The International Encyclopedia of Gender, Media, and Communication

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Abstract

The technology gender gap is a phenomenon with many interconnecting parts. This article describes the history of the technology gender gap and the experiences of women working in technology professions today. It also examines consequences that the technology gender gap has on technology creation processes and products. The article will conclude with survey of initiatives aiming to counter the tech gender gap.

Keywords

computing, gendered labor, hierarchy, innovation, technology education

Main text

The technology gender gap is a phenomenon with many interconnecting parts. This article will look at the history of the gender gap and the experiences of women working in technology professions today. It will also examine the consequences that the technology gender gap has on technology creation processes and products. The article will conclude with a survey of initiatives aiming to counter the tech gender gap.

The advent of computer software development was defined by women. Mathematician Lady Ada Lovelace published the first algorithm for a general-purpose computer in 1843. Many decades after her lifetime, these machines were finally implemented by teams of men beginning in World War II. The software that ran on these large, room-filling machines was written by women "computers". These early software developers were called computers because they had previously done calculations on paper and were therefore seen as ideal candidates for early software development jobs. "Computing" was categorized as women's work because it required attention to detail and was seen as akin to clerical work, a job that was at the time done almost exclusively by women. In the hierarchy of achievement, the pioneering work of early women software developers long remained invisible whereas hardware work done by all-male teams of

computer engineers was celebrated. In the post-war years, software development shifted from the context of military and science applications into the business context and this started the influx of men into the field. Since 1985, the rate of women in computing occupations in the United States and the United Kingdom has been in decline even though women's participation in other areas of technology has increased (Abbate, 2012). For more than a decade, the rate of US women receiving undergraduate degrees in computer science and engineering has been in decline compared to other STEM disciplines. Women make up about a quarter of people working in computing occupations. The majority of these women are white (Ashcraft, McLain & Eger, 2016). International technology companies like Google and Microsoft have been releasing workforce gender data since 2014. The data reflects the trends cited above: Women and minorities are consistently underrepresented in the global workforce, the tech workforce, as well as in leadership.

Progress on increasing the numbers of underrepresented employees has been slow for technology companies. Sometimes this is attributed to a pipeline problem: Graduation rates among women in Computer Science and Engineering are low after all. However, retention of women in Science, Engineering and Technology (SET) jobs is the main factor in the stagnation of the number of women in tech occupations (Ashcraft, McLain & Eger, 2016). A study examining why women and men of all backgrounds leave tech occupations found that "Almost one-third of underrepresented women of color were passed over for promotion--more than any other group" (Scott, Kapor Klein, & Uriridiakoghene). In another study, a large fraction of women working in SET companies in the US, Brazil, China, and India reported that they considered leaving their jobs. SET women experience feeling stalled in their career. The highest rate of women who feel stuck or stalled are African American women. There are multiple factors contributing to perceptions of stagnation and lack of support among women. A large fraction of women in tech experience are sexual harassment and unwanted attention for feminine appearance (Hewlett, Sherbin & Dieudonné, 2014). Women receive disproportionately more criticism in performance evaluations than men. The kind of feedback in performance evaluations for women tends to be negative instead of constructive as is the norm for men who receive feedback (Ashcraft, McLain & Eger, 2016). Deeply ingrained macho cultures across SET further diminish the respect that women can claim for themselves. A symptom of women feeling stuck is that women report not having access to creative technical roles and being directed towards execution. Despite being told to "lean in" and become leaders, women as an underrepresented group in SET lack informal networks and sponsors. These are readily available to SET men and are crucial in helping them advance in their careers (Hewlett, Sherbin & Dieudonné, 2014). This leads to a general sense of isolation among women (Ashcraft, McLain & Eger, 2016). As a result, advancement to leadership roles is more difficult for women than for men in tech companies (Hewlett, Sherbin & Dieudonné, 2014).

Where do women who leave tech occupations in private companies go? Hewlett, Sherbin, and Dieudonné (2014) found that about half of the women who leave the private SET workforce use their training either by becoming self-employed, working in government or nonprofit sector or at a startup. The other half abandons their training. They find a non-SET job in at a different company take time out of the workforce, or find a non-SET job in the

same company. For the majority of the women who took time out of the workforce, family concerns did not play a role.

Among those who leave a tech job for another job in the same industry, the decision to leave is often related to experiences of unfair treatment. One study that specifically studies women and men leaving tech jobs, reports that experiences of unfairness are more common in the tech industry than elsewhere. The study reports that these experiences differ greatly across groups. Women regardless of background experienced or observed more unfair treatment than men. Underrepresented men of color were most likely to leave a tech job for another tech job due to unfairness. Almost a quarter of underrepresented women and men of color reported being racially stereotyped. One in ten women reported experiencing sexual harassment. LGBT employees were the largest group to report bullying or being publicly humiliated. The authors of the study emphasize that turnover in the tech industry costs $16B per year (Scott, Kapor Klein, & Uriridiakoghene).

The majority of the tech gender gap studies focus on employees in corporate environments. However, a large fraction of software is created by people in the Free/Libre Open Software (FLOSS) movement. FLOSS members develop, maintain, and document software as volunteers in a self-organizing community that sees itself as a meritocracy. However, the gender gap is even more pronounced in FLOSS than in corporate software development. The patterns are similar as in the enterprise-based studies cited above. There is a general lack of respect towards women and women's tech labor resulting in sexual harassment as well as discriminatory and predatory behavior (Nafus, Leach, & Krieger, 2006).

The studies cited above provide a nuanced picture of the barriers that women face in tech culture. These studies are based on interviews with women and men working in technology. They found that cultural factors are the drivers of the gender gap in technology. However, there is a subset of studies such as Rosenbloom, Ash, & Dupont (2007) that attribute the gender gap in technology to differing "choices" made by men and women. They found that women and men differ systematically in their interests, preferences, and choices. The study uses measures of personality and aptitude that are widely accepted in psychology and other applicable fields. This study is similar to others that find statistical differences between women and men and attribute these to "choice". These studies inform a worldview that assumes that statistical gender differences are insurmountable, rather than symptoms of work environments, and general societal views. The idea that the dominance of men in the tech workplace is due to women's differing career choices is surprisingly strong even though this kind of statistics focused research has been disproven by meta studies that have found that generally, women and men do not differ significantly in terms of personality, cognition, and leadership (American Psychological Association, 2005).

In previous paragraphs, I explored research that explains why the gender gap in technology exists. As a consequence, I am now looking at the implications of the tech gender gap for innovation. Diversity and inclusion have proven beneficial to innovation (Hewlett, Sherbin & Dieudonné, 2014). In an industry that depends on innovation, not embracing diversity therefore is a liability.

In the world of startup companies, gender bias plays a role in how funding is distributed. Bringing ideas to market through startups is therefore more difficult for women than men. A study found that venture capitalists favor startup proposals made by men and women with technical backgrounds. However, men without technical background fared better than women without technical backgrounds. The study authors identified a vicious cycle: Because there are fewer women startup founders, women do not conform to the prototypical group and therefore do not receive funding which leads to fewer women startup founders (Tinkler, Whittington, & Ku).

Technologies shape society and society in reverse shapes technology. Therefore, having fewer women in creator roles affects not just what kinds of products are made but also how products are made. In the 1990s, researchers studied product development of different household items. They found a hierarchy of practices and skills among technology producers. Male-dominated teams of engineers had the most creative input into the making of a household product than any other group within the production process while women were relegated to serve as gender stereotyped groups of product testers (Cockburn, C., & First-Dilić, R., 1994).

Bias affects not just physical products but also products based on algorithms as O'Neil (2017) explains. Algorithms have an increasing influence on people's lives as computing becomes more pervasive. Algorithms drive online advertising. They determine who gets a loan, an insurance policy, or a job offer. They influence whether someone goes to prison and how long their sentence will be (O'Neil, 2017). Computer vision algorithms have been found to have a tendency to best identify the facial features of white males (Buomlawini, 2017). The inner workings of algorithms are not always visible to those being subjected to them. Because of lack of regulation of algorithms and their opaque nature, there is rarely recourse against treatment by algorithms. Consequently, lack of diversity among people involved in the creation and testing of algorithms has been identified as a danger for society and democracy (O'Neil, 2017).

What is being done to overcome the gender gap? Efforts to counter the gender gap can be categorized into several groups: Educational initiatives, workplace-based programs, and advocacy. Educational efforts are primarily directed at girls, young women, and young people belonging to other underrepresented groups. Educational technology initiatives directed at girls and young women are among others the Computer Clubhouse Network, Black Girls Code, and Girls Who Code. These organizations are based in the United States. They aim to teach girls and underrepresented minority children Computer Science. In the realm of higher education, universities have revised curricula to attract and retain women in Computer Science. An influential example is described in the book *Unlocking the Clubhouse* (Margolis & Fisher, 2003). It documents educational reforms in Computer Science education in order to attract more women.

Researchers at the Kapor Center found that workplace-based initiatives to counter the gender gap in technology require the unequivocal support of management and need to be systemic, comprehensive, and inclusive (Scott, Kapor Klein, & Uriridiakoghene). The National Center for Women in Information Technology (NCWIT) has a list of advice aimed at eliminating bias and promoting fairness at all levels of the hierarchy within a company.

Among the items on the list is establishing equitable recruiting processes, sponsorship of underrepresented groups, promoting a “growth-mindset”, flexible work policies, and bias elimination in evaluation and promotion (Ashcraft, McLain & Eger, 2016). Researchers at the Center for Talent Innovation say that mangers who insure that women get equal speaking time are “89% more likely than non-inclusive leaders to “unleash women’s innovative potential”. Besides a “speak-up” culture, they also emphasize a constructive and supportive feedback for each member of a team (Hewlett, Sherbin & Dieudonné, 2014). The aforementioned organizations have a twofold function: They do research on women and the technology gender gap. However, they also use this research to advocate for the closing of the gender gap and for creating equitable technology work cultures. Another large organization advocating on behalf of women in technology is AnitaB.org, formerly the Anita Borg Institute for Women and Technology. AnitaB.org organizes the Grace Hopper Celebration, the largest conference for women in technology. Beyond large organizations there are many smaller organizations that have identified the technology gender gap as one of the pressing issues of our time.

I hope to have demonstrated that the technology gender gap is a complex phenomenon. The consequences of demographic imbalances in the tech workforce reach deeply into society. The tech gender gap therefore affects even those who do not consider themselves members of the technology profession. Due to the intersectional nature of the tech gender gap, it cannot just be ‘solved’ by instituting gender parity in tech education and within the tech workforce. Eliminating the gender gap in tech will require equitable representation of women and underrepresented minorities in tech workspaces. However, closing the gender gap will also need to be accompanied by a change of practices and hierarchies within technology education and the technology creation process. And finally, technology policy makers would need to insure transparency and the elimination of bias from technology products.

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Contributor Bio

Contributor Bio: Annina Rüst is an Artist and an Assistant Professor at the Wilkes Honors College at Florida Atlantic University. She is known for her work in software and electronics-based art. The Huffington Post called her recent robotics work ‘a badass feminist robot’. Her projects have been shown internationally in museums, galleries, and at festivals. She has an MFA from UC San Diego, an MS from the MIT Media Lab, and a Diploma from the Zürich University of the Arts.

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