centrism	59
Career Trajectory	60
Career Arc	60
Tenacity	62
Structural Injustice	63
Competence	64
Self-Discounting	66
Individual-Level Sexism	69
Job-Related Issues	72
Informal Professional Organizations	74
Counterproductive Habits	75
Misplaced Individualism	76
Representation Difficulties	77
Perfectionism	78
Work in Isolation	79
Female Suppression	80
Grief	83
5 Analysis	84
Symbolic Capital	84
Cultural Capital	86
Social Capital	87
Networking	87
Flexibility	89
Mobility	90
Work in Isolation	91
Collaboration	92
Structural Support	93
Representation	93
Gender: Rapport and Awareness	94
Personal Resilience	95
Environment	95
Roll Off	96

Optimism	97
Luck	97
Problem Solving Strategy	98
Age	99
6 Conclusions, Implications, & Further Study	100
Leadership Implications	100
Future Research	102
Leadership Development	102
Gamergate Case Study	103
From Where I Stand	105
Conclusion	106
Appendix	108
Author's Note	108
Research Questions	108

List of Figures

1	A Typical I.T. Career Arc	13
2	Wenger's Model of Learning	29
3	A Summary of the I.T. Habitus	47
4	The I.T. Habitus Applied	48

List of Tables

1	The Cost of an I.T. Career	46
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Abstract

Since the late 1970's, women's participation in Information Technology (I.T.) careers has dropped from a high of 35% to a stubborn $20 \pm 5\%$ (NCWIT2016, 2016). This, despite rapid growth in software engineering and associated I.T. fields, and an overall deficiency of I.T. workers (TEKSystems, 2017; USBLS, 2015a, 2015b).

This dissertation presents an analysis of ten interviews. All ten interviewees were women with I.T. careers of at least five years, though typically significantly longer. The analysis is presented through the lens of Max Weber's theory of Ständ, Class, and Party, (Weber, 2015), Pierre Bourdieu's theory of Symbolic / Social / Cultural capital (Bourdieu, 1984, 1985), Bourdieu's theory of Habitus (Bourdieu, Passeron, & Nice, 1990), Andrew Abbot's views on professional identity (Abbott, 1988), and Étienne Wenger's framework of Communities of Practice (Wenger, 1998). The goal is to understand better the norms which govern I.T. culture, show how these women have suffered under their imposition, yet thrived in their careers nonetheless.

Three major themes emerge from the interview analysis: early influences, loss, and recovery. Early influences explain how the interviewees chose I.T. as a career and illustrates some of the basic, personal motivation which still informs their decision to pursue it. This section also examines the role of friends and family, especially the influence of fathers. The section on loss carefully examines how the women internalized the male-dominant I.T. culture to their own detriment, how external factors reinforced this internalization and habitual repetition, and the grief which resulted. Finally, the essay examines the factors by which the interviewees recover from loss, including personal resilience, self-care practices, and the construction of women's support networks.

The essay concludes with some implications for leadership, especially in changing the I.T. culture to make it more welcoming and inclusive. Some ideas for further areas of research are also presented, including new structures for I.T. leadership and professional norms, and further research into young male "geek" video gaming culture as exemplified in the Gamergate case (Quinn, 2017).

1 Introduction

My I.T. Story

My career was an accident. I graduated from the University of St. Thomas in 1993 with three majors (French, Mathematics, and Psychology) and no clear idea what to do next. I spent the next five years as a neuroscience researcher at a VA hospital in Minneapolis, as an intern at West Publishing, as a sacristan at the Basilica of St. Mary, and as a youth minister at a local Catholic church. My youth ministry career didn't end well, and I spent several months paying my apartment rent as a UPS security guard, pulling seal bolts from incoming shipping containers. Around that time, the I.T. job market began to heat up. By 1996, the Minnesota economy was well in the grip of an Information Technology (I.T.) boom – the dot-com boom – where software programming jobs were plentiful and qualifications minimal. After revising my resume to highlight my Math and computer skills, and studying the “C” programming language (Gookin, 1994), I applied for several I.T. jobs. After about six weeks, I found a job at a local software contracting company. Within a year or so as a professional software engineer, I decided to strengthen my credentials and earned an M.S. degree in Computer Science (graduating in year 2000).

My career path is, well, weird, but since my first job as a consultant in the late 1990s, it has been very typical for white male software engineers my age. Modern neoliberal capitalism turned my resumé into a game of hopscotch; I've been “laid off” several times and openly fired twice, but I've never been unemployed for more than six weeks at a time. I easily trade “war stories” and swap LinkedIn.com connections with other men like me. Our experience of the I.T. industry has had its ups and downs, but it was never anything we couldn't handle. Despite moving from job to job, I've progressed from junior, to mid-level, to senior software engineering positions without incident. My income has occasionally stagnated, but I have only taken a pay cut once. I have also been offered leadership positions, to take or leave as I please.

In my daytime professional life, I work with other white, Midwestern men like myself. They seem like “decent guys”, most of them family men who hold moderate political and social views. They seem very “live-and-let-live”, and I would count myself as “one of them”. I’ve navigated my career as if it were mostly a series of jobs; my resumé reflects any larger, organized reality if there is one. Until recently, I’ve never had to give my career path much thought.

Much less frequently do I work with female software engineers, and I have known only *one* African-American software engineer. I’ve always wondered about why this is, since many other professions seem – at least anecdotally – to have a better gender balance. The few times I have worked with female software engineers, I have benefited directly from their diversity of opinion and perspective. I can’t be alone in this regard. But since this is so, why is gender parity in I.T. so difficult to achieve?

A Brief Reflection

In about 2008, the U.S. housing market crashed due to some unsavory, scantily-regulated mortgage lending practices (U.S. Housing Bubble, 2019). The resulting economic recession (U.S. Great Recession, 2019) affected nearly all my friends’ workplaces, and I was no exception. I was working as a consultant, providing staff augmentation to some local companies’ I.T. departments. It was surprisingly safe employment, though it meant I was nearly constantly looking for work; companies needed software engineers, but couldn’t commit to full-time employees.

One workplace I remember well was WebCo. WebCo was unique in one respect: I had two female colleagues (Ivy and Connie) and the software development team reported to a female manager, Francine. When I met my WebCo colleague Ivy for the first time, she was just returning from maternity leave. During Ivy’s leave, I had been hired as a consultant software engineer. The director of the department I worked for, Francine, was impressed with me to the point where she bought out my contract and hired me for an open Team

Lead position. Like Ivy, I was already a senior software engineer, but I had never served in a leadership position before. At the time, I was happy to be promoted and thought the position was worth a try.

After working with her for several months, I discovered not only that Ivy was an astonishingly good software engineer, but that she was eminently and obviously qualified for the leadership position to which I had been promoted; Francine had passed me over Ivy over for promotion. The situation didn't work out – but not, perhaps, for the reason one might expect. Promoting an evidently unqualified person (me) to leadership was symptomatic of Francine's more general mismanagement. Within three months, Ivy, Connie, and I had all resigned and moved on to positions at other companies.

More recently, I was hired at TaxCo for a full-time position as a senior software engineer. Shortly after I started there, I discovered that a colleague of mine, Lucy, had been passed over for promotion from mid-level (Programmer II) to senior-level (Programmer III). Rather than promoting her, they had hired *me*. Yikes. This despite her manager Tom's high opinion of Lucy's work, and both of them reporting to a female director (Nancy). I always thought my experience at WebCo was unfortunate, but at the time, I was able to blame the outcome on Francine. The episode with Lucy, however, gave me pause. Both experiences were similar; too similar to dismiss as “a fluke” or “the way it goes sometimes”. The more I thought about it, the more differences I could identify between myself and my female colleagues' careers, and the more clearly my own professional privilege emerged. The privilege I enjoyed stood in contrast to the struggle my female colleagues had faced, to the point where it called into question the merit-oriented workplace ethic I had – until this point – accepted as “natural”.

A Roadmap

This dissertation will outline the arc of a typical career in software engineering, and argue the existence and significance of sexism in I.T. I will provide a more comprehensive view of the scholarly literature on sexism in I.T. and discuss five major theories which we will use

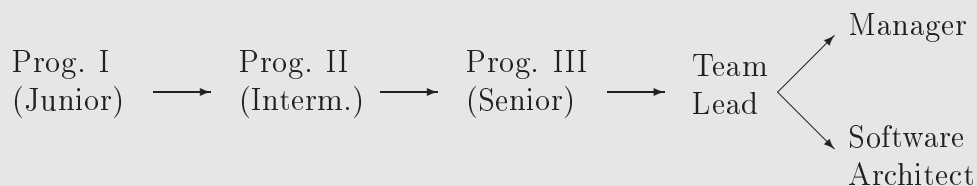
to model women’s experience in I.T.: Max Weber’s theory of St and, class, and party, Pierre Bourdieu’s theory of symbolic, cultural, and social capital, Bourdieu’s theory of Habitus, Andrew Abbot’s views on professional identity, and Étienne Wenger’s social theory of learning. We will examine Bourdieu’s theories in some detail, as they will inform much of how we understand sexism in I.T.

Next, I will examine carefully the research methodologies I will use to analyze ten interviews with successful women in I.T. I will then present an analysis of these interviews, carefully applying the theories presented earlier. I will conclude the dissertation by exploring some implications for leadership practice and for future research.

It is easy – I claim, facile – to dismiss something like sexism in I.T. as just a series of unfortunate events or scenarios. Certainly, I’ve heard male colleagues pose this kind of watercooler reasoning as they bemoan the “difficulties” of their own jobs. Explaining sexism in I.T. requires not only that we reflect on individual cases, but that we understand the underlying system which causes and sustains I.T. sexism. The cases we will examine follow a well-worn career path, so the best place to begin is, well, where one begins: the arc of a career in software engineering.

A Career in Software Engineering

Figure 1: A Typical I.T. Career Arc



At the beginning of their careers, software engineers receive a junior rank of Programmer I and spend most of their time writing computer programs (source code), also known as

“programming”. As years pass and their experience and expertise grow, they proceed to the Programmer II and Programmer III ranks. Each successive rank entails more responsibility and independence, and of course, better compensation. After a software engineer has reached the rank of Programmer III, they generally consider one of two leadership roles. Figure 1 diagrams this career progression.

The first leadership option is Software Architect, in which they develop a bird’s-eye view of all software in a particular department, often developed by different teams. Software architects are responsible for ensuring individual software projects integrate into a larger, coherent system. Typically, no further formal education is necessary to attain a Software Architect position, though accreditations in software methodology and security may be required. The second option is management, where software engineers essentially *end* their careers as programmers in lieu of a role managing software projects. Managers work not only with programmers and team leads, but with business analysts, sales staff, and executives. Most managers are usually given a “director” title and are required to have an advanced business degree (e.g. MBA, MMIS, MISM).

Between the role of Software Engineer and either the Software Architect role or the Manager role, is an interstitial leadership role called “Lead Programmer” or “Team Lead”. Each Team Lead heads their software development team in the technical aspects of software development, deployment, and support. They also uphold software development standards and manage team member responsibilities. Team Leads are often the best senior programmer and train for the next level of leadership. This position is a “proving ground” for management and architect candidates; promotion to Team Lead indicates not only great competence as a software engineer, but great *esteem* within the development group and in the eyes of management.

Regardless of career goal, most enter the I.T. field as software engineers because they *enjoy programming*. Many would rather *not* progress to the Team Lead, Manager, or Architect position. More than one male software engineer I’ve know have deliberately taken a

demotion from a Team Lead position (back to Programmer III) because they so missed the daily practice of developing software.

Most female software engineers I've known have followed the promotion sequence in Figure 1, but their progress has been very uneven and at great cost to them personally. They generally find their work receives harsher critique than their male counterparts (Corneliussen, 2010; Hayes, 2010), even while having surpassed the expectations of their teammates and managers.

The decision to stay a software developer and *not* pursue a leadership role means this mistreatment may continue indefinitely. One solution is to leave I.T., and many women do (Misa, 2010). That they do is significant for several reasons, which we will examine next.

Significance of the Issue

The social significance of a workplace culture unwelcoming to women is fairly obvious. Systematic inequality such as sexism or racism is normalized violence and injustice (bell hooks, 2014). Less obvious, perhaps, are the practical implications. Current statistics indicate a very low U.S. unemployment rate overall, and a deficit of I.T. workers in particular (CompTIA, 2017; TEKSystems, 2017; Taulbee Survey, 2015). Outsourcing efforts which intend to save money may backfire (Johanek, 2015) forcing companies to recall – or “onshore” – their I.T. departments. Meanwhile, the employees who lost their jobs to offshoring often leave I.T. and are reluctant to return. Companies are in the difficult position of needing more I.T. workers, whom they have in turn made increasingly difficult to find.

These points may seem compelling, but equally important is the conceptualization, design, and implementation of computer technology itself. Jane Margolis, an educator at Carnegie Mellon University (CMU) makes this point well:

At stake in the experience of women as undergraduates is the makeup of the technology-creating population. ...It is predominantly men who are programming the computers, designing and fixing the systems, and intervening in the

technology that will affect all aspects of our lives... The under-representation of women and minorities among the creators of information technology has serious consequences, not only for those individuals whose potential goes unrealized, but also for a society increasingly shaped by that technology (Margolis, Fisher, & Miller, 2000).

Margolis and colleagues restrict their comments to their female Computer Science (CS) students, as their education is essentially the beginning of their careers. More deeply, however, her point appeals to the pragmatic core of the American psyche: knowledge is rooted in personal experience, and so therefore is work. Technology implemented *by* men is designed *for* them. Others who have obvious investment in the design and use of technology are dismissed simply as “users”.

In a joint effort from 1997 to 2003, several professors from the Computer Science and Education departments at CMU performed landmark studies on sexism in their CS classrooms and implemented curricular and social changes to remedy it. Ten years in, the student composition of the CS program at CMU has been brought to parity: half their students are men, and half women. Their insights into classroom sexism lead to a seminal first book on the subject (Margolis & Fisher, 2002) and inspired work which has continued since (Abbate, 2012; Frieze & Quesenberry, 2015).

While laudable, this research is restricted to the undergraduate CS classroom. Comparatively little scholarly literature is available on sexism in the I.T. workplace. The literature which does exist tends to explore the extent of the problem (Delia, 2015; Merrills, 2016) or the utility of various survival strategies (Hua, 2010; Kolacz-Belanger, 2008).

The problem of gender imbalance in I.T. is long-standing and multifaceted. It is difficult – even unlikely – to identify any one trend or factor which adequately explains it. The next section provides an overview of the research on women in I.T.-related postsecondary education (both professors and students), statistics from national or governmental organizations on I.T. gender imbalance and reviews the historical literature on women’s success in and

departure from I.T. fields. These studies show how the computer technology trends of the past 60 years influenced the roles women played in I.T., their success in those roles, and the difficulties they faced.

2 Literature Review

Topical Literature

The Issue's Historical Significance

This section will provide a brief history of the modern digital computer and the Information Technology (I.T.) industry which grew up alongside it. First, we will recount the earliest origins of computers and I.T., including its roots in military service. Next, we will examine a major shift in the I.T. industry: from monolithic mainframe systems to highly distributed, networked personal computers. Finally, we will explore cultural shifts which occurred during this technological evolution, centering on the evolution of women's roles.

Mainframe Computing

The very first computers were curiosities, built by philosopher tinkerers such as Charles Babbage and Ada Lovelace, for display in the parlors of 19th century England. Babbage's greatest accomplishments were the analytical and difference engines, used to generate tables of numbers used by engineers, scientists, and navigators (Campbell-Kelly, Aspray, Ensmenger, & Yost, 2013). Despite these modest applications, Babbage and Lovelace successfully formulated the essential mathematics of computation, which still holds to this day. Lovelace invented the first computational algorithm and is considered the first computer programmer (Fuegi & Francis, 2003).

Matters grew more serious during the Second World War. Faced with the daunting task of deciphering machine-encoded Nazi communications, Oxford mathematical Alan Turing created the first computer whose sole task was to expedite calculating the formulae for

deciphering German encryption codes (Copeland, 2004). For Babbage, Lovelace, and Turing, the problem was not that of knowing what sort of formula to calculate, but overcoming the time required to execute the calculation “by hand”.

The same sense of urgency held true during the Cold War of the 1950’s and 1960’s, after the U.S.S.R. launched the Sputnik satellite into space. The space race and nuclear arms race which followed thereafter cemented the computer as the principle tool by which military command-and-control structures aggregated information and executed strategic decisions. Computers such as the early ENIAC machine (McCartney, 1999) were instrumental in calculating space launches, rocket trajectories, and the mathematical foundations of thermonuclear weapons.

While the architecture and implementation of large-scale mainframe computers has changed, from the ENIAC to the IBM OS/360 (Brooks, 1975), the purpose and programming procedures for these large-scale, centralized mainframe computers has remained mostly *unchanged* to the current day. Mainframe computers still dominate domains where computers must be reliable and computation results are time-sensitive. Nuclear missile silos, thermonuclear reactors, Wall Street stock and bond calculation, and Social Security benefit administration still remain almost exclusively within in the purview of these monolithic systems (Misa, 2010).

Noteworthy at this point is the evolution of the roles which evolved for the use and care of mainframe computers. Before computers were digital, they were *persons* (Campbell-Kelly et al., 2013; Shetterly, 2016). Digital computers were essentially treated as large calculators, and computer workers were drawn from stenography pools. Programming computers was a laborious task, requiring not only knowledge of the appropriate programming languages (COBOL, FORTRAN, JCL, Assembly, SQL, etc.), but required hours of working meticulously with punched cards (J. Cohoon & Aspray, 2008; Misa, 2010). In these days, a computer program was written as a series of cards, with commands sketched onto each card, then the cards punched through to create holes. Card readers would scan the cards,

read the pattern of holes, and execute the commands accordingly. Often, a single program would consist of a large stack of cards which needed to be punched and sorted carefully. Any card out of place or improperly punched would require re-sorting or repairs and incur costly delays.

The digital computer itself was a configuration of circuits consisting of vacuum tubes inside a very large metal case. The dedicated “computer room” would need to be kept cold with fans running constantly, else the tubes would overheat. Computer repairs had to be done quickly and efficiently in this difficult environment. On one occasion, Grace Hopper was working on repairs for the Harvard Mark II when one of her associates found a dead moth trapped in a relay switch. The insect was removed and carefully taped to the log book as evidence the repairs were necessary (Danis, 1997)¹. “

Equally noteworthy is the role women played in the care and operation of these large systems. Human computers and their counterparts in stenography pools were exclusively women (Shetterly, 2016). Card punching was a menial and manually intense task, requiring long hours and attention to detail. Computer hardware maintenance likened to working in a refrigerator while handling hot glass. Women were expected to tolerate these conditions without complaint, while supervisors, directors, and computer program designers were almost exclusively men (Downey, 2010).

One very important advancement of the late 1970’s was the invention of a worldwide computer network. This early network, called the ARPANET was a way initially a way to connect major universities and major military installations. Information was sent over the network’s copper cables using a method of breaking a message into pieces, sending the pieces one at a time, then reassembling them once the destination had received them. The protocol included two very important features. The first was error correction: any corrupted or missing pieces of a message could be requested again automatically. The second and more important feature followed from the network’s original intent: to withstand a thermonuclear

¹This is the incident which gave rise to computer errors or glitches being known as “bugs”.

war. Communications protocols to this point worked like circuits: a telephone, for instance, assumed the existence of users on either end of a phone line. Sending a message required both the sender and receiver to complete a circuit. The new TCP / IP network protocol for sending messages made no such assumptions: senders and receivers could appear and disappear from a network completely at random, and the network would adjust messaging routes automatically. If a network node disappeared (e.g. Los Angeles is demolished by a bomb), the network would re-route messages through other network nodes (cities) automatically and request new copies any of data lost when the node “went offline” (Schneider, Evans, & Pinard, 2009).

While World War III has yet to occur, the volatile network conditions TCP / IP allows certainly have. The ARPANET grew at an exponential rate, beginning with an initial 9 nodes in 1971, and expanding to over 200 nodes by 1981, with new hosts connecting on average every three weeks (Stewart, 2014). This growth set the stage for a major change in how and where digital computing would be done: the personal computer.

Evolution to Personal Computing Moore’s Law states that the number of components in an integrated circuit doubles approximately every two years (Keyes, 2006). The consequence of this law is two-fold: central processing unit (CPU) speed doubles given the size of the circuit doesn’t change, or conversely, a new processor with the same speed as an older one will occupy half the space. This sort of advancement is beneficial for all involved: mainframes grow increasingly powerful without requiring any additional space, and smaller computers with sufficient processing power become more easily portable. The first personal computers resembled microscopic mainframes: a clackey mechanical-lever keyboard, an eye-watering green phosphor display screen, and a CPU enclosed in a large metal case. Programs and data were stored on an external media device (“floppy disk”).

Programming and using computers changed dramatically during that time. Instead of writing programs as stacks of punch cards, they were written as a series of text files stored *on* the computer’s storage medium (a “floppy disk” or the “hard drive”), which were pro-

cessed by a compiler to produce a binary (machine) code which the computer would execute. Seminal programming languages such as C (Kernighan & Ritchie, 1972), which were initially developed for mainframe and UNIX systems, were rewritten for personal computers. Many programming languages followed suit, to the point where most software and engineering tools today are developed on hardware no larger than a laptop computer.

At approximately the same time, the number of women earning I.T.-related degrees and working as software engineers dropped precipitously from a high of 37% of the I.T. workforce (circa 1986) to approximately 20%; a trend which has remained stable ever since. With computers directly available to men, the work women performed for mainframe computers was no longer considered necessary. This relegated women to their previous roles as secretaries, typists, and administrative assistants. Women were denied access to computers, except as “users” (J. Cohoon & Aspray, 2008).

Major Contemporary Themes and Tensions

The problems women confront during I.T. careers begin long before women arrive in the workplace. This section will examine the trajectory of girls and women’s development as they pursue their interests in technology, especially Computer Science. Whether or not – and when – women choose an I.T. profession can depend on their early formative experiences with computers. Experience with computers begins with using them and proceeds to creating technology, specifically software. Equally important is their earliest pedagogical experiences with computers, usually as undergraduate university students. Having outlined both of these, we will briefly examine the evolution of women’s roles in the workplace.

Women’s Preparation for I.T. Sexism is discrimination against women on the basis of gender (Lerner, 1986) and may take many forms, including the devaluing of women’s work relative to “men’s” work, relegating women to menial tasks and non-leadership, subordinate organizational roles (Coontz, 1992). Women in subordinate I.T. roles is already well documented, both in the U.S. (Haigh, 2010; Schlombs, 2010) and internationally (Corneliussen,

2010; Hicks, 2010). The evolution of women's roles is also well-documented and consistently subordinate to men's (Hayes, 2010). Unfortunately, the effects of sexism can be traced to women's earliest experiences with computers.

The latest research on girls' exposure to computers indicates it is consistently less than boys exposure (Barker & Aspray, 2008), sometimes to the point where for every girl who uses a computer, two boys do. Girls are also half as likely to own computers (Goode, Estrella, & Margolis, 2008). To this point, research suggests that boys are viewed somehow as more mechanically inclined, better tinkerers, or somehow "better suited" to using computers. Boys also have more male mentors and role models who use computers and develop software, often family members (Zarrett, Malanchuk, Davis-Kean, & Eccles, 2008).

Undergraduate postsecondary institutions are the first place we see the trend of 15% – 25% of women comprising the I.T. workforce: the same holds true in the classroom. As previously mentioned, CMU faculty studied gender disparities in Computer Science (CS) students and by understanding them better and changing the curriculum, brought their CS classes to gender parity in ten years (Frieze & Quesenberry, 2015; Margolis & Fisher, 2002). This is great but uneven progress. Most universities still graduate on average 20% women in Computer Science (Charles & Bradley, 2008; M. Cohoon & Aspray, 2008). This trend is uneven internationally; some countries experience the same trend as the United States (e.g. Norway (Corneliussen, 2010)), others have gender parity in I.T., or the profession leans toward women (e.g. Indonesia (Othman & Latih, 2006)). The reasons for these differences are not very well understood.

One issue young women face is when and how educational programs evaluate their perceived "fitness" for I.T.-related fields. The most common narrative is that one must be sufficiently "rational" in order to excel in Computer Science. They are then forced into prerequisite, "weed out" mathematics courses (Blickenstaff, 2005). Mathematics classes entail none of the software programming they enjoy, which may diminish their enthusiasm for choosing a CS major, possibly to the point of quitting. Meanwhile, there is significant

question as to whether or not mathematics is any kind of test for “rationality”, and most importantly, whether or not “rationality” is required – or even desirable – for excellence in software engineering (Katz, Aronis, Wilson, Allbritton, & Soffa, 2008).

There is also evidence that Computer Science departments – and therefore, classrooms – are male dominated. Modern Computer Science pedagogy not only exemplifies male learning styles, but represents and enforces patriarchal values and work norms (M. Cohoon & Aspray, 2008; Cronin & Roger, 1999; Jesse, 2008). This despite the great flexibility of Computer Science as a subject and an abundance of literature on women’s modes of knowing, learning, and information processing (Arnold, 1992; Belenky, Clinchy, Goldberger, & Tarule, 1997; bell hooks, 1994; Bryson & Bennet-Anyikwa, 2003; Hanisch, 2015; Tarule & Tetreault, 1992; Weiler, 1991).

Women’s professional roles have changed dramatically in the past three generations, though they have stayed consistently secondary to those of men. Women’s skilled labor during World War II was considered necessary, but after the war, women returned to their roles as homemakers (Miller & Cornford, 1995). Women’s roles in office work are often designed to keep their decision-making autonomy to a minimum. Whereas early clerks of the 18th century were men, and required business and law acumen, women’s roles as typists and stenographers rely only on their ability to use machines such as calculators and typewriters (Campbell-Kelly et al., 2013; Haigh, 2010). This trend continued as computers required workers and card punching replaced typing (Downey, 2010; Schlombs, 2010).

The I.T. Work Environment Capitalism exerts a downward pressure on wages (Marx, 1867). The efficiencies of (Taylorist) Scientific Management (“Management”, 2005) have de-skilled work to the point where many trades – and their workers – have become obsolete. De-skilling in the I.T. industry mainly entails making software production and maintenance less expensive. Roles are collapsed or consolidated: systems administrators, database administrators, and network administrators all abdicate their expertise to software developers. Instead, developers must administer their own systems (i.e. DevOps).

Competition dominates I.T. culture, especially among the men who comprise the majority of the workforce. It is difficult to discern whether competition is the result of hierarchical organization or its cause. Whatever the case, competition is fostered in I.T. culture at all levels, even in teenagers exploring programming for the first time (e.g. <http://www.usaco.org>). Geek culture (Bates & Haynes, 2010; Mulkerrins, 2012; Staff, 2015; Wayne, 2013), which values curiosity and creativity over competition, has most recently evolved into “brogrammer” culture, which has dramatically increased the competition ethic among programmers (Baker, 2012; Gross, 2012; MacMillan, 2012; Staff, 2012) and fostered a hostile form of sexism (Burns, 2013; Lee, 2015; Romano, 2014; Trapani, 2012; Weisul, 2014).

Even I.T. workers who do not agree with sexism as such often keep traditional views of women’s roles (Hayes, 2010). As a result, more paternalistic views of women’s roles and work dominate the workplace and sexism exists in more subtle forms. Meetings and discussions about work are laced with sports metaphors and non-I.T. male culture (Agile and Scrum). Work evaluation is a direct reflection of the dominance men exert over the daily work culture in an I.T. department. The male-centric ethic systematically grants advantages to men and disadvantages women. Women often perform the same or similar work as men, but their work is evaluated with greater scrutiny and by higher, harsher standards than men’s. As a result, women are assigned longer shifts or overnight oncall schedules where I.T. staff are expected to carry a company-issued pager or phone and maintain the computer system (often a large server) at any hour of the day. Similarly, women are often passed over for reviews, rather than receiving promotions and higher salaries on a predictable schedule, as men do.

Devaluing women’s work mainly takes two forms: professional communication and work evaluation. Sexist professional communication uses stereotypically male metaphors (sports, cars, computers, space fiction, or military) when making a point, especially when describing excellence in performance or quality. Instead of working faster, one “kicks it into overdrive” (a metaphor for a car’s highest speed gear). Younger men make extensive use of the terms “bro” and “dude”, while older men refer to each other as “sir” or “chief”. The net result

is a dramatically imbalanced I.T. culture, which seems to possess no internal mechanism for correcting itself. The question becomes what leadership can or should do about the situation. Capitalism-oriented leadership has very little motivation to correct the situation as long as some form of I.T. worker still exists and is available. Leadership with a broader base of perspective would see the greater need for gender equality. This broader base is more consistent with cooperation-based team dynamics (Johnson & Johnson, 2012).

Gaps and Disagreements The setbacks women face in a software engineering career stand in direct conflict with the goals the industry itself. I.T. is a large, worldwide field, requiring a great diversity of skills and aptitudes. It also features an essentially negative unemployment rate; more jobs available than workers.

I.T. comprises a prominent segment of the world economy. According to Statistica, in 2017 the I.T. industry worldwide consisted of \$2.6 – \$3.5 Trillion in investment (Statistica, 2017a), and \$225 – \$462 Billion in revenue (Statistica, 2017b). In 2017, United States firms invested approximately \$1 Trillion (CompTIA, 2017). Ideally, a typical corporate I.T. department would consist of staff with a mixture experience levels. However, with an unemployment rate of 2%, hiring and retaining staff at all levels often prove problematic (TEKSystems, 2017). Graduates from postsecondary technology programs provide an average of 10,000 new employees annually (Taulbee Survey, 2015), though trends in I.T. industry growth (17% – 21% (USBLS, 2015a, 2015b)) suggest a net I.T. worker deficiency nonetheless.

I.T. staff are typically graduates of postsecondary Computer Science (CS) or Management of Information Science (MIS) programs (Taulbee Survey, 2015), though neither is a strong requirement. The best predictors of long-term success in I.T. professions are software production and deployment, neither of these depends on a CS or MIS postsecondary education (Evans, 2002). Despite these low qualifications, however, I.T. workers are still difficult to find. I.T. departments have difficulty retaining female workers and workers of color. Since 1982, women have comprised 15% – 25% of all I.T. workers. The proportion for I.T. workers of color is far lower: 2% – 5% (NCWIT2016, 2016).

These statistics solidly establish an obvious contradiction: despite a desperate need for workers and multiple points of entry, the I.T. profession is nonetheless very exclusive. The unfair treatment women receive from their colleagues is a very important reason they are leaving the I.T. professions (Misa, 2010), despite an increasing need for I.T. workers (USBLS, 2015a, 2015b).

Previous research into this problem has centered on the features of workplace sexism (Delia, 2015; Merrills, 2016) and the ways female I.T. staff cope with them (Hua, 2010; Kolacz-Belanger, 2008). However, no vein of research has provided insight into the social mechanisms which underlie and reproduce it. The following section explores several social theories, which provide a framework for understanding the sexism women experience in I.T. departments.

Theoretical Framework

Relevant Analytic Theory

The Marxian family of social theories deals primarily with conflict. Marx's magnum opus, *Das Kapital* (Marx, 1867) and his work with Friedrich Engels on communism (Marx & Engels, 1848), form the backbone of his economic and social theories. Foundational to both is an inherent conflict between capitalist (Muller, 1993) owners and their workers. The centerpiece of Marxian theory is the marginal surplus – profit – which results from the difference between the cost to produce an item and its market price. Marx's theories mainly concern economics but have been successfully extended to education (Anyon, 2011) and social movements (Callinicos, 2011) among others.

Max Weber's social theories built on the work of Marx, with additional influence by Friedrich Nietzsche, George Simmel, Ferdinand Tönnies and others. While the centerpiece of Marx's theories was historical materialism and its resultant inter-class conflict, Weber placed greater emphasis on social structures and the role of bureaucracy. One of Weber's greatest interests was, in fact, how bureaucracy exerts control over societies (Weber, 2015, p. 7).

Weber: Three-Component Theory of Stratification Weber conceptualizes of three simultaneous forces which influence society: economic class, status, and party. The first is class, or using Weber's terminology, *Gesellschaft*. *Gesellschaft* is the rational, calculated basis of market-driven transactions (Weber, 2015, p. 4), which is also synonymous with market or class situation (Weber, 2015, p. 42). Economic monopoly is the centerpiece of *Gesellschaft* (Weber, 2015, p. 46). Bureaucracy, whether governmental or corporate, counterbalances the otherwise volatile capitalism (Weber, 2015, p. 9). For bureaucracy, process triumphs tasks (Weber, 2015, p. 9). For Weber, the "discipline" of a bureaucracy is in turn the foundation of "habitus" (Weber, 2015, p. 7), a concept which Bourdieu will later develop further. Despite their volatility, Weber claims that "classes and economic power dominate only in times of rapid change" (Weber, 2015, p. 38). Part of the counterbalance to *Gesellschaft* is *Gemeinschaft*, or social standing.

The term Weber uses for status is *Gemeinschaft*. *Gemeinschaft* is the prestige, honor, and status of a group which defines its "us" identity (Weber, 2015, p. 4). *Gemeinschaft* serves the social core of groups and is ultimately responsible for its integrity (Weber, 2015, p. 8). *Ständ* is status one has within a group, or more precisely, the social assessment of one's *Gemeinschaft* (Weber, 2015, p. 48). *Ständ* is primarily expressed by one's lifestyle and participation within a particular social circle (Weber, 2015, p. 49). According to Weber, "lifestyles ... arise from the *Ständ* or are supported by the *Ständ*" (Weber, 2015, p. 53). Honor and status is based on how well people know each other, and how well they interact (Weber, 2015, p. 8). *Ständ* also places restrictions on members of a group, including dress code, interactions with others (Weber, 2015, p. 50), haggling during business affairs (Weber, 2015, p. 55), and common physical labor (Weber, 2015, p. 53).

Economic stability, even brief, gives rise to *Ständ* (Weber, 2015, p. 54). *Ständ* is independent of employment and is opposed to market forces (Weber, 2015, p. 53). *Gemeinschaft* has an uneasy relationship with *Gesellschaft*, "like oil and water" (Weber, 2015, p. 4) *Ständ* restrains the market (Weber, 2015, p. 54) and ensures it doesn't move or grow in ways which

don't benefit the group. In extreme situations, *Gemeinschaft* can evolve into a caste system with very exclusive membership and even initiation rites ("knighthood") (Weber, 2015, p. 52). This elevation of privilege influences how society views the privileged group. Those in the privileged group exercise their privilege for the present, as an inheritance from an exalted past (Weber, 2015, p. 51). "Pariah peoples" who by their *Ständ* are at a privilege disadvantage (e.g. Jews) (Weber, 2015, p. 51) look to a future beyond the present, by way of a transcendent, providential "mission" (Weber, 2015, p. 52).

Party is concerned primarily with power and arises from the interaction between class and *Ständ* (Weber, 2015, p. 56). According to Weber, the party uses the levers of hope and coercion (Weber, 2015, p. 8) for its own ends. Party exists across *Ständ* and class boundaries (Weber, 2015, p. 46). The centerpiece of the party its leader or *Führer*. The *Führer* figure (*Herrschaft*) is a savior figure (Weber, 2015, p. 10) whose charisma "rises above the rules" and "invites [followers] on a shared journey beyond the status quo" (Weber, 2015, p. 11). The *Führer* leader seizes power, and often organizes the party in an authoritarian fashion (Weber, 2015, p. 57). Unfortunately, the *Führer* position ultimately corrupts anyone who holds it (Weber, 2015, p. 12).

Weber's three-component theory of stratification informed how I inquired about the nature of women's relationships with their colleagues, teammates, and managers in an I.T. department. Part of the interview questions concerned how women find status, or in Weber's terminology, "*Ständ*", within a software development group. Interviews established how and on what terms women are accepted by their (mainly) male I.T. department colleagues. The points they make about their *Ständ* among other software engineers also proved subtle, as their male colleagues were under public pressure to openly reject sexism but practice it nonetheless, whether intentionally or not. Women's narratives ranged widely, from "war stories" depicting open sexism to more nuanced relationships with mentors, colleagues, management, and family members. Sections below will show how these narratives aligned not only with Weber's ideas on *Ständ* and status, but previous research on sexism and male-

dominant workplaces (Hesse-Biber & Carter, 2005; Hill, Corbett, & Rose, 2010; Lerner, 1986).

Other aspects of the interviews addressed *Ständ* less directly, in the form of personal and professional support. According to Weber, persons with greater *Ständ* receive greater support for their professional conduct, lifestyle choices, and themselves personally (Weber, 2015). Personal and professional support are often intermixed, and it may be difficult to tell when one receives one kind of support but not another. For instance, a manager may express sympathy for a female I.T. professional having a sick child, yet not support the job flexibility she may need to care for the child.

Abbott: Professional Association and Professionalization Sociologist Andrew Abbott's essay on the social development of professions provides us a framework for integrating the insights of Weber's theory of *Ständ*. According to Abbot, professions are remarkably consistent in that they are all "occupational groups with the same special skill", which include "abstract skill, one that required special training". These skills "require[d] revision case by case". Professions are also "more or less exclusive" (Abbott, 1988, p. 7). In sum, "professions are exclusive occupational groups applying somewhat abstract knowledge to particular cases." (Abbott, 1988, p. 8).

Ständ within a profession is subject to professional identity, codes, conventions, and practices. Upon joining a profession, professional identity is malleable, changing slowly as a function of time spent in a profession. After a certain amount of time in a profession, the worker's professional identity loses its flexibility and workers resist changing their identity, even when they change professions. Workplace performance, according to professional standards, raises or lowers one's *Ständ* among co-workers. Professional codes and conventions provide criteria by which *Ständ* is gained or lost during work.

Wenger: Communities of Practice Educational theorist Étienne Wenger's work on communities of practice differs slightly from Abbot's theory of profession. Whereas Abbot

Figure 2: Wenger's Model of Learning

1. *Meaning*: a way of talking about our (changing) ability – individually and collectively – to experience our life and the world as meaningful.
2. *Practice*: a way of talking about the shared historical and social resources, frameworks, and perspectives that can sustain mutual engagement in action.
3. *Community*: a way of talking about social configurations in which our enterprises are defined as worth pursuing and our participation is recognizable as competence.
4. *Identity*: a way of talking about how learning changes who we are and create personal histories of becoming in the context of our communities.

centers on the identity of professionals and the skills they bring to bear on their work, Wenger balances professional identity and practice with two other components he views as necessary in the workplace: meaning and community (Wenger, 1998, p. 5). The resulting model (in Figure 2) provides a holistic view of professions, which situates professional practice within the worker's entire life, rather than carefully separating it: "Workers organize their lives with their immediate colleagues and customers to get their jobs done. In doing so, they develop or preserve a sense of themselves they can live with, have some fun, and fulfill the requirements of their employers and clients (Wenger, 1998, p. 6)".

For Wenger, the centerpiece of professional life is learning, not simple productivity: "Participation here refers not just to local events of engagement in certain activities with certain people, but to a more encompassing process of being active participants in the *practices* of social communities and constructing *identities* in relation to these communities. Participating in a playground clique or in a work team, for instance, is both a kind of action and a form of belonging. Such participation shapes not only what we do, but also who we are and how we interpret what we do (Wenger, 1998, p. 4)".

We will see later how Wenger's model of learning as central to professional life can be at odds with Habitus and its emphasis on norms and rules. Under the wrong circumstances, Habitus can become part of the problem of racism and sexism in I.T. Wenger's model predicts

why such discrimination would be a problem: knowledge-based professions such as I.T. entail a great deal of learning, and learning requires *community*. Without a community ethic which espouses a warm (not simply tolerant) inclusivity of its members, learning is much more difficult when possible at all. We will also see later how women compensate for the lack of community in their workplaces and advance their I.T. learning nonetheless.

Bourdieu's Theory of Habitus

Bourdieu's theory of Habitus (Bourdieu et al., 1990) explains how newcomers to a culture or system of beliefs acquire and internalize what they are taught to the point where it is "second nature" or automatic. Bourdieu specifies several components of the process of acquiring the culture or belief system, and cites several consequences which follow from it. This section will outline Bourdieu's theory of Habitus and apply it to the software engineering. Our later discussion on the experience of women's experience in I.T. will refer to these initial observations. Related to Bourdieu's theory of Habitus is his theory of economic, cultural, and social capital. (Bourdieu, 1985) These will be explained immediately below, as they are important components in his theory of Habitus.

Symbolic Capital The most common association with the term "capital" is *economic* capital. Economic capital is most easily recognized in its primary form: money. Economic capital is a major component of commercial markets (Muller, 1993), which exist in organized societies where individual citizens are unable to produce everything they need to live. In open markets, the purchase price of a good or service is set at an arbitrary amount by its vendor. Overall market prices of goods and services are controlled by competition between vendors, and to some extent by government agencies which oversee market activities (e.g. in the U.S.: the Federal Reserve, the Securities and Exchange Commission, the Federal Trade Commission, etc.).

Agents acting in a market (e.g. shoppers in a grocery store) need to abide by the constraints of a budget: they can only buy what they can afford, and they typically need to

buy numerous items to satisfy their overall needs (e.g. a collection of foods which in aggregate provides balanced nutrition). Working outside the constraints of a budget are either impossible (loan credit is unavailable to them) or viewed as at best temporary (loan credit is expensive). Budgets require agents to balance economic needs and desires, both current and projected.

These features of economic capital are foundational to three analogous ideas which Bourdieu introduces (Bourdieu, 1984, 1985): symbolic capital, cultural capital, and social capital. Symbolic capital is associated with prestige, or the influence a symbol has on a group of people who observe it. For instance, the U.S. Congressional Medal of Freedom is widely considered prestigious among U.S. citizens. In the I.T. workplace, symbolic capital is the ability to get I.T. work done well and efficiently: competence with a combination of I.T. tools and procedures designed to produce and deploy software. Workers who perform well are treated with respect and prerogative, and are considered first candidates for advancement within the organization.

Of the three analogous forms of capital, symbolic capital is the most easily and readily converted into economic capital. Symbolic capital is the essential reason a worker is hired and stays employed in an I.T. department. Symbolic capital is also integral to the worker's advancement through a typical I.T. career arc, as illustrated in Figure 1. It is generally expected that a worker's symbolic capital will increase in amount and value as their career progresses.

Cultural Capital According to Bourdieu, cultural capital takes two forms: an embodied state, and an objectified state. Embodied cultural capital exists “in the form of long-lasting dispositions of the mind and body” while objectified cultural capital exists “in the form of cultural goods (pictures, books, dictionaries, instruments, machines, etc.) (Bourdieu, 1985, p. 143).

In the workplace, cultural capital concerns workers personality and ease of interaction, and the cultural artefacts which may result. If workers interact easily and well, they may form

informal groups or cliques. Products resulting from these persons or groups include items of value which bear their “signature”, such as authoritative documents describing procedures or standards which other software developers must follow (e.g. a document enumerating source code standards). The cultural capital of the authors of these documents increases with the scope and power of the documents. Cultural capital correlates with influence: persons, dispositions, and products with the highest cultural value acquire greater symbolic capital and become standardbearers for group value: “the head of the family, the *pater familias*, the eldest, most senior member, is tacitly recognized as the only person entitled to speak on behalf of the family group in official circumstances”(Bourdieu, 1985, p. 164).

Notably, cultural capital also concerns the “disposition of the body” of those who earn it; specifically, race, gender, or ability. The I.T. workplace is male-dominated, so women are given less cultural capital simply because they are not men; they differ on one standard by which cultural capital is conferred. Men by contrast receive cultural capital easily, by virtue of being men in a male-dominated profession. “Boys clubs” may form in I.T. departments, for no reason other than that its members are “boys”. By extension, actions and products which bear the imprimatur of such a “boys club” are considered more valuable than those without.

Social Capital According to Bourdieu, social capital is defined as: “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – in other words, to membership in a group – which provides each of its members with the backing of the collectively-owned capital, a ‘credential’ which entitles them to credit, in the various senses of the word.”(Bourdieu, 1985, p. 161).

Social capital primarily concerns the maintenance of relationships between members of a group: “the network of relationships is the product of investment strategies, individual or collective, consciously or unconsciously aimed at establishing or reproducing social relationships that are directly usable in the short or long term.”(Bourdieu, 1985, p. 162). Social capital

is intended to benefit the group *and* each of its members: “the profits which accrue from membership in a group are the basis of the solidarity which makes them possible” (Bourdieu, 1985, p. 162).

One corollary should be noted at this point: the value of one’s social capital is inversely proportional to cultural capital or prestige. Members of a group with great cultural capital have greater influence with less social capital than do members with less cultural capital. Those with less cultural capital will need to spend more social capital to have the same influence. Otherwise, their membership in the group is questioned or diminished.

Symbolic, social, and cultural capital concern a person’s readiness and ability to interact with others in a social system. This is important, as women’s ability to use these kinds of capital determines how well they can navigate and progress in the I.T. workplace. With these concepts in mind, the sections below describes their participation in an I.T. workplace designed to regulate their behavior.

Symbolic Violence The centerpiece of Bourdieu’s theory of Habitus is symbolic violence. Symbolic violence has several components: a symbol, its meaning, and a power which imposes the meaning of the symbol. The most basic definition of a symbol is: “something that stands for or suggests something else by reason of relationship, association, convention, or accidental resemblance” (MerriamWebster, 2018b). The first half of a symbol is a sign or physical representation; the second is what the sign signifies or what is associated with it. For instance, a lion is for some, a symbol of courage; lions in the wild are regarded as courageous and fierce, so anyone likened to a lion is also believed similar in this respect.

Every example of a symbol generates – or should generate – the same question: why does the symbol signify what it does? What supports or enforces the association between the two halves of a symbol; between a sign and its perceived meaning? To answer this question, Bourdieu introduces the idea of a *power* which *imposes* the meaning of a symbol on its perceiver. At the same time, the agent which uses this power of imposition *conceals* the fact that power is involved in imposing the meaning of a symbol on a perceiver. This concealment

adds power to the relationship between the symbol and the power which enforces the sign / significance relationship. For Bourdieu, this concealed imposition of a symbolic arbitrary is a form of violence: symbolic violence.

For Bourdieu, one additional detail about symbols is very important: all symbols are *arbitrary*. This is contrary to the way we commonly consider symbols as “natural”; as if there is some sort of intuitive compatibility between a sign and its meaning or interpretation. Bourdieu insists there is not, and always speaks of a “symbolic arbitrary” rather than a “symbol”. All of these details – the sign, its meaning, the arbitrariness of the symbolic relationship, and the power which enforces it – are important in software engineering. Software engineering is *replete* with the symbolic: programming languages of all kind (e.g. Java), operating systems (e.g. Windows or Apple OS), user interface design, hardware design, etc. All of computer science is artefactual, or designed (Simon, 1996), and all designs are *arbitrary*. Software engineers may understand the arbitrariness of the everyday symbols they use, but seldom do they perceive the power which imposes and reinforces symbolic meaning. The symbols themselves may be a source of sexism in I.T.: all major programming language authors are white men (e.g. Brian Kernighan (C), Bjarne Stroustrup (C++), Larry Wall (Perl), James Gosling (Java)). The construction and use of software engineering symbolic arbitraries is likely a product of male-dominated software engineering culture.

Pedagogic Action The imposition of a symbolic arbitrary by way of a power relation is an “inculcation”. “Inculcate” is commonly defined as “to teach and impress by frequent repetitions or admonitions” (MerriamWebster, 2018a), which fits Bourdieu’s use of the term. Inculcation is regarded as central to pedagogy, or education, but it is by not restricted to formal education. The semi-formal and non-formal definitions of education (Hall, Clover, Crowther, & Scandrett, 2011; LaBelle, 1982) are more compatible with “impression” as the process of transferring knowledge or changing behavior. This latter definition also fits more comfortably fits the corporate I.T. setting.

Pedagogic action in I.T. departments can take many forms. Pedagogic action may be

between two people (one-on-one) or in groups. For instance, new employees receive an “orientation”, whether by an official company representative, a teammate, or manager. Group pedagogic action could be a code review, where teammates or business groups review new code before it is implemented. However it occurs, pedagogic action is always exerted in a context of pedagogic communication, where the power relation is implicitly invoked; not informal communication and not outside the appropriate social context. That is, pedagogic action only takes place while at work with their own I.T. team.

Pedagogic Authority The next construct Bourdieu introduces is Pedagogic Authority. Pedagogic Authority is the legitimacy by which a social group enforces the power of the pedagogic action. The authority of the group depends on its unity, which is indicated by the symbolic arbitrary and to some extent depends on it. Male software engineers tend to show a loyalty to a particular computer technology, including programming language(s), operating system, and software development tools. Accompanying these technologies is a culture concerning their use and often, their development. These norms are borrowed from a more general I.T. professional identity (Abbott, 1988), but is enforced locally and according to the particular details of the software development team. For instance, a development team may use best practices written by John Papa for developing in the Angular JavaScript software language (Papa, 2017), but may modify those practices for use in their own group and according to the software system they are developing.

In software engineering, pedagogic authority is wielded officially and unofficially. Officially, power rests with two roles in a software development group: team leader and system architect. The system architect designs software applications and systems, specifies software development norms, and chooses which software technologies which will be used. The team leader organizes software development efforts (team members) by organizing a development schedule and resolving any dependencies between developer’s tasks. These are typical management functions, essential and expected for the normal functioning of a software development group. If anything, development staff expect team leads and architects to regularly

guide and direct team members. Used judiciously, management power is used sparingly and allows for software development team members a modicum of individuality, even artistic expression through their work.

Unofficially, pedagogic authority is wielded by the most prolific and productive software development team members. Their authority is based on their expertise, their alignment with norms outside the workplace, and their attitude toward other team members. The attitude of the developers can be cooperative or more competitive, depending. More collegial or cooperative team environments lead to a sharing of power, while more competitive ones result in an hierarchy.

Pedagogic Work The inculcation process takes place in the context of pedagogic authority, and consists of a series of pedagogic actions. Together, the pedagogic actions under pedagogic authority constitutes Pedagogic Work. More formally, Pedagogic Work is: “a process of inculcation which lasts long enough to produce a durable training, i.e. a *habitus*, the product of internalization of the principles of a cultural arbitrary capable of perpetuating itself after PA has ceased and thereby of perpetuating in practices the principles of the internalized arbitrary (Bourdieu et al., 1990, p. 31)”. Less formally, pedagogic work refers to the interactions by which a culture is internalized by a perceiver. Essentially, the daily interactions between power-advantaged and power-disadvantaged trains the disadvantaged in the symbolic meanings of the advantaged.

By pedagogic work, the symbolic arbitrary is internalized to the point where it is transposable, exhaustive, and reproductive. “Transposable” means the habitus applies to contexts other than where it was acquired, consistent with the original principles of the habitus. “Exhaustive” means it is complete to the point where it “reproduces the principles of the cultural arbitrary of a group or class in the practice it generates (Bourdieu et al., 1990, p. 34)”. “Reproductive” means the pedagogic work “contributes towards producing and reproducing the intellectual and moral integration of the group or class on whose behalf it is carried on (Bourdieu et al., 1990, p. 35).”

Habitus applies well to the I.T. workplace, and especially to software engineering. The centerpiece of the software engineer's professional life is the tools and practices of constructing (writing) software programs. The symbols are the features and commands of the programming language employed for program construction and are arbitrary in the most literal sense possible. Conventions surrounding the software development lifecycle (requirements, design, coding, and testing as a simple example) are equally arbitrary. Habitus is acquired and reinforced daily, through the context and practice of writing software.

Bourdieu's reasoning helps explain why the social currents in the software engineering workplace are so strong. The more arbitrary the symbol, the more arbitrary the power to enforce it becomes, and the stronger the power must become to maintain the arbitrariness of the symbol, the control the social group has over its inculcation, and the concealment of the power itself. Once the social currents surrounding the procedures, norms, and software technologies of a particular software development group have been established, they are very difficult to change, or even redirect. We will see in the following sections how Bourdieu's theory, applied to software engineering, in turn applies to the professional and personal lives of female software engineers.

3 Methodology

The methods for this study are principally qualitative, similar to those used by CMU in their work on undergraduate classrooms (Frieze & Quesenberry, 2015; Margolis et al., 2000). Specifically, this work was done as a normative case study, in which the experiences of 10 women across 4 – 5 professional I.T. workplaces are considered as a single amalgamated context.

Grounded Theory

This study used grounded theory (Berg, 2008; Bogdan & Biklen, 2011; Charmaz, 2014) to model the social dynamics of the professional lives of women in I.T. Grounded theory and qualitative research methods in general are designed to answer questions of causality, or the “why” of a situation. Grounded theory begins with natural recorded observation: interviews captured using a recording device (audio or video), paper or electronic documents, and field notes taken on personal observations. Observation data is then analyzed using three stages of iterative review:

1. Observational data is annotated (coded) with thematic information, called open codes. Open codes are intended to describe as accurately the theme or dynamics reflected by the data. Open codes are intended to be as flexible as necessary to accommodate observational data.
2. Next, the open codes are themselves coded for thematic information, called axial codes.
3. Finally, axial codes are annotated for thematic information, called selective codes.

Open, axial, and selective codes are chosen arbitrarily at first, and then as coding progresses, coding becomes more standardized across interviews. Most codes do not apply to all interviews, nor are they expected to. As coding proceeds, the three levels of thematic information begin to emerge and converge, until they reach a “saturation” point, where existing codes are repeatedly reused and few if any new ones are introduced. These themes become the basis of the theory which explains the situations and contexts common across interviews.

Grounded theory provides a rigorous methodology for finding major themes across data sources, which can be reconciled with existing social theory or become the basis for new ones. Grounded theory is especially good at clarifying the relationship between theory and practice, and how they inform and influence each other (Flyvbjerg, 2007).

Normative Case Study

The normative case study framework is a qualitative research method which includes ethical inquiry alongside data collection and analysis (Thacher, 2006). More specifically, “normative case studies aim to contribute to our understanding of important public values” and “are particularly useful for analyzing so-called ‘thick ethical concepts’ like ‘courage’ that have both descriptive and evaluative dimensions that cannot be disentangled (Williams, 1986, pp. 129 – 30, 140 – 144).”

The normative case study methodology is compatible with Flyvbjerg’s ideas about practical wisdom, or using Aristotle’s terminology, *phronesis* (Flyvbjerg, 2007). By definition, *phronesis* is aimed not only at answering empirical questions, but ethical ones as well. Certainly, some questions have a greater or lesser ethical component, but at no time does an empirical investigation exclude ethical considerations (Weber, 1949).

This study will use the normative case study framework, with grounded theory as its principle empirical method. Discrimination of any kind – and certainly discrimination against women for working in a male-dominated industry – immediately raises questions about how and why the abuse women routinely experience in the I.T. workplace is tolerated, even supported by workers and management alike.

Previous Studies

Most studies on women’s I.T. careers use quantitative methods for assessing education (Cronin & Roger, 1999; Dorman, 1998; Thom, Pickering, & Thompson, 2002) and work experience (Ahuja, 2002). Survey data is collected from interviewees, then collated and analyzed for differences between groups. Differences typically occur either by survey question or by survey question category. Survey data uses likert scales for rating the feelings or thoughts of women in I.T. careers or those who would discriminate against them (Lemons & Parzinger, 2007). Some studies have examined the influential factors in women’s lives as they pursue I.T. careers while others examine the impact of environmental factors of the work-

place. Workplace evaluation followed similar ratings scales as surveys but were administered by interviewers and observers.

The major flaw of quantitative studies is the incomplete picture which results from the accumulation and aggregation of numerical data (Flyvbjerg, 2007): the practical wisdom imparted through narrative is removed in the process of operationalization and quantification. Mixed methods studies such as (Margolis et al., 2000) begin as quantitative studies, but evolve into qualitative studies. Quantitative studies serve to establish the existence of a case, but qualitative studies explain it. For instance, Margolis et. al. surveyed female students at several stages of their CS education and found regularities in the ways they felt discrimination from male peers and lack of support from professors. They were then able to collate and code their data in ways which found regularities across female students experiences while maintaining the nuances of individual narratives.

Data Collection and Analysis

Types of Data

Two types of data were collected for this study: interview data and observational data. The primary data source were interviews with 10 female software engineers. Other sources of data included documentation on common work practices, such as software requirements specifications, code review standards, and software deployment procedures. Policy documents such as off-hours support procedures, team composition, and career advancement guidelines also proved valuable. The goal of collecting this data was to triangulate as complete a picture as possible of female software engineers' relationships in the workplace. The goal was also to discover the social constraints by which they are forced to live.

Participants

For this study, I recruited 10 female software engineers, each of whom had at least five years of experience as a professional software engineer at the time of the interview. Their rank

position at / their company was typically Programmer II or Programmer III (or equivalent). One woman had served as management for approximately half her career, and two others had recently been promoted to team lead positions. The participant pool included a mixture of women who were married or not, did or did not have children, had varying commute times, and had varying experiences of workplace flexibility.

One restriction of this study is its sample geography. All interviewees were women residing in the Minneapolis / St. Paul (Minnesota, USA) metropolitan area. All women were employed at companies with 50 employees or more, all worked within a 20 mile radius of home, and all reported to their workplace on a daily basis; none of them worked remotely, except for occasional instances. Most women were white, though the sample included three women of color, which is consistent with the Minnesota state population.

As of this writing, I knew 7 participants personally, who agreed to participate (convenience sampling). The remaining 3 participants were found using snowball sampling; referrals from the participants whom I already knew. I carefully noted which of the participants I knew personally, as our friendship or previous working relationship influenced the type and depth of narrative they shared with me. Interviews lasted approximately 60 minutes and topics of conversation spanned most of their university education and professional career.

Interview Content and Discussion

Most female software engineers are understandably cagey about their professional and personal lives, as they are aware of their disadvantaged position in the workplace. One could reasonably expect them to demand to know the nature and purpose of this research in order to participate. Early in the interview, the participants were be presented with information about the ethics and confidentiality of the study. This was the most formal part of our interaction, though it provided some important conditions for the interview which follows.

To set the stage for the interview, participants were provided an introduction to the study and its emphasis on workplace relationships; however the interviewees would describe

them. Interviewees were encouraged to speak as freely as they wished, given our previous professional and collegial relationship. I asked them to think of me as someone genuinely concerned with how women are treated – or mistreated – in the I.T. workplace.

Each interview began with one or two informal questions, intended to begin a conversation about the interviewee's career in I.T. These questions were designed to understand the appeal the interviewee felt toward programming, the software programming practices they created for themselves, and the support (or lack of support) which the interviewee received for programming.

With the previous questions as a kind of “icebreaker” or “warmup”, the interview proceeded to more probing questions involving the workplace². One indirect goal of these questions was to find the point at which the interviewee's programming experience became self-reinforcing. The scope of personal support was still narrow, but the amount and quality of their programming experience has no limitations.

The next series of questions explored the interviewee's relationships as they progressed from middle school (age 11 – 12) through their first internships or jobs as a professional software engineer (age 22 – 24). The questions followed the interviewee's programming experience chronologically but centered on how key people in their lives showed support, disdain, or indifference to their career choices. Questions were also intended to show how the support they received broadened or narrowed as their career progressed, and if it narrowed, how they compensated or coped.

Other questions dealt with the norms and rules the interviewee worked through while practicing software programming. These rules changed over time and across circumstances and interacted with how they felt or perceived personal support. Some changes were gradual, others more sudden. Some norms were explicit, while others appealed to a sense of “normalcy” or expectation. The interviews were careful to note when and how the interviewee's intuitions, desires, or plans conflicted with the norms.

²Questions with additional indentation are follow-on questions from the previous.

A full inventory of the questions asked during the interviews is available in the appendix. Not all questions were asked, as sometimes earlier questions lead to conversations which answered later questions. The questions listed in the appendix were mostly guidelines for the kind of stories I was seeking, and I resorted to them only in instances where the interviewee hadn't already addressed what I wanted to know. The scope of most interviews went well beyond the questions I had prepared. It was clear that given the opportunity, they were eager to speak about their experience.

Data Acquisition

All interviews took place in public places: cafés, restaurants, and public libraries. All interviews were recorded using a portable digital recorder. Recordings were transcribed using the Rev Transcription Service³. After recording and transcription, interviews were corrected for transcription flaws. Confidentiality and security policy concerning files submitted to and received from Rev Transcription Services was covered in an IRB in section on Ethics and Confidentiality below.

A clean copy of the corrected interview transcription was augmented with observer comments and coded for topical themes using grounded theory coding procedure described earlier. Codes included relationship parameters, the participant's status within her work group and the power she has or lacks within that group. Memos were also written throughout the process in order to help synthesize findings and assist in theory development. Special attention was paid to ethical concerns, especially instances when seemingly ordinary practices (e.g. source code review) suddenly – and often surprisingly – included

According to the Minnesota State Demographer's office, in 2018, "In Minnesota, People of Color (those who identify as a race other than White alone, and/or those who identify as Hispanic) make up 19% of the total population. Non-Hispanic White Minnesotans represent the remaining 81% of the statewide population" (MNStateDemographer, 2018). For the

³<https://www.rev.com>

purpose of this study, all names cited for quotations or referred to in scenarios have been changed to typical / high-frequency Non-Hispanic White names. The goal is not to modify, diminish, or erase the ethnicity of the persons described, but simply to better protect their identity.

Validity

Validity may be an issue for this study, especially due to my presence in it. I'm not female and only recently became aware of the issues women face in IT. It was difficult – especially initially – to be sure how my interview questions and theory building would apply to the issues my female interviewees routinely face. I will need to rely on three important features of the theory-building process: validity checks, interviewee self-reflection, and memo writing.

Validity checks were formulated to serve as rough parameters for theory development. It is important that validity checks align with and enhance the research paradigm rather than conflicts with it (Lather, 1991; LeGrange & Beets, 2005). Carefully formulated, validity checks can assist in the cycle of acquiring new data (surveys, observations, and interviews) and formulating theory.

The interview process provided provide relevant and nuanced information to inform theory development. The best techniques for exploring a topic often prove beneficial not only for the interviewer, but the interviewee also. Paulo Freire discovered an iterative technique for teaching and developing pedagogical theory which increased his students' self-awareness. The process, called “conscientização (conscientization)” (Freire, 2000), suggests that if successful, the theory-building process invites not only the interviewee's knowledge, but also includes their insights into their situation and its significance.

Generalizability

The generalizability of this study is affected by its sampling methods. Convenience and snowball sampling are by definition less generalizable than probability-based sampling. The

women I interviewed worked at numerous companies, each of which has its own I.T. department. The women's experiences working in these I.T. departments were similar enough to provide common threads for analysis and theory development. As a result, I can be confident this research has good internal generalizability and will apply well to the lives of women with similar careers (internal validity) (Maxwell, 2005). As a normative case study, this work represents what Weiss calls a "conceptually important case" (Weiss, 1994).

The generality of a theory outside its original context – or external validity (Maxwell, 2005) – depends perhaps paradoxically on its integrity within its own context (Charmaz, 2014, p. 323). The generality of a theory is a product of its analytical strength, rather than the research goals. This analytical strength comes from its critical characteristics, including attention to preconceived assumptions about race, class, gender, sex, or other unwanted biases (Charmaz, 2014, p. 323).

Nuances

During the summer months of 2018, I interviewed ten women currently working in the I.T. industry. All had at least ten years experience as professional I.T. staff. All had at least five years experience in software engineering, network or database administration, or software quality assurance (testing). The interviews performed as part of this research are compared for similarities and themes. Once the themes are identified, they are explored in detail across interviews. One by-product of this process is a kind of fragmentation of the interviews. It is important to remember these interviews are a coherent whole, as are the lives of the women who so graciously consented to the interviews.

The kind of analysis presented here entails a kind of deconstruction; everything discussed here is considered one item at a time, one scenario, idea, or case at a time, and often one conclusion at a time. It can be easy – even tempting – to overstate the individual conclusions drawn from an analysis or to present them in an imbalanced or disconnected way. This is especially true where conclusions seem to contradict each other or simply not comfortably

fit together.

The women I interviewed were consummate professionals. Most had multiple employers on their resumé, but all were consecutive and most had a tenure of 3 – 4 years at each employer. The centerpiece of their professional lives was their daily jobs; solving problems and writing computer source code. Relatively few had aspirations to management positions, and as of this writing, only one served strictly as management. Any of those with a team lead position still had heavy software development responsibilities. None were system architects. Those who were promoted to leadership positions did so as a result of a deficit of existing leadership, and the opportunity not only to lead, but to help out a friend or colleague. They typically stepped into these roles as a matter of necessity or as a personal favor, not just as a new opportunity.

All of the women were very family-oriented, most with spouses and children. All struggled to balance work and family life, and all of them succeeded. All had the support of their spouses in their careers, and usually their extended families as well. Most of these women cited their fathers as a major influence in their lives, and mostly in a positive way. In sum, these women pursue their I.T. careers in good faith: working to the best of their ability while on the job, and being their best to their colleagues, family and friends throughout. All of the following analysis should be read in this light.

4 Findings

Data Patterns

During the summer months of 2018, I interviewed ten female I.T. workers, mostly software engineers. I reviewed and analyzed the transcripts of these interviews using Grounded Theory (Berg, 2008; Bogdan & Biklen, 2011), with a view toward ethical and normative issues (Thacher, 2006). The goal of the analysis was to find patterns across interviews. While the narratives themselves would provide useful detail about the difficulties they encountered at

work, the common themes – patterns – across interviews would contribute to a model of women’s careers in I.T.

The analysis presented here used the theoretical constructs reviewed earlier: Weber’s theories of Class, Ständ, and Party (Weber, 1978), Bourdieu’s theories of social / symbolic / cultural capital (Bourdieu, 1984, 1985), Bourdieu’s theory of Habitus (Bourdieu et al., 1990), Abbott’s theory of workplace identity (Abbott, 1988), and Wenger’s framework describing communities of practice (Wenger, 1998). Each of these theories provide a mechanism for connecting specific narrative anecdotes to larger social realities.

	Men	Women
Symbolic Capital	\$	\$
Cultural Capital	\$	\$\$\$
Social Capital	\$	\$\$

Table 1: The Cost of an I.T. Career

Bourdieu’s theory of symbolic, cultural, and social capital grounds the analysis directly in the women’s experience. In the I.T. workplace, all interactions are based on – and require – all three forms of capital. The difficulty women encounter is in the *cost* of their interactions. A conceptual diagram of the difference in capital costs between men and women is illustrated in Table 1. Given a constant cost for men, women require more cultural capital and *far* more social capital than men to accomplish the same goal.

In this study, Bourdieu’s theory of symbolic / cultural / social capital interacts closely with his theory of Habitus. Whereas Table 1 describes the *cost* women pay for interactions, the Habitus sets and controls their *price*. The sexism component of the I.T. habitus sets higher career costs for women than men. The reproductive quality of habitus enforces those costs throughout women’s careers, and even ensures younger female software engineers will pay as the older ones did.

Previously I described Bourdieu’s theory of Habitus in some detail. The major components of symbolic violence, pedagogic action, pedagogic authority, pedagogic work, and

Figure 3: A Summary of the I.T. Habitus

1. Early Experience with I.T. Habitus:
 - (a) Family, friends, and teachers have negative attitudes about women in I.T.
 - (b) Software and systems are written by and *for* men.
 - (c) The path to an I.T. career is straight, certain, and well-defined.
2. I.T. Habitus in the Workplace:
 - (a) Men's power is forceful and capricious.
 - (b) Sexism is internal as well as external.
 - (c) Emotional expression is considered unprofessional.
3. Challenging and Changing the I.T. Habitus:
 - (a) Women rely on a basic sense of self-worth.
 - (b) Self-reflection brings new insights and confidence.
 - (c) Women's networks and groups offer support and advancement.

habitus are outlined and applied to several instances in the I.T. profession. The interviews examined here show how the I.T. habitus is structured and applied. First is the structure, illustrated in Figure 3. This structure shows that the I.T. habitus has three major areas of concentration: early experience(s) with I.T. habitus, I.T. habitus in the workplace, and challenges / changes to I.T. habitus. Each of these three areas include rules or principles which the women I interviewed were forced to follow or created themselves. All three entail areas where women's lives are governed by the I.T. habitus, or ways in which they wrested control from it.

The application of I.T. habitus to women's lives is summarized in Figure 4. Three major themes emerged from the research. The first is early influences and interest in the I.T. field, and writing source code in particular. When women decide to pursue an I.T. career, the path they take can be circuitous. The second major theme is loss, demonstrated in three major components.

Figure 4: The I.T. Habitus Applied

1. Beginnings: how women begin their I.T. career
 - (a) Early Influences: the influence of friends, family, teachers, peers, and mentors
 - (b) Career Appeal: why (generally) women pursue an I.T. career
 - (c) Career Trajectory: the (general) path women's I.T. careers trace
2. Loss: the losses women incur during their I.T. career
 - (a) Structural Injustice: systematic factors and workplace conditions which cause loss
 - (b) Counterproductive Habits: how the I.T. habitus works against women's careers and personal lives
 - (c) Grief: women's reactions to their insights about loss
3. Recovery: counteracting loss
 - (a) Personal Resilience: personal factors which support recovery
 - (b) Self-Care: ways women support their own recovery
 - (c) Structural Support: ways women support *each other's* recovery

The first is systematic, structural injustice in which sexism causes loss in women's professional and to some extent, personal lives. Habitus is internalized, resulting in counterproductive habits and grief. Grief leads to the realization of loss, which in turn inspires efforts to recover. Recovery is first based in personal resilience and a sense of self-worth. Self-care includes reflection on their personal and professional lives: their first insights about their situation come from themselves. Finally, the interviews show when and how women reach out to each other to give and receive support.

Throughout the findings and analysis, we will see the interaction between the increased social and cultural costs to women, and the I.T. habitus setting its price. We will also see how women's efforts to survive and support each other alleviates that price. Bourdieu's developed the theories of symbolic / cultural / social capital and habitus independently, but we will see in the following sections how they move together – like the two sides of a coin.

Early Influences

This section charts the beginnings of the interviewee's careers in I.T. Their accounts of their early experiences show the positive *and* negative influences which shaped their career choices. In these stories, the women recount the formative and seminal experiences which motivated and guided them toward a career in I.T. In many ways, these experiences still sustain them. I note carefully here, not all motivational experiences are positive.

Family and Friends

One major factor in the interviewees choosing I.T. as a profession is the influence of friends and family. Parents have primary influence on the role of gender in choice of profession, as Thomasina describes:

I was raised by parents that did not see gender as something that held you off from doing anything you wanted to do. I was very much encouraged in sciences and math to do that from a very young age. ...and we talk about the bias as kids

grow up, and being segmented into that, “Well, you’re a girl, you should do this, you’re a boy, you should do this.” It still is very prominent and I feel like maybe I skated through that because my family wasn’t in a situation ... I didn’t grow up in a situation where I felt that bias. I never felt like I couldn’t do something because I was a girl, but I think a lot of girls do feel that as they grow up, and they’re kind of diverted.

Thomasina’s experience suggests parents need to coach girls when taking interest in STEM and computer science fields. These fields are dominated by boys and men, so parents need to be sensitive to any additional needs girls have when asserting their interests. In the literature reviewed earlier, it is clear most girls enter STEM fields prepared. Or at the very least, any additional experience boys have over girls doesn’t substantively matter when evaluating their work. Young women’s perceptions may differ, however, and that difference may justify additional STEM training to bolster their self-confidence even when their skills in these subjects are already competitive:

I can remember my dad sitting down at the kitchen table with me in first grade, second grade because my teacher wouldn’t give me extra math work and I wanted to do more math... Yeah, in fact rather than discouraging me from it, he encouraged me at it. He celebrated that I was doing well in those fields, and that I had an interest in that. So, I feel like I had an advantage from a relatively young age.

In their narrative, fathers emerge as especially important in supporting young women’s STEM and computer science careers. The influence of fathers is manifested in numerous ways. For instance, Linda’s father was influential on her in his facility and confidence with working with electronic equipment:

That’s because my dad was doing this home study course for electronics repair, to be an electronic repair technician to get into a different career. I remember

him making these devices and making a television set, and I thought that's pretty cool 'cause I was in there playing with the volt meter and some of that.

Her father's confidence influenced Linda's curiosities in exploring electronic equipment past its repair and into its creation. Similarly, Lucinda's father shared his interest with electrical diagrams with her, leading later to his support of her work on web sites:

So, my dad is definitely the main, and I'm sure that happens a lot. But, my dad's an electrical engineer. And so, he's always...like I remember being five, six years old and my dad trying to get me to read electrical diagrams... And then, when I was in high school my dad got me my first website, or my first domain name. And, this is how you push up the content to it. And, it was very very simple. I was posting pictures for my friends to see for the various shenanigans that we got up to. And it was just like HTML on a website, nothing fancy or whatever. I did that for awhile and I still really wasn't interested in technology. I wanted to go into art professionally and my dad was the one who was like, "Well you can always do art on the side, but computers make more money and maybe that's...". So, I went into college for Computer Science right away 'cause that made sense.

Fathers supporting their daughters in a flexible way allows them to show their particular interest in technology (e.g. electrical diagrams or electronics repair) but allow room for their daughters to show a similar kind of interest in a different area of science. Kari felt support from her father to pursue robotics after she expressed interest in it, though her narrative doesn't indicate whether or not he knew anything about it:

But I didn't ... computer science wasn't even on my radar because I wasn't sure where my direction would be. It was only in my junior year in high school where my dad and I met the guidance counselor and at the time they were offering whatever extra curriculum for my senior year, and there was a course,

an alternative school, a course like industrial class and had something to do with robotic arms. And so my dad encouraged me to pursue it and so I did.

While most interviewees felt support from their family in pursuing technical careers, one or two did not. Ivy's parents were much more supportive of her pursuing a business-oriented career, and Beth's parents were supportive of her career choices, but not specifically in a science-oriented career. These women found the encouragement of mentors in their educational and professional experiences, which we will explore next.

Education

As we saw in the literature review, formal education can be an important influence on how far a young woman will persist in pursuing an I.T. career. More specifically, formal education is an important time for professors, teaching assistants, and classmates to encourage or discourage female students. Unfortunately, many professors and staff view I.T. as "politically neutral", and while the specific subject matter (mathematics, physics, programming, etc.) may not be subject to political mores, its professional practice most certainly is: the I.T. habitus.

Early in her education, Linda encountered professors who believed the functionalist fallacy about women's minds not being adequately suited for scientific fields, but perhaps more importantly, such professors did nothing to prevent Linda's fellow students from diminishing her social status (Ständ) at every available opportunity:

So, then I went to UND, which had a bunch of sexist professors. My advisor said that women didn't belong in engineering because their minds couldn't handle the math, and then there was another professor in a classroom full of people, mostly men, who said, "Women don't belong in engineering because they take jobs away from men." The class was also probably 90% white males at that time, so I didn't flourish there.

One of my best professors was a female chemist and she taught chemistry. She was awesome, and so after I finished my year there, I decided, "Yeah, I don't like this place," and I transferred to Metro State, and at that time, they were just starting their electrical engineering program and they only had three professors, and I went through there. They were all good professors, supportive. There was no problem with the professors. The problem was with the guys in the class. My lab partner was this guy who had worked as a technician, and he said, "Well, don't worry. I'll put this all together. I'll put the circuit together," and, "I know what I'm doing."

And, we had a dielectric capacitor in there, and I looked at it, and I said, "I think you got it in there backwards," because if you put it in the wrong way, it's gonna blow up. There's one direction the current can go. So, he said, "No, don't worry. Don't worry," and he turns it on and then he walks off, and then, you know, maybe 30 seconds after he walks off, it pops. It starts smelling, smoking, and the other guys look across the table at me like, "That's what we expected."

One good example of this was in the communications class. We were doing 40A transforms, and one of the calculations, the function was $\frac{\sin(x)}{x}$, which is a sinc function, you know, that at 0, it's whatever the scaling factor happens to be, and then wherever it crosses the 0 line ... these guys were beating their heads against the table, "How am I supposed to map this? How are we supposed to graph this? When I put 0 in, the calculator blows up." And, "Where do the 0s go? Where does it cross the 0 and then the amplitude and all that?" You're sitting at a table, and I said, "It doesn't matter. Just draw a little bit, 'cause that x and that n is just a scaling factor, and L'Hôpital's rule tells you that at 0, it's gonna be whatever the value of n is. "

Well, they didn't believe me. They went ahead and did whatever the hell they did. Then we get in class after we've handed in the homework, and what does

the professor say when they ask him? He says, “It’s just a scaling factor.” They all look at me, the guys who had been at the table, and afterwards, they said, “You only knew that because the professor told you.”

Linda’s narrative shows how the hubris of the I.T. habitus is already well-ingrained in her fellow male classmates: the social capital price she pays to prove she’s right is too high; they will hear none of what she has to say. The mistake proves fatal; that she was right all along provides Linda with support for her competence and therefore her worth as an I.T. worker. Further incidents like this fail to threaten Linda’s confidence in the same way.

Thankfully, there are other cases where education provides the edification and confidence one would expect from gaining technical experience. Beth explains how this was true for her by attending a technical school named “TeachCo”:

We actually had one of the instructors from TeachCo who decided to work with us for a while and he was very helpful, so I got on the right track, I think, because he came to work with us and he was actually doing reviews and being more helpful.

In cases where parents don’t support their daughter’s interest in an I.T. career, women like Tabatha recommend educational institutions provide this support instead, by bridging their perceived gap in STEM skills prior to taking STEM or computer science classes:

I think I’ve heard probably some of the same, like NPR blog posts that you have where they talk about how it’s shifted to, we’re all learning this together to, guys coming in with this level of knowledge and women who hadn’t tinkered with it having a different level. Having everyone have the, let’s get everyone on the same page course to get them ...

As shown earlier, Tabatha’s recommendation has been taken seriously by researchers and educators at CMU. It seems it would be well if they were adopted more widely. Tabatha also

supplied me with the replies she made to a class assignment for her M.S. degree, where she was asked to discuss whether or not women can “flourish” in a male-dominated profession. Her lengthy and nuanced response demonstrated that she could and by any measure *had* successfully forged a successful career despite I.T. sexism.

Second, however, was the lengthy enumeration of the personal and professional *cost* she had incurred in the process. Tabatha’s critique of the female professor who had given this assignment was not so much that she was tone-deaf to Tabatha’s concerns; the professor seemed to have a receptive ear. Rather, Tabatha’s objection was that her professor’s understanding was oversimplified; that her perceptions lacked the nuance and sophistication Tabatha would need to make any practical decisions which would improve her professional life.

Seminal Mentoring / Mentorship

Another important source of career support is the mentorship women receive on the job. The interviews did not indicate any particular or consistent source for mentorship, whether colleagues, managers, or other. The foundation of the mentorship is a common style or approach to problem-solving, usually the kind required to accomplish a work task. Ivy explains succinctly why she and her mentor of many years were able to connect, and why Ivy learned so much from her:

We both like simplicity, well organized, clean code.

Thomasina outlines an experience she had with a work colleague. In this case, he was a former (retired) I.T. manager called upon to train a team:

I actually got assigned to a project, it was a major undertaking for them. They were bringing in some new software and they had brought in some consultants to build a system, and I got assigned to it to work on that project as the database analyst. One of the people they brought in was, one of the consultants they

brought in actually was a retired IT manager from NetCo. So, he actually turned out to be probably the best mentor I had early in my career... He encouraged me to do things, he said things to me that made me feel like I could be successful in the career. He talked about that I had the right way of thinking about things. He told me on thing that I thought about the rest of my career. He said, "You're not very good at building something from scratch, but you're really good at putting pieces together into something new." So, I feel like that maybe defined some of my career after that.

For others, the story is more complex, but often reduces to a similar – intuitive – connection about the nature of the work and the approach required to solve it. Linda explains one such instance in her professional life:

I worked with a team out of Wisconsin. The rest of the people who were working in Mason City were working on the FlyCotesting, and they just had this small group that needed to work in Des Moines, and the other people in Mason City did not like the program manager, but I thought the program manager was great. He sat us down, told us what he wanted to test, how to test it, laid everything out... 'Cause it made sense to me what he expects and what he expects you to do.

Sometimes, internal competition or jealousies can result from a mentorship becoming too visible to other members of a development team. Again, as this happened to Linda:

Yeah, they didn't like him. They didn't like working with him, and he said to me, "You're so different from the rest of the people from there. You listen. You go through the requirements. You pick out things that are wrong in the requirements. You pick out things that are wrong in the code." He thought it was great. That's why he wanted to hire me...

Other women had to withstand the oddities or quirks of their mentors in order to receive mentorship. Connie recounts an instance where her mentor – someone whose opinions on software development she had identified as valuable – refused to meet with her during regular business hours:

He would stay late too, so until 5:00, he would not help me at all, and after 5:00, I would just stop by his cube, and he will show me. It's like, "okay, maybe you need to start thinking about" ... No, he wouldn't even say it like that...

Nonetheless, Connie credits this mentor with imparting valuable knowledge and practice:

I would leave work at 6:30 / 7:00, so I was working very long hours. I learned a lot, I'm not discouraged by that experience, I learned a lot; I even had a mentor, who was not official mentor, but I am grateful to him that he taught me what I know today.

All instances of mentorship include their own particular details, and for the most part, all are founded on basic trust and respect. That said, few of these relationships seemed collegial: most included a power imbalance between mentor and mentee.

Career Appeal

As one would expect, certain features or attributes of software engineering appealed to the women who chose and pursued I.T. as a career. These experiences can become a source of competence and confidence, as their interest in a technology leads them into further understanding it, then developing the software itself.

Curiosity and Play

Some experiences such as those recounted by Theresa indicate interest during their teenage years, but regardless of when it occurs, there is a modicum of freedom for them to "take it or leave it". In their case, they take it:

Yep. Yeah. So I remember those. And then I think when I was maybe 14 or 15, we started getting the AOL CDs in the newspaper and stuff, and I somehow convinced my parents that we should sign up, and nobody used... Maybe even Prodigy, I remember being on Prodigy.

Curiosity about / play with a particular technology leads to the desire to understand its underlying mechanics and structures. Beth recounts an early experience where playing a game lead her to be curious about the source code in which it was written:

We didn't have one, personally at home, but I loved computers. I loved going to my friends houses and playing on them. My parents were teachers, so they'd bring them home every once in a while, always Apple. And then, some of my friends' parents worked at CompCo. They had a lot of those around, which were different computers than we're used to now, personal computers... Yeah, they're ... so, yeah, I don't know. I really liked technology like playing games. I always wanted to program. We had a Commodore 64 for a long while, and I did the ... you just put in exactly all the codes and that was pretty fun. I never saw ... it didn't seem gendered to me at the time. That only happened, I think, when I got older.

Beth notes at the end of her story how she didn't realize any of software engineering was gendered until long after she became experienced with it. While the I.T. habitus is an important feature of the industry, it's not a high priority at this point. Beth continues her story about how technology as a pleasurable avocation became a source of income:

I was just interested in it. I liked seeing information displayed. I don't really have a other good explanation for that. I was just curious and I wanted to see if I could do it, so people asked. I would play around with stuff and show people on message boards in local twin cities. People on there like, "Oh, can you do this for me?" And then I'd do it, and then eventually I started charging people, and one

person would recommend me to another person, so I had a group of about four or five people I was just doing work for on websites like cataloging, displaying mostly music stuff.

There is also a point at which young women often make a crucial decision which young men in general do not: they see technology not only as an amusement or potential commercial venture, but as a benefit to broader society. Kari shows this in a narrative of how her own thinking and feelings about technology evolved:

Experience with the robotics and also I was just fascinated with the Internet at that time. So, in high school, I was part of a speech group, and I did a speech on the informational highway. At the time, it was unheard of playing ... I was talking about like reading articles about you're gonna play virtual games with someone in Japan or something; that was unheard of back then.

But now, it's like ... it was just ... and that's what ... it's like this is awesome where we're gonna embrace this technology that's going to connect people. And I thought a computer engineering degree was more related to that, to what piqued my interest.

Work / Task Centrism

For many, connection between colleagues is predicated on a common work task. Many I.T. places include review processes, in which co-workers review one of their colleague's proposed work before it becomes production-level or public-facing functionality. In the case of code reviews, one or more software engineer reviews the software (source code) produced by another to evaluate it for best practices, potential design flaws, security issues, and other less tangible qualities such as "readability" and reusability. Many developers such as Ivy use code reviews as a pedagogical exercise:

I've learned what not to do by being in other people's code. I like simplicity.

I think that sometimes people in IT want a very complex project that makes... and I think it's more about getting back to simplicity. Let's go from A to B. You don't need to ... You don't need A to Z with a point in each place just because you've over-engineered it.

The code review process allows the developer to shift the evaluation of their professional worth to their work product. This is arguably the best-case scenario for all involved, though in tense or highly politicized work environments, something as fundamental as work product may be overlooked. Even deliberately. In Ivy's case, she insisted on it, and by doing so gained great confidence in her work; if her code *works*, she's successful:

I don't feel like I need to justify, and I just ... I get things done. I run circles around some of the guys I've worked with, who are doing this all the time. Talking about all the stuff they do. I just do it. Just get it done. And it's taken me a while to figure that out. Like ... And I'm probably sounding a little bit cocky now, but it's just in the last couple years when I'm like, "You know what? Enough. I'm good at what I do."

Career Trajectory

Career Arc

Several of the women interviewed had non-I.T. undergraduate university majors, which started them on non-I.T. careers after graduation. For instance, Ivy and Beth both had non-CS majors, and Linda is an electrical engineer. Contrary to an important rule of the I.T. habitus, their route to an I.T. career was neither direct nor certain. The "dot-com boom" of the late 1990 – early 2000 period relaxed this requirement somewhat, but as of the end of the "boom" – approximately 2005 and onward – the "best" candidates for I.T. positions were those who seemed to know their career long before they started. Thomasina explains

her own career in these terms and remarks that since the dot-com boom ended, there has been a shortage of I.T. workers:

There was a period in the late '90s where universities were not putting out computer science or IT graduates, because the market .. Once we got past Y2K, it was hard, it was a hard market. So, universities were not encouraging young people to come out of college with computer science or IT, management services, MIS degrees. So, there was a long period of time where there wasn't a new crop of people to be doing this.

It's only been in the last, maybe 5, 10 years that we're seeing really more of a surge in people going into this as their career and coming out of colleges with this as a degree. Many of our consultants actually didn't come out ... I don't have a computer science degree, most of our consultants, older consultants don't. A lot of math majors, chemistry majors, music majors, a surprising number of music majors.

Thomasina's "second career" in I.T. is typical for other interviewees like her: she did well in her subjects in school, knows how to learn, is self-motivate, and knows how to -direct a project to completion. The rest is just needing adequate time to learn I.T. skills:

I started out in just liberal arts, I moved over to the college of biological sciences. I graduated with a degree in microbiology. When I got out of school, when I got out of the university, at that time, there was two paths that you could take as a microbiology graduate. You could go into the healthcare industry, where most of the jobs were working in laboratories and hospitals, or you could go into the food industry.

So, I went from ... I started taking orders and then quickly moved into being what they called a verifier, which was the person that sat down at the computer screen after they had been scanned, and reviewed it and made sure there weren't

issues or changed issues, or something didn't need to be re-scanned or something like that. So, at the time I graduated, they actually had an opening in their IT department, in the database group. I applied for it, and got it. So, I started out as a junior database analyst, and went on my career through database.

Thomasina's experience on the job is similar to the "curiosity and play" others experienced outside the professional environment. In the case of Thomasina and others like her, practical necessity rather than amusement drives their success:

Yep, yep. They kind of followed a similar path to what I did, graduated with one thing, wasn't really interested in working in the jobs that were available, so found something that seemed interesting and could support you at the time.

Tenacity

One common undercurrent in all the interviewee's stories is tenacity: the will to pursue their careers despite obstacles. This is especially evident when they re-trained from a non-I.T. university subject or career into I.T. Many such as Beth chose a private course of study (online or from a book) or took a brief but intense programming skills course. This part of their education is very practical and results-focused. Their goal is to join the I.T. profession as quickly and easily as possible:

It's a boot camp. It's in the Twin Cities. It's not online. It's the only one ... they're not like one of the franchises. They're for web stuff, and it's like a ... it was an 18-week program when I went there. I think it's a 20-week program, now, and it's intended to take anyone who applies and qualifies. You don't need any background, and they have some connections with the local community. They find out what technologies they want, and then you sort of do the work of getting a job yourself. It's not like you're guaranteed a job.

Another major event in women's lives is when they have children. Many interviewees enjoyed support from their spouses, but were reluctant to discuss the details. Only in a few cases, such as Beth's were they able to work on their new career during their child's early years. No doubt, Beth's choice to pursue an I.T. career while raising a young child required tenacity and grit:

So, I mean I was doing it when he was a baby. I do remember doing some of it. I was also working full-time pretty much the whole time so that was like outside of work or when I had breaks. So, I went back to school right before he went to kindergarten, so that was like four years, yeah.

The most prominent theme which emerged from the interviews is *loss*. The loss these female software engineers experienced varied in degree and in kind, and was understood and expressed in numerous ways. The following subsections explore the various ways these women experience loss. Most make it difficult to distinguish personal loss from professional loss.

Structural Injustice

The I.T. workplace is male-dominant, as is its culture. This culture imposes male-oriented rules and norms on all I.T. workers, but clearly this culture has a disproportionate and adverse effect on women. The culture restricts women's bodies, personalities, or abilities. This includes both *realized* expression (actions, personal traits, or abilities they've actually done or expressed) and *potential* expression. The result of imposing these norms is the first and greatest loss women experience: loss of self. Loss of self entails a curtailing of person, personality, or ability according to imposed rules. Imagine the word "**don't**" sounding in your head; the source can be one or more people, an institution, or yourself. The result, though, is always the same: a diminution of some aspect of self.

Most of the loss experienced by female software engineers is systematic: caused by a structure of confluent factors rather than one factor in particular. Most loss is also experienced

as an aggregate of interactions, rather than any one interaction in particular.

Per Bourdieu's theory of Habitus, this system is the result of a male-dominated I.T. culture which has been inculcated in its members, male and female alike. This culture entails rules about how I.T. workers are allowed to act and interact. One goal of this analysis is to illustrate the rules and norms women must obey, and how they differ from the rules and norms for men.

Many of the rules or norms imposed on women are double-binds, or "damned if you do, damned if you don't". For instance, women who spend time at work instead of at home are considered bad wives and neglectful mothers. Conversely, women who don't spend enough time at work, in lieu of family time, are bad employees: distracted, disloyal, and unproductive. We will see other similar rules throughout this analysis.

Competence

The main social currency in software engineering is competence: the ability to think creatively and logically, then to express these in writing computer software. One of the first effects of sexism is to diminish the social currency of women; that is, women are assumed to have less intelligence, have fewer or less effective organization skills, and are believed to be less creative than men.

Women's professional contributions are treated with a double standard, depending on outcome. This is most readily apparent under stressful conditions. If a woman receives an assignment and successfully completes it, her presence is tolerated as minimally acceptable. She is unlikely to receive praise or recognition, or at least not as much as men would. When women's contribution is successful or leads to success, their work goes mostly unrecognized. Conversely, when difficulties lead to project delays or failure, women take the brunt of it, and often are blamed more than men. If for some reason the project goes badly, a woman can expect harsh critique or even humiliation. This despite any factors beyond her control or outside her area of responsibility. Women's actual experience, credentials, and ideas are

ignored if acknowledged at all. When women *are* recognized or acknowledged, they are kept at a social distance. They are excluded from social groups and informal teams, some of which are precursors to more formal promotions. Except formally, women aren't asked for advice, to contribute, or for help except when necessary. They are generally not invited for new or innovative work and instead need to compete for it. Sometimes, women step in to compensate for men's lack of skill or inability to communicate effectively. All by itself, contributing to a team or compensating for others is expected of professionals. What isn't expected is that good professional conduct remains unrecognized. Like housework, women's professional work is often invisible, especially the emotional work they perform.

Professional environments are hierarchical, but within levels, employees' attitudes toward each other are supposed to be collegial and relatively impartial. Because of their position of privilege, men may take a more imperious attitude toward women; expecting their opinions and judgments to go unchallenged or above critique. Men are therefore less likely or able to compromise. Male "allies" do what they can to make things easier for women in the workplace, but they typically don't place themselves at much risk in the process. They limit their effect on the workplace to the status quo, and do unfortunate little other than to smooth women's feelings in the wake of a sexist comment or event. Whether they intend it or not, "allies" tend to be less effective at alleviating sexism than they believe they are (Hess, 2014; Larson, 2014a, 2014b; Murphy, 2015).

Less commonly, men may treat women as a threat or their presence as an intrusion. At its most harmless, men treat women as an unwelcome presence, as if they don't belong. At worst, they exclude women from opportunities for innovation or promotion, which can stall their careers or starve them of interest. Somewhere in the middle is the most problematic way men exclude women: daily interaction. When women are spoken to only when it's necessary, rather than as a part of the normal daily interaction between colleagues, the result is social isolation. Women are allowed to contribute less to the pool of shared knowledge (Brown & Duguid, 2000), receive less feedback on projects, and receive less attention for

their achievements.

One of the women I spoke with, Thomasina, had over ten years of experience as a manager. Another named Kari was just entering a management training course. My interview with Thomasina examined her professional experience at length, and she insisted throughout that she had never experienced sexism of any kind; that as a network administrator, she had moved from one work environment to another with ease. Her management experience was a natural extension of her work and professional contacts, and she had never experienced sexism as a manager either. Kari was in the process of moving from her software development position to management. She was thoughtful about her experience as a software engineer, but seemed eager to leave it behind.

I believe Thomasina told me the truth about her career as she knew it, but I also believe she underwent the same kind of transition Kari was in the middle of. That women in I.T. management have never experienced sexism before their promotion is strange at best, unless one considers their perspectives as illustrating a crucial point: the I.T. habitus forces a change of worldview when a worker is promoted to management. During the transition, the workers suppresses past memories or reinterprets them to be consistent with a new, more powerful management role. Power is attained through “merit” rather than luck and professional connection, so only personal attributes and memories which support an image of “merit” are kept. The rest are forgotten or denied.

The I.T. habitus explains the interaction between women who have been promoted to management and their female employees. The bulk of their professional experience they have in common, but the promotion forces a change of worldview in the manager which estranges them not only from their themselves, but their reports as well. For the new manager, this estrangement may mean relief from memories of the past, but it also causes deep between women. The experience may change women’s minds about promotion. Ivy and Connie had a very negative experience with a female manager, and spent years reconciling with their own approach to management. Both Ivy and Connie have different – and more thoughtful –

experiences as team leaders, and neither has any connection to their previous female manager.

Self-Discounting

Women who decide not to pursue management as a career goal develop a collection of coping mechanisms to preserve their psychological health. One method they use is similar to the worldview change which occurs more automatically when women accept a promotion to leadership. I will refer to this skill as “self-discounting”. Self-discounting is a form of self-denial where instead of reinterpreting the past with a view to their merits (as new managers would), it is reinterpreted with a view to *others* merits. More directly, the past is reinterpreted in a way which denies the sexism and therefore denies that anything sexist occurred to them. Instead, their thoughts and feelings about being treated in a sexist way are reinterpreted as imaginary or illusory. When asked to recall instances of sexism she had experienced in the workplace, Theresa said she thought she remembered a few, but that she wasn’t sure it was sexism; “Maybe it’s just me.” and “I’m sure it’s all in my head.”

Sexism is internalized at the individual level as much as it is systemic. The sexism of self-discounting is some of the most deeply internalized of any encountered in the interviews. Theresa expressed this well during one such interview:

I sell myself short. I feel like I don’t like to say I understand something unless I really feel like I understand something, and I can’t ever tell. Like, do I have the same skillset? Am I qualified? They talk like they know what they’re saying, and it sounds like they know what they’re saying, and you play these head games with yourself that you’re sort of like, “I don’t know if I know.”

Sentiments like these indicate deep self-doubt; discounting their competence, which is the fundamental social currency of the I.T. field. In her first thought above, her inclination is to not say anything; as if she has no competence and therefore nothing to contribute. She notices others (men) have no such problem. Both of these lead her to the contradiction that she was qualified enough to be hired for the job, but somehow no longer believes in her

qualifications when compared to men. Theresa “sells herself short” not only to others, but to herself.

In this previous situation, the women’s social currency – competence – is devalued, and this de-valuation is done by both men *and* women. One of the main problems with self-discounting is the rule which denies women the right or ability to express their feelings. Social progress despite, women are still expected to maintain a demure countenance, lest they be labeled as aberrant or misbehaved.

Self-discounting extends into many areas of women’s professional life, including their belief in the monetary worth of their work, whether or not they merit promotion, and whether or not women in general can develop software. This despite their own experience receiving competitive wages, opportunities for promotion, and their success writing software on a daily basis. One reason women tell themselves is that men are more competent than women in software engineering because of men’s earlier exposure. Again, from Theresa:

I felt like I may have had low self-esteem, so I bought that idea where things are somehow ... like the guys figured things out easier than the girls. But looking back, I realize that it’s because they had exposure to computer science before coming to college...

Also, from Beth:

I’d just be like, “Well, I could do that for \$200,” and they’d be like, “Okay.” Or, I did have a guy who I was charging hourly, but he was getting everything from scratch, and I wasn’t charging him that much for it ’cause I was like, “I don’t know what I’m doing, really,” even though it turns out I did know what I was doing. I just had thought at the time, I was like, “Oh, I’m not a professional, really,” yeah. I was doing totally fine. I was doing real websites, PHP and JavaScript. Because I had learned it all kind of in a vacuum, I didn’t really see myself as knowing how to do it.

These are the same sentiments women express as part of their undergraduate experience, extended into their careers. Self-discounting is also a frequent defense mechanism, or a way to smooth over a tense social situation. More specifically, women use self-deprecating humor, usually at their own expense. For instance, Beth uses self-discounting to counteract a male co-worker's sexism and fragility:

I would say nobody there is sexist except for one person, and I don't think he wants to be, but he constantly is coming up to me and saying stuff like, "Oh, I have this pink cable. I don't want it," and handing it to me, or apologizing for swearing, and I'm like, "Would you do that for other people? I'm a person that's clearly not sensitive." I feel singled out, and it's very irritating to me, but if I tell him that, he gets super apologetic and it's almost even more irritating. Like, "Just stop doing it."

Individual-Level Sexism

In some instances, women experience sexism from men on an individual basis rather than from a group of men. Women are still a minority in I.T., so their diminished representation makes them an easy target. Men know when they act as bullies; when they overstep their representation and use power they shouldn't. The result is a form of passive-aggressive behavior termed "male fragility". Men act as if threatened by women, though the threat is at best illusory. This "threat" seems to extend even to family members, as Tabatha relates about her own brother:

It's a really difficult subject to talk about, because even when I talk, say like with my brothers, my one brother, he feels very threatened by it. Like, "You can't do anything, you can't say anything to anyone." It's like, it's not about that. People know what's right and wrong, what's intentional and what's not. People just, they automatically tense up.

As does Lucinda:

...He just, he would make jokes that I wouldn't let other people get away with. But, that was just because of, it's like my brother makes the worst fucking anti feminism jokes ever. He trolls me more than...but I know where he's coming from. Because we grew up together and I know his wife really well, and we've had also serious conversations about feminism and stuff where I know that he is not coming from a shitty place. I know that he's just trying to get me mad or whatever like he's my little brother. And then, this guy I knew him for long enough where he would say stuff and he wouldn't get as much of a pass, but he still would get a little bit of a pass.

This strained relationship is difficult to undo or re-do with men who understand their power and deliberately pose no threat. Their experience with bullies makes women reluctant to trust other men. Kari says this succinctly and precisely:

I guess I'm more cautious with the men allies.

Taken to its extreme, men bullying women in the workplace surpasses sexism to sexual harassment. The sexual harassment or sexual assault pattern typical in this collection of interviews entails individual men making sexually suggestive verbal advances toward women. That is, sexual harassment wasn't usually done by two or men together, nor did it extend to physical action (sexual assault). Whereas sexism discounts women's social value and social currency, sexual harassment treats women as if they have no such standing or currency at all. Instead, women are judged strictly on external appearances or behavior men incorrectly interpret as sexually suggestive. Lucinda describes one episode, typical for herself and other women she knows:

Oh people do street cat calling all the time. When you walk around down town.

That was the biggest thing of getting used to work, walking around down town.

Is like, don't make eye contact, head phones, just don't even respond. I have a friend who is younger by me, she went to a coding boot camp and not a full college. So, by the time that she was working she was a lot younger, and she's very cute. And, she is basically like... people would like... what people take as an invitation to move forward. I think she smiled at someone and they just got all, like you smiled at me so that means I have to do all this. So, head phones, sunglasses, bitch face, and you don't want to do that. But, it's, just listen to podcasts.

The compensation women do in situations such as this have nothing to do with a common, negotiated social currency such as competence. Instead, it's basic self-defense. The example Lucinda cites happens outside the professional workplace context, but *not far*. The trauma they experience – simply walking to their office – follows them inside. Women have similar experiences online, in situations where their virtual identity the fact that they are female. Online forums which allow for comments – Twitter, bulletin boards, and news websites to name a few – leave women vulnerable to men who leverage their online anonymity to gratuitously intimidate women. In some cases, the violence men express online risks spilling over into real life. Lucinda discusses her experience with one such Twitter user:

...he's been going by other names. He's dangerous. He's got restraining orders, be careful.

The result is a reduction in the public freedoms women enjoy (Lucinda again):

I don't Tweet about where I work anymore and I don't when I go to get interviewed by a podcaster or give a presentation I don't talk about where I work anymore.

Less common than sexual harassment is sexual assault. Only one interviewee, Tabatha, reported an incident of a near-miss sexual assault:

Anyway, the problem was that when I brought up his behavior, then they told me, “Are you sure you’re misreading it, are you sure this is happening?” It goes on and on. Then when it got to an incident where it was like, “I will not work with this person, I do not feel safe,” because he cornered me in a lab... I literally was trying to figure out, if I run that way around the table or can I get around that piece of equipment to get away from ... literally, calculating.

Tabatha considered the situation unique and mostly random, however dangerous. She is notably reluctant to discuss it, and is careful to situate it in the context of the suppression she experienced in its wake: the management she worked for tried to negotiate – gaslight – her out of her own perspective on the event.

Job-Related Issues

Inside the I.T. professional environment, women still have problem navigating their position among their colleagues. One problem concerns the role or roles they play on a software development team. The first problem is role ambiguity. Thomasina provides the first instance we will examine:

Having maybe started out in database analysis, I have a very data centric opinion about developing systems. If you don’t get the data right, I don’t care what beautiful system you put on top of it, it’s not going to work right. So, I have a very data centric view of systems and building systems. So, yes data analysis always came into my business analysis. Quite frequently, I was asked to review other people’s data, logical data designs or database designs to see what they missed, if things made sense, if they connected correctly and stuff.

Connie provides perspective on her own position, which seems similar:

I think they are trying to leverage my skillset, as in I already knew big data, and I have technical background, and I had been in an analytics team where I had

learned enough about marketing the business, so they see a good combination. I have a very good combination, where I know the business, so I understand what needs to be done, or I understand the business problem when somebody comes to us, and I am technical enough where I know where I need to intercept myself, and how to get help from IT, if needed. Yeah, now I'm talking IT, since I'm in marketing, but-

Thomasina and Connie see opportunity in the ambiguity; flexible job roles provided opportunity for advancement and leadership where more traditional or well-defined job roles did not. That said, Thomasina and Connie were seasoned I.T. veterans who had previous, extensive experience in well-defined job roles and were ready for the new challenges entailed by more flexible job roles. Conversely, ambiguous job roles may also entail compensating for Younger or less experienced professionals might find such ambiguity confusing or distressing.

Closely related to ambiguous job roles is invisible job roles, or more generally, invisible work. The term originates in domestic life, where women assume nurturant roles to the point where they become responsible for the emotional life of their family. Beth recounted her experience with her husband:

My husband and I have the emotional labor discussion. He doesn't believe it exists. He thinks it's a miscommunication. He thinks it's couples miscommunicating what they want. I don't know. It's hard for me to understand. He's trying to figure it out. He's listening to people.

Role ambiguity backfires when it entails not only fulfilling stated work duties, but ensuring others fulfill theirs and feel good about it. Official job roles have little to do with the emotional esprit de corps of a software development group, so one would assume it's an equally shared responsibility among team members. However, when a woman join the team, she is assumed to be responsible for it, whether she wishes it or not. The result leaves her feeling trapped in her job for reasons which have little to do with the reasons she agreed to take it, as Beth explains:

And then, you know, realizing you're never gonna get ... no one's ever gonna hire you to be the boss 'cause you're doing so well in this role.

Anne's insight is not only that managing her team's emotional life reduces her manager's workload, but Beth's (male) manager likely believes as the rest of her male teammates do; that women are responsible for nurturance, regardless of context. Beth takes a nurturant role in her professional life, despite the repression she experiences. She "cleans up after" others emotionally or socially, and this informal role keeps her in her formal one:

That got promoted or something. Do you know what I mean? I'd always be the person that kept cleaning up after everybody, so-

Informal Professional Organizations

While a formal promotion hierarchy exists for most organizations, the method or procedure for ascending to a higher status (e.g. team lead or management) is vague or at least underspecified. Promotion becomes a competition of sorts, and the first step is to reduce the number of potential promotion candidates. One tool for winnowing the field is sexism: informal "boys clubs" emerge from informal social workplace connections. Beth noticed this at her workplace:

Male. They're all male. It was kind of like a secret club, it seemed like.

Ivy noticed some the men in her department had formed an informal group, the purpose of which was to promote leadership from within the group:

But at ChainCo, that was very, very boys' club. So much so, that the guys that wanted to be the leads created themselves a little Monday morning meeting group that only they were invited to.

Ivy also noticed she was explicitly not invited to join in the "boys club" meetings, based mainly on her gender:

“And you’re not going to be in the Monday morning meeting.”

Next, Ivy noticed the “boys clubs” efforts were successful: they had eliminated her as a leadership candidate, despite her long years of experience as a developer and leadership qualifications:

And you knew who was going to get promoted from like a level two. So I’d be there... I’d been there for a really long time, had a lot of years of experience in data warehousing. And they’d bring in these guys a year after me, and all of a sudden they’re making them level threes. And you know they’re making them level threes because they’re ... they get invited to this Monday morning group that the guys set up that only certain people are invited to.

Ivy is passed over for leadership, but still has all the maturity and leadership skill as she before. The difference now is that the new team lead – appointed by the “boys club” – knows Ivy was excluded from the promotion process. The new team lead is still a member of the “boys club”, and now excludes Ivy from daily software engineering operations the way she was excluded from the promotion process. Ivy’s ideas are disregarded, her competence discounted, and her prospects for promotion are less than before:

“And you need to listen to this guy who knows less than you and has less data warehousing experience than you. He’s your lead.”

In the wake of being passed over for promotion by a less experienced man, Ivy needs to go to her manager, with whom she fortunately has a good, collegial connection. Through her manager, she is able to have her ideas implemented despite her team lead’s bias against her:

And I’ll be like, “Here’s what I think. I think duh duh duh duh duh.” And he’d be like, “That’s good.” And he’ll take it back to the boys.

I note carefully here that Ivy’s collegial relationship with her manager is unique; most I.T. employees don’t have the ear of their manager over their team lead.

Counterproductive Habits

One logical consequence of habitus is the internalization of the rules and norms which not only govern behavior, but the development of thought itself. Axiomatic to Bourdieu's theory of habitus is how behavior and thought reinforce each other. It is therefore contradictory when it seems they don't. This section will present several seeming contradictions between how several female interviewees viewed their careers and the careers of others, and the systematic female suppression which the I.T. habitus entails.

The sections below are problematic, principally because the observations presented here are sometimes at odds with interview quotes. This conflict must be treated with care, especially because it assumes the female interviewees are not entirely aware of the contradiction between their insights into their own careers and the conditions in which those careers exist.

Misplaced Individualism

Individualism is a dear American value, one which we attribute to those we respect most. Fierce individualism must be a primary attribute or virtue of the successful. In the following interview passage, Thomasina talks about how she tries to impart independence to her family and work colleagues in order to support them:

I think in my own life, I've tried. I have children and now grandchildren, and I've tried to not impose any stereotypes on them as far as gender, and no gender biases. My grandchildren are relatively young, but still, it starts at a very young age I think. So, from a professional career aspect, I think we haven't done enough as an organization, and Beatrice would agree with this, and that's why we're trying to change that to get actively involved in bringing more young women into this career, and to giving them support when they need it.

The difficulty with Thomasina's sense of individuality is that it reflects the mistaken views of her male colleagues. The three issues Thomasina identifies are gender stereotypes, and

mentoring / supporting young women in I.T. The problem is that each of these aren't isolated, as the single person is; they exist in a societal, social, and often economic context. The idea of the "self-made man" or "self-made woman" turns invisible the persons, circumstances, and luck which has supported them throughout. Later in the interview, Thomasina reiterates the importance of individuality over connection:

Well, when I say support, it's giving them maybe training or mentoring that they need to be successful in their career in the workplace. My experience has been, and I think maybe ... I won't speak for anyone else, but I think if you prove yourself, and how do you prove yourself, how do you prove yourself that you can function as well as anybody else doing that job? So, I think what we need to do is give young women the opportunity to prove that they can function as well as any man can in that position.

Thomasina traces her thoughts and inclinations about individuality to family connections:

In thinking about this, and thinking about what I might be able to tell you, I keep going back to the fact that I was raised with this attitude, there isn't anything I can't do if I want to. I feel like maybe that's what I bring to everything. Don't tell me I can't. I don't even have to say it, it's just maybe in the way that I approach things.

Most interviewees I spoke with had insight into their dependence on their connections with friends and family, colleagues, and mentors who had helped them in their careers. In some cases, these connections made their careers or its continuation possible. The important part is, they acknowledge as much. The problem is, they still see themselves primarily as individuals, instead of chiefly part of the same social system which supported them.

Representation Difficulties

The lower number of women in I.T. means less representation by women in all hierarchical ranks: few female developers in the lower ranks means even fewer female team leads or managers. Nonetheless, women look to whomever they can for inspiration. Connie cites an example of this:

Fair, fair, a sense of fairness is what I get from her too, and I look up to her in that way, and that's the reason why I feel like there needs to be more female, whether it's like I have had bad female manager too, and it just so happens is now I have a very good female in management, who I look up to, so I think it's good to have more of them.

Kari also has a similar sentiment about a mentor of hers:

And I'm fighting hard for this position because the vice president is a female. And I've had such a connection with her and maybe more than what she thinks it is with me. But she handed a book out to me and another female about ... this book, about like "Nice Girls Don't Get the Corner Office". And so I've been using that as sort of like my coaching Bible. Yeah, "Nice Girls Don't Get the Corner Office".

One of the problems of impoverished representation is lack of diversity in the broadest sense: not only gender diversity, but racial diversity, class diversity, and even differences in personality. Leaders are inspiring, but we relate to leaders that are more like us than less.

Perfectionism

Interviewees typically put a great deal of pressure on themselves to perform well; a heightened perfectionism which governed not only the substance of their work (the source code), but the context around it as well: the process by which their work was produced, the extent and depth

to which their work was tested, and its durability in production computing environments. Ivy puts it succinctly:

You cannot make a mistake. That is one thing. I have learned to basically be perfect, or to cover my mistakes very carefully.

Ivy's quote also reveals the scrutiny women suffer in work environments; high pressure, high visibility, and sexist bias against any mistakes they make, often the same mistakes as their male counterparts. This tendency toward perfectionism also prevents women from entering the I.T. field, delays their entry when they do, or encourages their early exit. As indicated earlier, several women including as Ivy and Beth had non-I.T. undergraduate majors. Both women entered the I.T. field later than their male colleagues and spent longer "preparing" in the process. Women such as Theresa, Tabatha, and Trina did have undergraduate I.T. majors, but spent longer preparing before seeking promotion.

Perfectionism is also an instance where the sexism of the I.T. habitus is exercised on women not only by men or by other women, but by *themselves*. The scrutiny women receive justifies their caution, but the distinction between responding to scrutiny and internalizing critical voices is a fine one indeed. As mistaken as the impulse may be, it should come as no surprise. As illustrated earlier, this is the way habitus works.

Work in Isolation

Work in isolation – alone – emerged as a clear theme in all ten of the interviews. Theresa worked for very a small I.T. department in a much larger organization and specialized in one very carefully bounded area of responsibility. Connie, Beth, Ivy, Tabatha, and Lucinda all had very specialized skill sets, which enabled them to work mainly by themselves and report to a single manager. Kari, Trina, and Linda typically worked in teams, though small teams. Thomasina was a system administrator, and depending on the size and structure of the company may have worked by herself or in a small team. Whatever the details of their

work situation, all interviewees had managed their careers carefully and to the point where their daily interactions – especially with men – were very carefully prescribed.

To call this a counterproductive habit would be inaccurate, at least for the women involved. On the contrary, their relative social isolation not only suited their personalities, but ensured they *were* productive in their daily duties. For the I.T. habitus, however, this women's coping mechanism is clearly at odds with the team-oriented ideas associated with typical I.T. departments. Isolated work also doesn't lend itself to social forms of knowledge or the development of a common knowledge base. Again, this is more of a problem for the department or company than it is for the female employees.

Finding positions where one can work by one's self is also more difficult than finding a team position. Popular I.T. management methodologies such as Scrum or Agile assume a team work structure, or at least a functionally interdependent one. Once they found a position where they could work in solo, few interviewees were willing to leave them unless under severe circumstances (e.g. Linda, Tabatha and Kari's companies closed, respectively).

Female Suppression

Sexism is sometimes exerted by women on other women. For instance, Connie recounts a female manager she found difficult to work for, who seemed to be an exception among past managers she had known:

Once I felt that I was performing well, but my performance review were consistently poor, sometime negative, it was just very discouraging, so the last one and a half year, like after the first review, it was like, "okay", because I kept on working more, and delivering quality work, what I think is very quality work, but it was always discouraged. Like, "oh, no, no, no", that was the like, you know. So WebCo was a different experience, I'd say. I learned something about having ... Some of the folks used to say, "you don't work for a company, you work for people", I think that's when I understood that, why it was said that, because

having a good manager was very, very important at that point, and that's why even today I look for a good manager and not for a great job.

Ivy recounts a similar experience at the same employer, in which she had developed an ad-hoc user group for the data her development group produced. Ivy's supervisor Francine suppressed Ivy's efforts despite the advantages Ivy's actions would have brought:

And then I started this little user group, so we could talk through it. You know, "How are you using the data?" Because I really wanted to understand it. And it wasn't like ... I wasn't trying to get ahead back then. I didn't even know what I was doing. I was just trying to market our data more and, you know, kind of get a single version of truth. What are we doing here? Where do we want to go with it? Which everybody loved. The people that were in WebCo were loving that meeting. And Francine's like, "Don't do that anymore."

Francine's suppressing Ivy's initiative may have been based on some kind of perceived disruption of a social order intended to accompany the management hierarchy structure. That, or plain jealousy, which may be a simpler explanation. In her current employment, Ivy still experiences suppression from her female colleagues, though this mainly occurs as a kind of social back-stabbing. Rather than leaving room for interpersonal differences, other women whose approval Ivy doesn't quite acquire invent reasons for her to be denied advancement or opportunity:

If I'm not happy with something, I'm not going to talk about them behind their back. I think that happens a lot. "Ivy's this," or "Ivy's that," or ... I've found through the grapevine that people say things about me and put me in a box throughout my career. Like you told me, and it ... Things ... And they stick with me, David. They never go away.

Sometimes, women receive pressure from other women to conform to "traditional" gender standards, which naturally discourage women from participating in any of the STEM or

I.T. fields. In the following excerpt, Linda recounts a time in high school when despite her curiosity and play with computers, she was discouraged from pursuing an I.T. career by a female guidance counselor:

And then, my senior year, my math teacher said he was offering a course in computer programming, and it was on an Apple IIe with a 5.25 floppy disk, and I wanted to take that. Well, my high school counselor said ... she told me, "Well, I don't think you should take that course, 'cause even the smart kids have problem with it," which seemed odd to me because that was like the second time they were teaching this course, so what was her track record on? I was just stubborn, very stubborn. I said, "I'm gonna take this course." I got an A in it. The other kids were coming to me for trying to figure out, "How did you do that?" So then, I did go to UND for electrical engineering.

At one point, Linda received negative attention from the wives and girlfriends of her male I.T. colleagues, simply for being a woman in the men's workplace:

So, then this mean girl dynamic started, which is just ... I said, "This isn't worth it. This is too small-town. This is too ridiculous. This is just ... I don't need to be in junior high again. I don't get it," and similar things have happened other times. You have to work with this guy and then say, "Oh, here's my wife. Yeah, say hi," and the wife is like, 'Mm-mm.'" You're like, "Really? Come on," and it's just ... if you're a woman, you'd know right away. Guys are clueless⁴.

In rarer cases, women could be hostile or territorial to each other, to the point where it influenced career decisions. Tabatha recounts one work environment where the women were so openly antagonistic, she opted for a different department and with it a different career:

Yeah, competition but also just, "I'm going to make your life miserable. I'm going to make things hard for you. The more you try to fit in, the harder I'm

⁴Guilty as charged, Linda.

going to make it for you. I'm going to sabotage you." A lot more talking behind backs and stuff like that. I experienced that both when I ... in college I worked at the University of Northern Iowa hospitals and clinics. I experienced it there and then at ProdCo too. Then the women who were in engineering that I met, they were a lot more pragmatic. It's like if there was maybe some competition, it's more like the challenge competition to bring out your best, like one-up, but not to sabotage or to make somebody feel bad.

Grief

When we sat down for the interviews, I deliberately opened the conversation for them to express whatever views they wished. I carefully emphasized the ironclad confidentiality silence the study's IRB accreditation requires me to keep, and that I find it completely acceptable and reasonable. I realized my presence as a man may have dampened their perceived freedom to complain, so on occasion, I would make observations about the sexism I believe they had experienced. I would comment to the effect that I thought it unfair or unjust. My goal throughout was to enable them to speak as freely as possible.

Later, I reviewed the transcribed recordings and I was astonished at what I found. On occasions when I would comment on the sexism they experienced, the interviewee would typically reply with one of two responses: basic assent or diversion. If they agreed with me, they would usually say "Yes.", "Uh-huh.", nod their head, or otherwise indicate agreement. If they agreed, though, it would only be *in brief*. Seldom would they elaborate. On occasions when they disagreed, instead of indicating assent, they would divert the topic to something they believed instead about the situation, or change the topic to something else entirely.

The range of emotion they expressed during the interviews indicated a professional demeanor: very matter-of-fact, with occasional inflection for emphasis. They would often convey things in a "best light". A "best light" could be a positive point of view, levity, or humor. They expressed frustration, but never anger. This emotional range is consistent for

women following the rules and norms (*habitus*) of the professional I.T. workplace, given their gender. These women were no exception. Men routinely show frustration and anger with impunity, but not women. This was reflected in the women's interviews.

The one "non-professional" emotion they did show was grief. Sometimes their eyes would well with tears as they spoke, sometimes the tears flowed. They seemed aware of the problem of sexism, even if just at that moment. One interviewee apologized for "getting emotional", as if to acknowledge the "impropriety" of feeling as she did, or at least of showing it. I am still uncertain at times how to interpret this experience, but I understand at least that they would feel conflicted about their experience and what they may understand as a result of discussing it, and I am honored they would take this risk with me.

5 Analysis

The women interviewed here showed that they could not and did not stay in a state of permanent loss. Their personal resilience bolstered by external supports, they improved their situation to a livable – if not always comfortable – new status quo. This section will explore the different ways these women recovered from loss and built their careers and the careers of other women like them.

Women's resilience to the effects of the I.T. *habitus* comports with Wenger's theories on communities of practice. In a knowledge-based profession such as I.T., learning is essential for the continuation of one's career. If Wenger's theory is correct, community must be formed *somehow*, in order to support the learning necessary to sustain a career. In the following sections, we will see how women create their own communities of support to sustain their I.T. careers.

Symbolic Capital

Symbolic capital is the basis of competence and is the primary currency between I.T. workers. Especially in instances where they understand they are paying premium social and cultural capital, women are careful to notice any problems determining the social price of an interaction. For instance, one cannot be incompetent or non-competent and still perform well. Trina noticed this in one of her Computer Science courses:

Yeah, and I actually missed one of her classes, so I missed the class where we got the paper back, or our tests. Everybody in the class failed the test. I was the only one who got an A on that particular test and she was about to read me the riot act, and then she was, “Oh yeah, you’re the one that passed.” And I’m like, “I didn’t just pass, I aced it.”

Similarly, Connie noticed that while she received poor work reviews at WebCo, she received very good reviews at BookCo. This, despite her doing the best work she could for both companies, and both companies being reputable:

Yeah. I think I left on a very, for myself, on a very positive note, because after that, I went to BookCo, and it was really soul boosting for me. That I’m worth something, I’m worth a lot, a lot more than ... I am smart, is what I found out... Then I was like, “Oh, that means I am smart”, so that felt good. I think after that point, everything went a little up for me.

Connie frames the experience as pedagogical; a “learning experience” from which she derives further confidence:

I learned from everybody. Later, after working with a lot more, then I realized that it’s not the year of experience, it’s how much you know that translates to how smart you are, or how much I should learn from you, so that was good. I learned a lot from that team, a lot in technical world.

Arguably, the “teacher” of this pedagogical experience is Connie, not the experience itself. It would be easy enough – perhaps easier – to interpret her experience at WebCo as evidence she should *leave* her chosen career, not pursue it further. Ivy has similar thoughts, noting how she has progressed in technical skill and work responsibility, despite low management reviews:

This sounds cocky, but sometimes I feel like I know more sometimes than the people that I’m ... are my leads. They gave me this low review. Like, “You’re not adaptable. You really need to work on that.” I’m like, “I just solved the problem that you guys didn’t know what to do with.” I’m ... They didn’t want to make me a lead, but I’ve got guys who can’t make decisions. I’m the one doing the design work.

Noticing contradictions between formal evaluation and work promotion becomes a pattern; something they notice more with every example. Theresa sees other colleagues, mostly male, who evaluate their own or other male colleagues performance well, but which doesn’t compare well with her own:

Right. I mean, because I see pockets of ... well, I don’t know how much you’re seeing them. You see pockets of incompetence.

Trina has a similar experience at her workplace, with other colleagues who over-value their work:

It was really weird. I was like, “Is it because I can code circles around him?”

Because, we fixed a lot of code that he had written from the company that-

Sometimes compensation comes at the cost of one’s opinion of others (as immediately above), sometimes not. Whatever the case, these women are addressing external sources which mean to reduce their *Ständ* by degrading their primary social capital (Competence). In brief, the women don’t allow it, at least not to themselves.

Cultural Capital

Cultural capital concerns the results of symbolic and social capital, whether as a person or as an object. In the case of software engineering, software source code is a very important form of cultural capital. In the excerpt below, Trina recounts confronting a male software engineer about reviewing his software source code:

But it was like- We've been pretty collaborative and this was one of those things, I even said to him, "You know what, I'm really glad I brought you in at the beginning because if I'm showing you this two days before it was going to production after everybody tested it, I wouldn't be changing it." So, I think timing is an issue and some of our code reviews have not been as timely as they should be. Today, someone said, "I'm done with this code and this code and does anyone have a problem with me moving it to production tomorrow?" And we're like, "Yeah, all of us. 'Cause you haven't reviewed it with us, nobody has tested it. Yeah, no." He's like, "Well I've tested it." We're like, "Yeah, not good enough. Not even remotely good enough." So, that was interesting. It's like, you know better. No, it's not going tomorrow. He's just like, "Well I've just got so much- My hands in so many different pots and I just want some of it gone-"

In this case, the male employee doesn't degrade Trina's cultural capital. Instead, he assumes his own cultural capital is more valuable than hers, to the point where he doesn't need to follow the typical review procedures where she would review his code.

Social Capital

Other forms of social currency are also compensated for, usually personal. Trina recounts her experience getting laid off after a vacation, knowing it was likely but not knowing precisely when it would happen:

I took one week's ski vacation, came back for a week. We had a giant party, giant happy hour. It was pretty fun. We actually had a happy hour and the director paid for the first two rounds. I was like, "This is not a normal layoff."

Trina and her colleagues decided not to take the negative feelings one could have about a layoff seriously. This clarity about how work is situated within life – rather than the reverse – was a major premise of group dynamics:

Never about work, they're usually about family and life and stuff.

Networking

One important way women compensate for high social capital prices is networking. Networking lowers the price of social interaction – or at least stands a chance. Tabatha recounts an hostile work environment, where she circumvented the normal management structure to improve her situation:

Yes. I mean, yeah, it was. You kind of felt cheap like, pulling the senior management card, but he was in my chain of command and he took care of it, so it was good. That's the other thing I would say about TankCo, is that they had not just mentors, but they had advocates.

In Linda's case, her network of women helped her stay away from potential sexual harassment or sexual assault:

Yeah, and the other women would be there to tell you, "Yeah, stay away from that guy. That guy's trouble," kind of the whisper network they talk about with Harvey Weinstein.

Adding new women to development teams presents the opportunity to grow their network, as well as grow in skills. Kari cites an example where a new female work colleague made her work environment emotionally safer, which helped improve her programming skills:

I came to the job wanting to learn, and so I would work alongside my older male counterpart, just learning how to develop. What made it great was when there was another young female engineer that came on board and we bonded and we started taking over, like contributing more to the code base, and actually helping ... like being pivotal in the success of the project because we would be given these star awards. So it was really nice when you have another female engineer to just ... where you feel safe and can just back each other up and just support each other through that journey.

Trina made a point of making friends with new women in the workplace and growing her network:

It was fairly good and it seems that I've been surrounded by women in a lot of my projects. That project I remember was- My particular team was mostly women. As a matter of fact, it was mostly white women, which is interesting.

Yeah, no, I always fit in, oh, with women. Or I always feel like I fit in. I guess I just make myself fit in. I think it's genetics. My dad's always been that way.

Flexibility

Flexibility is also a very valuable skill, and women may be called on to be more flexible than their job description entails. Connie cites an instance where she was flexible about her job title, but in the process was able to leverage her prodigious technical skill to her advantage:

I think they are trying to leverage my skillset, as in I already knew big data, and I have technical background, and I had been in an analytics team where I had learned enough about marketing the business, so they see a good combination. I have a very good combination, where I know the business, so I understand what needs to be done, or I understand the business problem when somebody comes to us, and I am technical enough where I know where I need to intercept myself,

and how to get help from IT, if needed. Yeah, now I'm talking IT, since I'm in marketing, but-

Sometimes, a sense of humor – even a dry or ironic one – is needed at the same time as flexibility. In one instance, Ivy was criticized by her managers as not being flexible, despite her result on a “Strength Finders” professional skills test:

They gave me ... You know the five ... the “Strength Finders”? My top strength finder is adaptability.

Sometimes, there's now way to describe the kind of flexibility you need, other than the “just go with it” kind of attitude Lucinda describes:

Yeah, you can just bounce.

Tabatha

I just kind of fell into it, because anything you could do to improve the communication, because they kept butting heads so much. Nobody was like, hostile about it or anything like that, whereas I think at Lockheed it was, only certain people could talk, only certain people have value, only certain people were important enough. Titles are status, and that kind of thing.

The ability to walk away from a job rather than fight unnecessarily about or for it is also a form of flexibility. Trina describes one such instance:

And a week later I asked him “Had he thought about it.” And he's like, “Yeah, in six months we'll revisit it.” And I'm like, “I'm not doing this for six months.” And then I left. At the end of his speech he was like, “Are you gonna look for a new job?” And I was like, “That's none of your business. It's just not.” And then I actually- The job I have now fell into my lap so I took it.

This kind of flexibility entails taking the chance that changing work conditions may or may not improve them, and to be willing to monitor the work environment carefully. While doing so, Trina discovers that her manager is the main problem with her job:

Male manager that after she left was calmer. She enjoyed her life- Kept the next job for five years after that. It was him. Even the first Trina that had that position hated her job and realized it was him that made her hate the job.

Mobility

If flexibility about work conditions is insufficient, it may be necessary to leave and find another job. Most women interviewed here had a work history which included multiple employers, though mostly similar job descriptions. Ivy describes her feelings when it was her only remaining option:

I moved ... I finally got tired of dealing with the male boss. So I moved teams so I didn't have to deal with this guy anymore. Which I find I have had to do a lot in my career, just say, "I can't make this work. So I'll move. I'll either quit my ... quit the company or ... " I quit ChainCo just because I got tired of the ...

Work in Isolation

One alternative to leaving a company is finding a position in it which isolates them from problematic teammates or managers. This often accomplishes the same goal as leaving, while retaining some of the desirable aspects of the work environment.

For some work environments, work isolation means shifting social engagement to a different part of life, such as engaging more with non-work friends. Lucinda cites an instance where this was true for her:

Mm-hmm (affirmative)- Yeah, it was really nice. I don't know. I think I've had enough jobs since then where it just hasn't really happened that I'm not really.

I'm just kind of used to it being this way. So, and you just make friends and have your lady friends come over after work.

Some jobs entail isolation by definition, such as Thomasina's experience as a contract software engineer:

Mostly, I worked on assignment at a client's site, and I was placed as an individual.

In other cases, isolation or engagement with colleagues is an option to take or leave. Beth cites one instance where she didn't feel she could easily engage with other colleagues:

It's all right. I have a seven year old son, so had I not had a seven year old son, I would be totally out of the loop on video game stuff, which they seem to like to talk about a lot, and I just really don't care about that kind of stuff: a lot of eating lunch sitting at your desk type stuff, which is a little isolating sometimes. I don't know why it's that way necessarily. I came from ... I worked with mostly young men at my other job, too, and we would ... because it was a food service job, we had a lot of eating together, hanging out together. It didn't seem to be a big deal, just less social than my old job, I think.

Disengagement may also occur as a result of differences in age or seniority, as Connie discovered:

There were a lot of other interns as well, but I would work alone on a company's project, yeah.

Collaboration

In a narrow sense, self-care also entails enlisting the help of others. Collaboration as a form of less formal networking establishes connections with others for mutual benefit, and often

personal support. In Trina's case below, the social capital resulting from a professional collaboration can be a source of accountability:

it was like- We've been pretty collaborative and this was one of those things, I even said to him, "You know what, I'm really glad I brought you in at the beginning because if I'm showing you this two days before it was going to production after everybody tested it, I wouldn't be changing it." So, I think timing is an issue and some of our code reviews have not been as timely as they should be. Today, someone said, "I'm done with this code and this code and does anyone have a problem with me moving it to production tomorrow?" And we're like, "Yeah, all of us." 'Cause you haven't reviewed it with us, nobody has tested it. Yeah, no. He's like, "Well I've tested it." We're like, "Yeah, not good enough. Not even remotely good enough."

Structural Support

Representation

The interviewees were aware of their minority status. Beth noticed this even while she was still a student at TeachCo technology school:

I mean, for one thing, it's pretty obvious that you're in the minority. For another thing, you're talking about it constantly and people are ... some people don't really wanna do that, you know, so there was some tension around women and people. I think it was if you weren't white or you were a woman, you got \$500. There was a scholarship, so when you applied when I was going there, there was a scholarship for women, people of color and veterans. So, that was ... a couple of the men in the class were like, "I don't get it. Why?" And we were just like, "What do you mean?" I personally wouldn't have gone had I not seen that they specifically wanted women to go there because a lot of this stuff is like ...

It was hard going into something like that and knowing you're in the minority and just looking for that in that situation... I mean, in our conception of how you're supposed to behave as an individual, you're not supposed to think about, "Oh, I would like to be people that look like me," because that's sexist or racist or something, but everybody does it subconsciously.

Beth chose I.T. because she loves it, but she also chose it as carefully as she could, given the representation she saw in related fields:

In electrical engineering. And that, specifically, that experience, I was really turned off by the lack of women. It was like me and one other woman, and rooms full of ... and my advisor was a woman, but it didn't seem to help... It was hard going into something like that and knowing you're in the minority and just looking for that in that situation.

Instead, Beth's time at TeachCo and in her workplace, she was able to find and create a network of colleagues and friends:

There wasn't a lot of girls, and I don't know if it was shocking or not, but I was felt like ... I did make friends with a lot of other females and the males, but the balances, there was a lot more males than there were females.

Theresa has some powerful thoughts on the double-bind low representation causes. Sometimes, the worst sexism is tacit:

It's more just like I would show up in a room with nine men, and nobody says anything or does anything that is rude or just dismissive of anything I have to say, but I sit there and I feel very uncomfortable.

Beth and Theresa's thoughts show how representation is important at every organizational level. Connie and Ivy were involved in management positions and networking groups and Kari was involved in leadership classes sponsored by her employer and women in management positions.

Gender: Rapport and Awareness

Trina had a unique relationship with her gay male friends, where she was able to discuss her professional and personal life more freely than with others:

It helped. Actually, I took him to happy hour to Buca and all the bartenders- 'cause it's a half a mile from my house, so I was there a lot- All the bartenders were all gay and he's like, "And they're cute." He's like, "OK, I can do this."

His insights provide her feedback she doesn't receive in other ways:

He picks up on tone when people are talking and I just don't always. I do now. He says, "You said this." And I'm like, "Yep." And he's said, "You said this in this way that makes me feel like this." And I'm like, "OK, then I won't do that anymore." So, he's always up front about everything and I think it's him being so up front that has helped everybody else. It works. It makes our team work better.

Personal Resilience

Environment

In addition to interpersonal resources, there were several kinds of internal, personal resources and strategies the interviewees used to improve their professional lives. One important strategy was to regulate or change their environment when needed. Some environmental changes were a result of company policies such as flexible working hours. Theresa cites one instance where she left a job because it didn't have the work hour flexibility she wanted:

I kind of like the cross between user experience and development and the web, specifically web-related work. But I think what I didn't like was the corporate atmosphere and the client base... But I also had found it restrictive with even

just the nine to five kind of thing. Most other places I've worked have had a little bit more flexibility than that.

Most interviewees needed flexibility to accommodate family life, but it also allowed them to better manage their interactions with other employees. The I.T. habitus would have workers take a stoic or at least indifferent attitude toward work environment. However, for many women, work environment wasn't just policy, it was ambience; the workplace had to be someplace at least nominally pleasant to be during the work day. Theresa cites one instance where she left a job because it wasn't:

We worked in basically a dungeon. They've since moved offices, but where we were working at the time was in an old mail room, at least the front end developers. And nobody liked fluorescent lighting, which I understand, right? Fluorescent lighting sucks.

Roll Off

One very common theme among interviewees was a basic indifference to sexism, especially sexist comments. The following quote from Trina exemplifies this attitude, which she established long before starting her I.T. career:

But, yeah, our professors were pretty even but that might be that whole bias thing again. 'Cause I just read that article about this friend, with the run-in, the racist run-in, texted his ex-girlfriend who happens to live here, and we were talking about it. She was like, I just always thought we lived such a wonderful normal life and there wasn't any racism. There was racism growing up, you just either take it in and it destroys your life or you just let it roll off your back-

Trina's family is originally from Jamaica, so she was conscious of strategies for handling discrimination in the form of racism. These applied just as easily to I.T. sexism. One core principle of the I.T. habitus is a kind of capitalist, Taylorist disloyalty to employees:

organizations are structured like factories, profit depends on production, and employees are organization components like factory machines. The “roll off” attitude easily extends from dealing with sexism to handling management decisions:

My team got dismantled and I got moved to that one team where I was the next person on the chopping block. My boss and our director both told me that they had this weird formula. They all looked at it and they went, “Trina’s the one that has go to, but we have under-performers across the board that could have been gone.” So that- It was fine.

Developers like Trina become agnostic to the decision methodologies used by management levels above the software develop. The apparent lack of rhyme or reason to their decision making is ultimately of no concern:

I have no idea what the formula was. 'Cause I also had a friend in HR that had known for four months that I was the next person in that team to go.

Optimism

Naturally, there are parts of a person’s professional support network which may prove deficient. There is a modicum of luck in finding colleagues with whom one can not only work well, but establish a professional support networks which will sustain them longer term. Realizing she needed better work and socializing opportunities, Kari decided to move to a different job:

I feel like everyone has opportunities, maybe more so than others. And sometimes you gotta take chances and that everyone has something to bring to the table. And that has always been my core belief.

Kari’s feelings are also shown later in her interview as she wrestles with whether and how to pursue her company’s leadership training and mentorship program. The optimism she

shows is a kind of multifaceted faith that events and involved persons will work generally in her favor. Even when not entirely true, this faith offsets the perceived risk.

Luck

The I.T. habitus generally attributes success to merit and skill, and failure to personal defect or vice. It leaves very little to chance, fortune, or plain luck. This stands in stark contrast to the interviewees' experience, which includes a healthy modicum of luck when finding and navigating a healthy work environment. During my interview with Linda, she and I discussed a point in my career when I had two simultaneous job offers and was contemplating which one to accept:

Okay, well, don't go to MedCo. They'll chew you up and spit you out. It's, I think, a matter of being lucky and who you work with, but also, they expect you to work overtime.

Linda talks about the luck which plays a surprisingly prominent role in organizational cohesion; ultimately, things will work out, or they won't, and merit may have little to do with it. As for me, I chose the non-MedCo job offer based on a gut feeling I'd had about one interview. I got lucky, clearly. In retrospect, I wish I had known Linda had worked for MedCo before; I would have had the benefit of her insight as I was deciding.

Luck holds a unique place within the logical of Table 1. The increased price men charge women for social and cultural interaction is based on what they view as the merit of men's position in I.T. Nothing could be further from the truth: men's position in I.T. – like their existence as men – is more accurately attributed to luck than to merit.

Problem Solving Strategy

One way which the interviewees showed intuitive leadership skill was their flexibility toward ambiguous situations. Regardless of its origins, they were presented with a software-related

problem which needed solving, and that was all the motive they needed to solve it. Their strategy was first to be flexible, and the only premise they held firmly was that the problem must *somehow* be solvable. That, or their efforts would prove a valuable feedback mechanism to the requirements they received.

The first decision they make is the role they will play, as evidenced by Kari's story:

I was asked whether or not whether I wanted to be more software or system. And so I'm like, "I'm going to go with software." I asked like, "Where do you need the help most." And they said software, and I said, "Okay. Then I'm going to go with software."

This first decision is one of the more crucial ones: where and how to deploy resources. Once this is decided, they proceed with analyzing and solving the problem at hand, as Trina illustrates:

It was interesting. Some of the people that worked for- We were at FoodCo. They felt more pressure than we did 'cause they had to teach us everything and they were like, "We really want you to know this, super fast so I can go do something else and I don't have to support it anymore." And for me it's always been, "If it works it works, if it doesn't, we'll figure it out," 'cause it's not surgery.

Reframing problems this way makes them a "no-lose" proposition: either the problem can (and will) be solved, or the good faith attempt at solving the problem will show how the requirements should be more closely analyzed.

Age

As women's careers extend into mid-life, they grow in maturity, knowledge, and experience. Commensurate with age are stabilizing personal factors such as long-term relationships with friends and spouses, and the household stability their children require. These factors combine to provide their own form of self-confidence, as Beth explains:

Yeah. I mean I don't necessarily not feel like that at my job. I don't feel that different because I'm a woman. In the past, I would say when I was working at corporate jobs after college — so this is like 2004, 2005 — I had a lot more skepticism than now. I don't know if it's 'cause I'm older and 'cause I looked 16, then.

I don't know. Maybe I have more confidence now, too. That's probably huge.

Beth also notes that as she grew older, others around her perceived and treated her differently.

6 Conclusions, Implications, & Further Study

Leadership Implications

Leadership implications for the problem of sexism in I.T. are numerous. First is the problem of initiative. Leaders who would change the I.T. culture must confront the “you go first” problem: both I.T. workers and management know their workplace would benefit from better cohesion, but both believe the other “should go first” to solve the problem. Leaders will need to bring both together simultaneously, to commit to rejecting and replacing the current sexist I.T. culture. This commitment will require continuous negotiation, new ideas, and reliable feedback mechanisms (Kramer & Enomoto, 2014). Reducing sexism in the I.T. workplace will likely require new forms of dialogue between male and female I.T. workers and management. I.T. workers within common social strata will need to engage with each other more to resolve and prevent sexist discrimination, rather than simply obeying orders from management or Human Resources.

Once brought to their attention, Human Resources departments are often assigned to sort out all manner of “social problems”. Explicitly, their role is to manage access to benefits such as health and retirement, and are sometimes called on to mediate problematic situations between employees. Less explicitly, they work closely with the company's lawyer(s) to

help it avoid legal liability. Accusations of gender-based discrimination can render corporations susceptible to costly, extensive court proceedings and public relations problems if the allegations reach public attention. Whenever such accusations are brought, director-level and upper management would be notified immediately, and H.R. representatives step in to mediate the situation. Their approach is very top-down, management-oriented, and legalistic. Additional reporting and surveillance (Foucault, 1977) measures would be implemented, with the goal of discovering and punishing transgressors.

The top-down, legalistic approach has several advantages. Once management is “on board”, they can explicitly set the tone for the entire company: if top management says openly that gender-based discrimination is wrong and counterproductive, then any ambiguity about it is resolved. Management is also able to provide clear direction for awareness initiatives, support groups, or in the best circumstances, policies or programs which encourage and train women for leadership roles. Programs and policies such as these are also popular in progressive urban areas, and may provide a public relations boost for the company. This same approach is also limited in several ways. The first is the basis of judgment: definitions of “discrimination”, “misconduct”, and more generally, how to know their effects. As previously discussed, the I.T. habitus generally prevents workers from sharing dissenting views with management, so the power of management allows them the prerogative of any definitions or judgments they choose. What management cannot control is their employees actual thoughts and feelings, expressed or not. Management’s assertion of force can be met with assent and compliance, or backlash and quiet subversion.

Alternatively, one could use a bottom-up, grassroots approach instead. On a small scale, efforts against sexism would consist of small-group interaction and organization. Goals for these groups would be equally small-scale, though important: discuss and monitor the progress men make in breaking sexist habits, hear women’s career stories, and take steps to further women’s careers. Cooperation and creativity should be the central values of these groups, as much as mutual benefit. Men may need to cede power at times, though the

practical realities must be understood carefully.

This approach would require sponsors and advocates at the lowest hierarchical levels of employment (i.e. software engineers), and would need to be balanced equitably by gender. The organizational and morale structures would be similar to social movements (Buechler, 2000; Clemens & Minkoff, 2003; Hall et al., 2011; Tilly & Wood, 2013) such as the civil rights movement (Civil Rights Movement, 2018), the human rights campaign (Human Rights Campaign, 2018), the equal rights amendment (Equal Rights Amendment, 2018), and the #MeToo movement (#MeToo Movement, 2018). This approach is also limited in several ways. Without juridical force, the movement's central issues or motives can be viewed as simply "optional" to those in positions of privilege (i.e. men). Movements are risky for this reason, and are vulnerable to counter-movements and anonymous (e.g. online) attacks.

The problem of sexism, like any repression, requires persistent effort to overcome. Neither the legalistic nor movement-oriented approaches are perfect; both are vulnerable to dissent, both internal and external. Not everyone will agree completely with either approach. For that matter, not everyone is likely to believe sexism exists. The most prudent course of action may be a balance between the juridical and movement approaches; a balance of coercive power and internal transformation. A feedback loop between official and unofficial sources should be established, in order to gauge quantifiable and qualifiable progress. Perhaps the greatest source of risk is the men concerned. Men are viewed with suspicion by the juridical approach, yet must be regarded as allies by the grassroots approach. This tension must be understood and acknowledged, since it will displace the comfortable privilege men previously enjoyed.

Future Research

Leadership Development

The first area of research is an application of leadership implications presented in the previous section: a hybridization of juridical and movement approaches to ending sexism. Implementing this idea would require women's support groups, support from management, and mens groups designed to break sexist habits.

The women interviewed for this research all worked at medium to large companies. Fortunately, companies of this size generally include enough women to form support groups. Women's support groups can aid in facilitating women's careers and providing moral support. These groups will need to develop strategies for working with men in new ways, negotiating new terms without compromising their position.

Upper and middle management who agree to anti-sexism efforts would need to support both men and women in their efforts. The reinforcing power movements lack must be supplied by the organizations they inhabit. Not to mention, companies could also provide basic infrastructure such as meeting space and electronic bulletin or posting boards.

One important third piece of the new anti-sexism efforts would be mens meeting groups. These groups would be designed to explore new anti-sexism concepts and support each other in breaking sexist habits. One constructive way to explore new habits would be to make women's "invisible work" as visible as possible. Men would be encouraged to be as involved as possible in emotional work, both at home and in the office. Men increasing their roles at home would give them a better idea of the stress women are under as they support both their family and work colleagues. Men increasing their use of sick and vacation time to take care of children could provide them a practical understanding of how time away from work can erode their chances of promotion. If enough men actually *did* as women did, how would their new insights change how they viewed the way work life and family interact? Would their new insight prevent women's careers from stalling when women commit their lives not

only to their work, but to their family?

Gamergate Case Study

One adjunct area of research is the nature and role of sexism in men's culture outside the I.T. workplace. Video games are very popular in general, but are especially popular among adolescent boys. Video games entail user escape from reality, and with a few notable exceptions, rarely depict real worlds accurately. This is deliberate and usually adds to the appeal of the game.

What video games cannot control for is the amount of time boys play them. Healthy video gaming entails a broad social perspective: video games are part of a much larger social life which includes a great deal of personal interaction. Healthy young men not only interact in school, but through social gatherings, events, and sports. Many times, video game play includes personal interaction (e.g. via headset).

A less healthy practice is where the games provide socially insecure boys an escape from interpersonal interaction. Online gaming often requires a user to create a personal profile or character to represent them in the game, most of which are as fantastical as the game itself. When taken too seriously, the gamer hides from their real life in the "life" of the online character and opts for the personal anonymity the game provides.

The "Gamergate" controversy concerns sexism among socially insecure male gamers. An online Wikipedia article summarizes it well (Wikipedia, 2018):

In 2013, Zoë Quinn, an independent game developer, released *Depression Quest*, a text-focused game designed to convey the experience of depression through a series of fictional scenarios, based in part on Quinn's own experience with the illness. The game received positive reviews in the gaming media, but faced backlash online from gamers who disliked its departure from typical game formats emphasizing violence and skill and who opposed "political" intrusions into gamer culture. Quinn was subjected to several months of harassment after its release,

including rape and death threats. Quinn documented the harassment she received and spoke openly to the media about it, which led to an even greater intensity of abuse against her, including the posting of her home address online. She ultimately fled her house out of fear for her safety.

There exists extensive journalistic coverage of Gamergate, including Zoë Quinn's own firsthand account (Quinn, 2017). Most striking about the case is the severity of the attacks against Ms. Quinn given the nature of her "transgression" against the norms governing gaming and game review. The attacks seem, in a word, overblown; exaggerated displays of aggression, open hostility, and threats against her person. None of these seem warranted, except perhaps to their larger male audience.

I am unable to find any disciplined scholarly analysis of Gamergate, or more generally, the hostility some gamer boys feel toward women. The importance of the situation, however, should not be underestimated: the boys who responded so violently to Ms Quinn are exactly the sort who grow up to be software engineers as men. An analysis of Gamergate would draw on several social theories, including Durkheim's theory of symbolic interaction and social ritual (Collins, 1994), standpoint theory (Au, 2011), and Irving Goffman's theory of roles (Goffman, 1959). The analysis would also use tools such as Lincoln's taxonomy and analysis of anomalies (Lincoln, 2014), and intersectionality theory applied to women's culture and geek culture (bell hooks, 2014). Application of this research would feed back into the anti-sexism research ("leadership implications") outlined earlier, especially regarding men who vehemently oppose it.

From Where I Stand

I remember meeting with Ivy recently, to interview her for this research. We both re-told our side of the WebCo story, adding a few details about what had happened before, afterward, and since then. I remember the situation with Francine, Ivy, and Connie as being unique to my career; I had never up to that point had such trouble with a manager, and really

hadn't since. During my conversation with Ivy, I discovered this experience was decidedly *not* unique to Ivy. Ivy had done much, much more than survive in her career. She had thrived and earned a managements spot at a small company where she was well-respected by her colleagues, well-liked by her manager, and enjoyed her work as a software engineer. But her career had come at a personal cost, one that I not only had never paid, but one I never dreamed *anyone would* pay.

I recognize the irony deeply embedded in the work presented here. That a middle-aged, middle class, white male – *the* picture of privilege, *especially* in I.T. – would take up the issue of sexism *in his own workplace* is problematic to say the least. Some would say I have no business writing about it; that sexism affects women directly and therefore is exclusively their purview. Others might ask why I care, or would find suspect any motive I would offer. All of these are fair objections, and in the public sphere, I am no doubt as guilty as charged⁵.

But these perfectly good objections do nothing to solve the problem. From a strictly practical point of view, sexism is counterproductive. The I.T. unemployment rate is underwater, and job recruiters have difficulty finding candidates. I still receive solicitations to fill job postings almost daily⁶, and if I turn them down, they always ask for referrals. Male-dominated software development teams are rife with competition, which is *known* to degrade performance (Johnson & Johnson, 2012). Conversely, team diversity is known to improve performance (Thompson, 2015; Woolley, Malone, & Chabris, 2015), starting as early as the undergraduate classroom (Kim, Fann, & Misa-Escalante, 2011; Ng, 2008).

Ethics is still at the core of this investigation (Thacher, 2006), so, I offer now what I offered at the beginning of this study: the intuition that something doesn't seem right; isn't fair despite appearances and accepted norms. Sexism degrades the I.T. workplace from several points of view, but primarily a personal one. And I am careful, here: my point is not to offload a "personal problem" onto any one person, but make it the responsibility of

⁵No, "as guilty as charged" is not a mistake. In the public eye, condemnation and guilt are often the same; the "where's there's smoke, there's fire" school of law.

⁶Well, for now. We'll see if this changes once this dissertation is published.

the I.T. workplace which fosters it.

Conclusion

Sexism – and those who would practice it – eventually presses its advantage too far. Women react first out of a sense of basic self-worth; that whatever sexism has been forced on them is no longer entirely reasonable and cannot be uncritically obeyed. There *is* room for them to keep their own counsel. There *must* be. Eventually, women examine their lives and experiences, especially with an eye for contradictions. Women also begin to reach out to other women – primarily – for support, both emotional and practical. They also look for advancement in their careers, seeking representation as software engineering specialists and as management. This cycle of self-worth, self-reflection, outreach, and action is exercised repeatedly as they build their careers and gradually make the I.T. habitus visible. Their efforts do relatively little to change the habitus, but instead inoculates them to it. They are no longer affected as intended, and feel no reservations about maneuvering their careers until they find a situation which suits them. Sexism no longer has any grip on what they *should* do, only what they *can* do.

The major findings of this research reveal substantial differences between the way men and women in I.T. are viewed and judged. Most of these are unexpected; buried deep in social context and nuance. The complexity of the situation bolsters its credibility. Many problems presented here will not be easily or quickly solved; it's difficult to know which problem is most important and even more difficult to know where to begin in solving them. These objections, however, do nothing to diminish the importance of addressing as directly as possible the problem of sexism in I.T. and elsewhere.

The greatest advantage of the work presented here is the women's voices themselves. Admittedly I have summarized much of what I heard in interviews, but except in instances where I demonstrate connections between their testimony and its larger context, I have served mainly as reporter. Certainly, it is my goal to preserve as much of their voice as

possible. The leadership implications identified in the previous section may provide some guidance; a larger and more nuanced conversation about sexism in the workplace is certainly merited. That, coupled with some concrete, tangible changes in the habits – the *habitus* – which so effortlessly supports sexism.

Now, if you'll excuse me, there are a few men I would like to speak with.

Appendix

Author's Note

This document was produced using the L^AT_EX typesetting language and associated technologies, as adapted for and distributed with the Ubuntu 18.04 LTS operating system.

Research Questions

The interview began with some informal questions, intended to begin a conversation about the interviewee's career in I.T. These questions were designed to understand the appeal the interviewee felt toward programming, the software programming practices they created for themselves, and the support (or lack of support) which the interviewee received for programming.

- What first interested you about computers? What was the appeal for you?
- What were your first experiences with computers like? Who was involved?
- What kinds of things did you like best about computers?
- At what point did you consider programming? Describe the experience.
- Did you talk to anyone about programming? If so, what did you talk about?
- How did your experience of programming feel over time?
- Did anyone you know also program computers? Do you know what that experience was like for them?
- How did your experience of programming compare to others you knew who were doing the same?
- How did others feel about you programming?

- Who supported your programming? What did they say?
- Was there anyone who “wasn’t so keen” about you programming? What did they say?
- Was there anyone who was indifferent to you programming? Was it expected, or not?
- Did you have friends who also programmed?

With the previous questions as a kind of “icebreaker” or “warmup”, the interview proceeded to more probing questions involving the workplace⁷:

- What norms for team interaction do you find suitable or comfortable? Which would you like to change?
 - How well do you feel valued by your teammates? By the company you work for?
- In what ways do you feel being a woman is different from being a male team member?
- Which, if any, standards or norms do you feel apply to you but not to the men on your team? To men in general?
- Conversely, are there standards or norms which you feel apply to men but not to women?
- What process does your team have for reviewing code or application design?
 - How do you feel about the norms used to evaluate your software design or coding?
- How are conflicts about software design or coding resolved?
- What process does your company have for evaluating work performance?
 - How do you feel about these processes (team and corporate), and how have they influenced your career?

⁷Questions with additional indentation are follow-on questions from the previous.

- How evenly or fairly are corporate policies applied to you, versus other team members?
- Have you received bonuses, raises, and promotions at approximately the same time as others who are also at your stage of their careers?

One indirect goal of these questions was to find the point at which the interviewee's programming experience became self-reinforcing. The scope of personal support was still narrow, but the amount and quality of their programming experience has no limitations.

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