“Women Are Just Not Interested in Computer Science”:
a Convenient Falsehood, a Convenient Truth

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Abstract

“Women are just not interested” is a convenient justification for the absence of women in computer science. This paper questions this simplification; it admits that women have not shown considerable interest toward computer science by referring to the relevant statistics and common observations by experts in the field. Second, it analyses several diverse factors that may have led to this lack of interest. This paper also points out the importance of women’s involvement in this field, and discusses some possible solutions.

1 Introduction

At the university’s restaurant, where my colleagues and I were eating lunch, Štefan broke the silence and asked me about the progress of my paper about the lack of female presence in computer science. While I was explaining the historical roots and background of this phenomena for a table consisting of only male researchers (with the exception of myself), a colleague said: “isn’t it because women are just not interested!”?

“Women are just not interested in computer science”, or STEM (Science, Technology, Engineering, and Mathematics) fields in general, is a quote that you encounter again and again. This claim aims to establish the easiest possible endpoint for a complex process that has formed over time due to various and multiple reasons. However, a quick search on the internet on the topic of “why women leave computer science” or “under-representation of women in computing” or other similar questions, demonstrates evidence that is contrary to common belief: an increasing amount of research and efforts are put into discovering the secret of the mysterious absence of women in STEM-related professions and college programs. Why mysterious? In the early days of computing, there were a majority of women doing the job. In the mid 80’s, the situation began to change.

While reviewing literature and interviews on the subject dating back to the 90’s and the first few years of the new millennium, I was astonished to discover that nothing has changed. Generations from the 80s onward all faced barriers, concerns and problems similar to today’s. Why has there been no significant change? Technology has changed, there have been many movements struggling to achieve gender equality in different aspects of social life. Then why are we still in a position that women find themselves deserting computer science faculties, at both graduate and under-graduate levels?

The answer to this question is rooted in a very broad aspect of gender inequality which itself originates from economical, political and geographical realities. For practical reasons, this paper only highlights some of the factors playing significant roles in issues related to the female presence in computer science. The main purpose is not to give an overview, rather, to point to some similarities between my own experience and the existing literature and statistics on this topic. Moreover, in this article, computer science, information technology and artificial intelligence are used interchangeably, because they share the similar educational curricula.

2 In Fact, Women Are not Interested In Computer Science

“Women are not interested in computer science” becomes a common belief simply because our collective experiences and observations say so. It does not surprise me anymore (but it still annoys me) when I find myself the only woman in a conference room or in a work meeting. Collective observations are also confirmed in the literature: several researchers ranging from social scientists to biologists support this observation through their studies. Examples include biological difference between women and men such as size of and organization of the brain [Deary et al., 2007], difference in hormones, or other biological reasons indicating cognitive differences among genders [Ceci and Williams, 2010]. Not only cognitive abilities, but life styles and preferences are also influenced by biological differences. More specifically, the overall difference (caused by physical and sexual and ultimately gender differences) in life style and preferences is the main reason for women’s under-representation in high-intensity STEM careers [Ferriman et al., 2009]. It is believed that women’s views toward life are more people-/society-oriented and that is one of the reasons why there are more women in health-related jobs rather than computer science [Eccles et al., 1999]. Even if women chose to become computer scientists, they are mostly active in medical-related branches of computer sci-
Let’s assume the inherent difference in lifestyle and preferences between genders, as the studies above suggest. The question is: why is computer science considered an anti-social field in the first place? Does the “all nighter geek” represent the broad field of creativeness? Figure 2 shows the percentage of women who have graduated in STEM-related degrees in the U.S [NECS, 2013] between 1970 and 2012. This data shows that there is no STEM gender gap in the U.S. The gender gap only exists in Engineering and Technology (ET). But even in ET, things were not always this way. Women were early pioneers of computer science and worked in the field for decades [MISA, 2010]. But women’s interest in computing started declining in the 1980s in the U.S. Many believe that this decline is a direct result of the fact that early personal computers were marketed to boys as toys for gaming, as well as the prevalence of male “geek” character in popular movies in the same decade [MISA, 2010]. Therefore, it is very important to see how this lack of interest was formed, through features of popular culture such as advertisements for example, and which factors consistently contribute to the continuation of the existing situation.

Figure 1: Two Nintendo commercials from the 80s and 90s. Most commercials from those decades showed only boys playing games.

3 Computer Science Culture, Media and Norms

The general atmosphere of computer science has not been very welcoming to women. “Male behavior becomes the standard for the right fit and success”, “[the emergence] of the male nerd in popular culture as well as the rise of computer gaming are barriers for women’s entry” are very common issues discussed by those who believe that the interest of women towards computer science is engineered by a harmonic symphony against women.

One of the prominent studies addressing this particular issue, is ‘anatomy of interest’ by [Margolis et al. 2000]. It should be mentioned that such ‘essentialist’ theories which view differences between men and women as eternal, and usually apply biological methods to support their ideas, are not so popular any more, and are widely opposed by the pioneers of sociology and gender studies in particular. Gender is no longer viewed as a result of biological difference between men and women but as ‘constructed’ by society, hence gender roles have little to do with the actual ‘capacity’ of men or women, rather are a result of how society, for example through popular culture, idealizes and enforces these roles.

Figure 2: Percentage of Bachelor’s degrees conferred to women in the USA(1970-2012) [NECS, 2013] who interviewed computer science under-graduate students at Carnegie Mellon University. The study is comprehensive in the sense that it involves students from both genders, different years and backgrounds. The result of the study showed how women’s confidence, as well as their early enthusiasm, faded when they were eventually confronted with the masculinized standard. They felt that they did not fit the program because they did not code in their free time. This gives credit to this feeling, which in fact is shared in my work/study experience, and raises the following question: the ability of thinking “out of the box” comes with broad knowledge and distinct backgrounds; is computer science the only exception in which only programming matters?

It is rigorously believed that geek stereotypes are an integral part of computer science culture. A team of researchers at University of Washington (UW) decided to find out how media representations of geeks affect women’s interest in the field of computer science [Cheryan et al., 2013]. In the first part of the UW study, Sapna Cheryan and her team set out to survey the common image of computer scientists among students at UW and Stanford. The results were predictable. They found a high percentage of both male and female students believing that computer scientists are male, obsessed with computers, antisocial or isolated, and that computer scientists “play WoW all day long.” More interestingly, women who had taken even just one computer science class were much less likely to believe in these stereotypes. So, does the stereotypical image of the field represent reality? My experience admits that the stereotypical image often represents reality; at the same time it is difficult to see any correlation between the stereotypical icons and successful computer scientist role models. Does being obsessive with computer games really contribute to enhancing the ability of problem solving
and thinking in an algorithmic way? There is no research that supports a positive answer to this question.

Media contribute negatively to create the gender biased computer science culture. In fact, media intensifies the wrong and biased image against women, and does so consistently all over the world. Even in a high gender-egalitarian country such as Norway, [Hilde 2007] studied one of the largest national newspapers in Norway, Aftenposten, to obtain the following significant findings. From 1980 to 2007, newspaper reports were most likely about men’s high skills in using computers, while reports about women and computing often focused on women's incompetence in mastering computers. One example of TV series propagating the typical stereotypes include “The IT Crowd”. In this series, the IT people are portrayed as boring, solitary, poorly dressed, and socially inept. Garcia-Crespo et al., [2008] conduct a study with 40 people as subjects from both professional IT sectors and last-year high school students (22 men and 18 women). Some of the results unfold as follows: 60% of IT professionals felt zero identification with the TV characters; women showed on average a lower level of identification than the men; and 80 percent of students, including both men and women, show a very low level of interest in the profession based on the show. The study is interesting because the stereotypical characteristic is not attractive for either of genders. This image of the field/profession, whether right or wrong, affects negatively both genders.

It is not just, TV series, gaming companies and newspapers (i.e., popular culture in general) that reproduce this culture. Governmental laws and regulations have also played their part. For example, in 1970, during the British technological revolution, the British government created a new Automatic Data Processing work grade for programmers, but explicitly excluded females form applying to the programmer position. Systematic prevention of women from learning new technology led to a gradual downgrading of their skills with respect to the state-of-the-art of the time, thus literally a dead end. This happened while British women were very progressive in working as technologists [MISA 2010].

Note that none of the factors above is the culprit on its own, and it is hard to believe that someone changes his or her career path only based on a TV series, or a few newspaper articles, or having a group of geeky classmates. All of these factors combined cause the problem over time, and they strengthen each other by providing complementary negative biases towards the profession.

Overall, the world of computer science is not separated from the rest of the world in which women are discriminated against on daily basis. However, many women overcame all these obstacles, passed all the difficulties, pursued their interest, graduated in a computing-related field, and followed a related career.

4 Why do we care?

Computer science related jobs are not the only ones that suffer from unbalanced gender composition in the workplace. For example, nursing is a female dominant profession around the world. Does the lack of male workforce in the nursing concerns us? Certainly yes. Diversity matters.

A very recent research done at MIT [Woolley et al., 2010] posits the question of why some groups are smarter than others. This research emphasizes that nowadays, regardless of how smart each individual is, the important decisions are taken by groups. They grouped 697 volunteer participants into teams which were asked to perform different ranges of tasks, and also designed a scoring mechanism to evaluate the performance of the group and measure each individual’s IQ. The result showed that teams with higher average IQs didn’t score much higher than the teams with lower average IQs. In fact, the results had nothing to do with average IQ. Smarter teams (the teams with higher score) were the ones where members contributed more equally to the team’s discussions, rather than letting one or two people dominate the group. Teams with more women outperformed teams with more men. This is an interesting study because it highlights the importance of having both genders in a group. This can lead the group to make better decisions. There is other ongoing researches which suggests that diversity in gender, ethnic and background benefit the workplace. [Baumgartner et al., 2007] studied teams comprising diverse members, finding that these consistently outperform teams comprising “highest-ability” members. More specifically, in computer science related workplaces, teams with equal numbers of women and men are more likely (than teams of any other composition) to be creative, share knowledge, and fulfill tasks [BusinessSchool 2007]. All of the above studies become important if we actually care about high quality and creating useful technologies which can benefit human beings. In other words, if the quality of the product matters, then diversity in the group which makes this product matters.

In addition to the importance of a balanced workplace, living standards also matter. Computer science related jobs are on average well paid, and job opportunities are rapidly increasing. Tech leaders in companies like Google, Facebook, Amazon, and Apple will need to fill more than 650,000 new jobs by 2018 to meet their growth projections, and two-thirds of those new hires will be for STEM roles [Craig et al.]. The situation in Brazil, China and India where technology industries play an important role in the economy, is similar. In such conditions, the absence of half of the population can be harmful in two ways: first, women are deprived from very broad innovative and well-paid jobs, and second, technology will continue to consists of male-customized products.

More importantly, no-one shall be forced to choose or not choose a job as a result of imposed stereotypes and wrong images. In fact, there is absolutely nothing wrong in not being interested in any STEM majors, for a female or a male person, as long as we can make sure that the lack of interest is the result of free, unbiased will, and not a consequence of false, misleading images.

5 Toward Solutions

The problem is recognized among different groups of people with decisional power, including CEOs, academics, job recruiters, politicians and several others. Each of these groups take minor steps toward balancing the situation. For example,
in academia, remedies for the problem range widely: courses on ‘Gender issues in information technology education and computer science’ (e.g., the WINIT project\(^3\)), holding women days in a CS/IT/Al related conferences (e.g., IJCAI, RSS), dedicating special issues to this topic (e.g., ‘Special Issue on Women and IT in Information and Communication technology: Research on Intervention Programs of the Information Systems Journal’). In addition to academic communities, there are private and governmental organizations which specifically address the issue of under-representation, and perform different activities to encourage women’s involvement in computer science programs and professions (e.g., she++, CodeEd, Geek Girl). In this paper, I only point out two possible solutions which in my opinion, are more prominent than other remedies.

5.1 See Inequality as a Problem!

To many people, gender-segregated playgrounds, gender-segregated parties, gender-segregated classrooms, gender-segregated pedestrian ways, seem extremely awkward and even offensive. I believe that working/studying in a gender-segregated location is also awkward and abnormal. Research shows that in many countries subject to the dilemma of female under-representation, there is no formal discrimination, nor are there overt barriers [Welle and Heilman, 2007]. However, is informal discrimination that is unlikely to be noticed by people. But is it always about the law?

“She is always moaning about inequality stuff”, “oh come on, this is too much, you are just cynical”, “stupid feminists are still alive” and in the best case “I am not sexist” and “I cannot understand what all the fuss is about”. These quotes are not unfamiliar to most females, or equality-sensitive males, in the field of CS. I do not want to list what I often hear, but in a nutshell: if you want to be an instant target for disapproval, or if you enjoy being referred as tiresome, all you need to do is to speak out about sexism in your workplace.

Sexism is not only about active and explicit discrimination. Being ignorant on discrimination or hidden sexism, as well as unbalances situations toward one gender, do assist the development of a sexist environment (e.g., I am not sexist, therefore sexism does not exist). [Briskin 1990] defines a non-sexist versus anti-sexist category. Non-sexists are those who see anti-sexist people as prejudiced. They also believe that questioning gender issues is irrelevant to any scientific development and it is only a matter of individual choice in deciding to do or not to do something. This, in turn, means that there are no differences between men’s and women’s conditions in society. With such an attitude, there is no need for further effort to empower women and endeavor towards gender equality, i.e., taking no responsibility for the existing problem, which leads to neutrality, inadvertently and effectively results in supporting the existing situation.

5.2 Target Kids

I started coding when I was twelve. I had my personal computer and a family which did not limit my ambitions and abilities. I was not aware of any computer science culture and stereotype, and lucky enough to not have a geeky brother. However, this is not often the case. Gender roles are shaped in the mind of children not only by family, but also by cartoons, toys, school and many other aspects. If we aim to separate science and gender as an ultimate solution, the toy industry, educational system, the cartoon/movie industry, and many other institutions should share the same concern, thus, contribute to solve the problem. There are efforts to ameliorate current gender biased situations, such as supervisory institutions that assure the absence of discrimination and sexism. More specifically related to the topic of this article, in several countries like Sweden and Germany, there is a girl day where school girls come to tour engineering departments. The purpose of the visits is to see some female role models, as well as what sorts of things can be done as an engineer. Showing technology-related labs which stimulates people’s creativity is one of the common practices these days. A school in Stockholm took part in a research program where high school students were asked how many of them wanted to be an engineer. Less than 5% of the students who wanted to be an engineer were females. The percentage was drastically changed when the meaning and tasks of an engineer was elaborated for them, thus their minds were cleared of the stereotypes they were fed over the years.\(^3\)\(^{\text{See } \text{http://www.winitproject.com/}}\)
6 Conclusion

This paper has discussed issues related to the lack of representation of women in computer science. The problem is pervasive in this field, and I have briefly discussed some of the related studies on the topic. It has been observed that popular culture (which is engineered by TV series, gaming companies, governmental laws, newspaper, and many other factors) related to computer science is strongly male-dominated, and projects the image of geeks – which are invariably male – as smart and intelligent people. I have reflected on the consequence of gender bias in our societies, which I believe precludes women from being involved in interesting, creative and well-paid career paths today. Some of the efforts toward balancing the situation have been mentioned. Also, I stress the importance of early impact on how gender roles are defined in children’s minds. An important steps toward solving this problem is to speak about the problem and to actively try to convince people (of both genders) that an unbalanced gender workplace is not normal. I hope that fostering the gender debate in computer science will lead more women to choose this wonderful line of research and profession.

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