

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

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Five-Page Summary

Introduction

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 research 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.

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”.

Literature

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.

Findings

	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 pay as the older ones did.

The application of I.T. habitus to women’s lives is summarized in Figure 1. 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.

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 see the interaction between the increased social and cultural costs to women, and the I.T. habitus setting its price. We also see how women’s

Figure 1: 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

efforts to survive and support each other alleviates that price. Bourdieu's developed the theories of symbolic / cultural / social capital and habitus independently, but this research shows how they move together – like the two sides of a coin.

Interviews

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), education, and seminal mentoring. A common thread through these experiences is the nurturance and personal acceptance exhibited by their role models, which they experienced long before they chose an I.T. career. Their experience with role models also provided psychological sanctuary during difficult times.

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. 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.

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.

Implications

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 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. 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.

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.

Further research would also examine the young male “geek” video gaming culture as exemplified in the Gamergate case (Quinn, 2017). Most striking about this case is the severity of the attacks against Ms. Zoë Quinn, a game designer, 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. This research is important because despite the apparent innocence of adolescent male vitriol, the boys who would so freely express such violent sentiments are exactly the sort who grow up to be software engineers as men.

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