

Creating an All-Human Human Experience in Computer Science

Traversing Through Gender Complexities in Technology

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ABSTRACT

Looking into the past, present, and future, the “human experience” has always been thought to be one simple thing...human. Though, who has had the same human experience? As diverse as humans are, the websites that humans use lack this diversity. This paper will examine diversity in web applications and how it hurts the inclusion of women in computer science fields.

Furthermore, examining results in studies involving the inclusion of women in computer science with web design, this paper will explore gender neutral ways to get everybody, including women, excited about computer science. This paper will examine the lack of diversity in computer science, how to use web applications to narrow the gap, and why diversity is so important in the field.

CCS CONCEPTS

• Human-computer Interaction • Gender Diversity

KEYWORDS

Computer science, Web design, Diversity, Human experience

1 Introduction

To those who find themselves wandering the halls of a university’s computer science building, attending a computer science lecture, or even anxiously waiting in a room for a tech interview, take a second to acknowledge the number of women surrounding you. Acknowledge all 21 percent of them [4]. The shocking lack of diversity in tech would bring anyone to wonder, why it is so low and if it would even make a difference to try to improve it.

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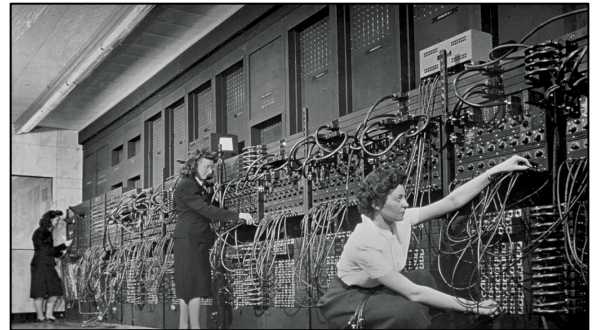


Figure 1: Secret History of Women Programming [15]

1.1 The Problem

In a world where only 21 percent of computer science is women, it is hard to imagine how much women contributed to the field in its early days. In 1843, Ada Lovelace expanded on the upcoming Analytical Engine, branding her as the first considerable programmer [4]. Major contributions to programming were made around the second world war when men began to be shipped overseas, and women had to pick up on some male dominated jobs. Because of this, many women were encouraged to take on jobs as “human computers” and advanced mathematicians [3]. In 1946, six women created the first all-electric programmable computer called the ENIAC for the US Army, although none of them got any credit. In 1952, Grace Hopper invented the first computer compiler and in 1962 Katherine Johnson was the only person at NASA that could correctly perform orbital calculations needed to send the first American on an orbital space mission [4]. The list goes on, and rarely were these women given any credit for their contributions. In the second half of the 1900’s there was a stable idea that building and designing hardware was a male job, and software was a female job since it was similar to secretary work. As wars began to die down, and men had more time at home to progress in their careers, they quickly took over programming as something of their own. Many papers were released saying that women were not capable of advancing in a field that they propagated themselves. Stereotypes were created that formed a wall almost separating women from computer science completely.

With sexism at a peak, social barriers were created to discourage women from joining computer science, and they still stand tall today. Many biased studies were released saying that men's brains were geared more towards programming than women's. As home computers and video game consoles began to enter the market in 1984, advertisements were focused solely on men and boys. At this point, computers were made by men, for men, and to encourage men to be interested in the field. Now, looking into 2022, almost all credited role models in the field are male. A quote by activist Reshma Saujani states that “for girls, you cannot be what you cannot see” [3]. Women cannot be encouraged by positive female role models when there are so few that are credited. Most of these positive female role models are progressing in “female based” fields such as education, nursing, and social work. The idea when women began to be filtered out of programming in the late 1960's was that there are specific jobs that men will perform better at, and jobs that women will perform better at [3]. The jobs were determined by biased “scientific” studies that benefited men and ultimately pushed women into jobs where they can take care of people, because that is a woman's natural instinct. The reality of it is that women show similar scores in mathematics and tech as men when they leave high school [12]. While there might be some truth in the sexist studies, such as women are natural care takers, it does not mean that they cannot outperform a man at anything else.

While there are so many social barriers that discourage and put down women to where they do not want to join computer science, there is one that also degrades men in the field. The jokes persist loudly on social media today, stereotyping males, and even females, in computer science as being weird, smelly, and antisocial. Imagine being in the shoes of a woman trying to decide if she wants to major in computer science and she simply decides not to because she does not want to fit into that stereotype [12]. She might not even consider computer science because it was never advertised to her as an option based on her gender; and in that case she most likely does not have any credited female role models to look up to. Even if she did consider computer science, it might not even be guaranteed that she would be credited for the work she will put in. For a field that heavily relies on the contributions of women in the past and present, having only 21 percent women contribution poses a threat to gender equality in the future. Perhaps, if these women were advertised computer science as an option now, and get the credit they deserve, young girls and women in the future will have examples to look up to as they pursue their dreams in such a heavily male dominated field.

1.2 The Solution

Instead, here in 2022, there is a presentable solution to increasing the number of women in computer science, thus creating more equality in the field; and that is with web applications. If the sexist programmers from the 20th century got anything right, it is that men and women themselves are programmed differently. The male brain might be more intrigued by certain stimuli than the female brain. Though, now there is an opportunity to approach gender diversity in computer science instead of completely segregating women out of the field. With psychological studies on the visual preferences of men and women, web applications for

“intro to programming” courses and university computer sciences pages can be created to appeal to audiences of both genders.

While history is definitely to blame for gender imbalances in computer science, modern computer science web applications may be responsible for the more recent numbers. Similar to home computers and video game consoles in 1984, modern computer science web applications are advertised to intrigue the male eye. While it might not be purposeful to turn women away from the field anymore, there are mostly men left responsible for creating these web applications. These websites might be covered from header to footer in Star Trek references, or they may have subtle psychological differences that ward women off. For example, the color red is a very attractive color to men, which would be the perfect color to catch the eye of a male audience [7]. Men are thought to be more dominant and confident than women, so when using a web application, men are more intrigued when it has more pop-ups, tabs, and flashing [10]. In this clutter, men prefer symmetry in the design, along with square shaped dividers. A good example of this is in the Colorado State University Computer Science website where all of the statistics are separated by blocks.

Moreover, when women see someone of the opposite sex, the color red is intriguing as a sign of status and dominance. In other situations, it is intimidating to women and would steer them away from a website if there is too much [7]. Surveys across cultures show that women think of themselves as being friendly, but also more anxious and neurotic than men. Conversely to men, women tend to leave websites faster when they have a bunch of pop-ups and clutter as it might cause more anxiety than interest [10]. When women observe an object, they scan from the top right to the bottom left of it. Again, a good example of this is in the Colorado State University Computer Science website where it shows the average beginning salary for computer science towards the top right corner [5]. While this healthy price is interesting to everybody, it catches the eye of women more algorithmically. While this website suits men with square shaped dividers, women tend to stay on web applications longer when dividers are circular. In contrast to that, simply having a photo of a woman programming, which this web application does show, makes the website more welcoming to women. Lastly, women are thought to be more organized and better at multitasking than men. A recent study gave men and women eight minutes to finish multiple random tasks. Knowing that it would be almost impossible to finish all of the tasks at once, the women created algorithms in order to prioritize the more meaningful tasks to finish them on time, and the men seemed to pick and choose tasks randomly [14].

Psychological studies on the differences between men and women may hinder the thought that computer science is only compatible with the male brain. Although when it comes down to it, we are all human, and the ultimate goal should be to create a website that appeals to all humans equally, especially for computer science websites. In the book “Don't make me think”, Steve Krug candidly lists numerous ways to keep the attention of humans on human-made web applications [11]. The purpose of this book is to examine ways to make web applications as easy to use as possible, because nobody, man or woman, is going to want to join computer science if they cannot even begin their research on a

confusing web application. In the book, Krug states that users do not use web applications the way the designers want them to use web applications. Designers will choreograph a route of paragraphs for the user to read with all of the information they will ever want, and while that might be exactly what the user needs, that is not what they are going to stick around for [11]. Designers think and design in an algorithmic way, but it is important to remember that these users are only curious about computer science, they are not in the field themselves. Krug demonstrates that designing a web application must be treated similar to designing a billboard [11]. If the user's attention span is treated similar to someone driving by a billboard on a highway, their interest will be grasped much faster. This loops back to gender-based styling conventions, like how much of the color red a web application should use, as well as human based conventions. Users expect the logo of a website to be at the top left corner of the page. If a user is not sure if they are looking at a computer science website for Colorado State University or for Yale, it might be a reason to move on. Another example would be what font and convention are used on the website. A letter that says, "**I will always find you**", in a cute pink font sends a much different message than a messy letter in a big red convention that states the same horrific words "**I WILL ALWAYS FIND YOU**". One styling convention might be more off putting than another, costing the advocacy of a web application [2]. Lastly, the most emphasized point that Krug makes in his book is that users should never have to think while navigating through a web application. If a user wishes to use a search bar, but they cannot find it, then they might prefer to leave the page rather than scan through it for what they are searching for. The fact of the matter is, people do not want to think when they initially access a web application. They will scan it with ease and move on before spending too many brain cells on it, even if it is something as life changing as choosing what subject they want to study at a university. History has steered computer science down a dark path, lacking gender diversity, but it is not the only culprit to blame. Web applications hold the power to increase that 21 percent of women in the field, as long as there are notable precautions made in creating them.

1.3 The Outcome

After reflecting over the history of computer science and traversing through psychological studies in an effort to increase diversity in the field, one may wonder, why? At a glance, even if computer science was composed of 100 percent of men, there should not be much of a problem. Although, looking into it, computer science was taken away from women. Today, it is one of the highest paying careers in the United States with one of the guaranteed best lifestyles. Computer science is the future, and if the future is 100 percent male dominated, then the world is going to evolve to benefit men and men only.

Similar to today's problem, being that there are mostly men in computer science that are creating computer science web applications, if there are only men creating tomorrow's technology, then how can it be fitted to a woman? In 2019, a study was conducted under the topic of male-focused car crash testing. While the immediate thought of car crash test dummies may be blank faced and lifeless pieces of plastic that are shaped

like humans, the reality is much more disturbing. Female test dummies do not exist. Test dummies are designed by their creators, being the American average 171lb, 5'9" male. The lack of diversity in this specific field has led 17 percent of women to be more likely to be killed in a car accident and 73 percent of women are more likely to be seriously injured. The list goes on as each specific body part of a woman has a number to its fate in a car wreck [1]. The problem is, all of this can be avoided with gender diversity in the field to step up and design dummies that test women. This is true to all fields, if all doctors are women, then they would never be advanced in male anatomy and disease, similar to if all doctors were men, they would never understand how important it is to study menstrual pains. Diversity in computer science is important because it is the predominant field of our world today. It is the difference between creating things for humans that actually work rather than creating things for humans that only work on some people.

One common attribute that exists on any university's computer science website is the average starting salary of computer programmers, being \$86 thousand dollars a year [5]. Computer science and computer engineers show up twice in the top ten highest paying majors after graduation [13]. For a little extra dopamine boost on the topic, senior software engineers make an average of \$119,000 dollars per year [13]. If computer science is a male dominated field at this price, then society can never be equal when female dominated fields such as education only make a comparable \$78,000 dollars a year at the most [6]. Professions in computer science and technological fields are also shown to have the happiest lifestyle after graduation [8]. Doctors are also some of the highest paid people in the United States, however, they are famously working stressful twelve hour shifts after attending years and years of schooling. After four years of schooling, software engineers are sometimes known to only work six-hour days [9]. In a field that began so women dominated, it is a shame to see so little enjoying its benefits like the pay, the lifestyle, and even the fulfillment that comes with it.

CONCLUSION

An important thing to remember is not to make web applications women specific, but just gender neutral. This paper reflects on the low percentage of women in computer science as well as ways to gain more women in the field. The completion of the paper discusses why it is so important to make web applications appealing to women in order to create more diversity in the field. Computer scientists are capable of recreating the world around us in a logistical format, it should pose no challenge to create a world with diversity between men and women. Diversity in computer science creates diversity all around us, in politics, engineering, economics, and more. Besides, how are we supposed to design things for women, without women?

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