

## Reducing the Gender Gap in the Computer Science Field

When you picture a computer science student, or someone who works with computers for their career, what do you see? More specifically, what gender is the person you envision? For the majority of the population, the person they picture will be male. Although the gender gap in many STEM fields is getting smaller, the gender gap in the computer science field has widened from 1984 to 2011(Sax et al., 2017). There are clear evolutionary factors that contribute to this gap. Masculine stereotyping of the Computer Science field contributes to the gender gap by deterring women from the field by making them feel like they don't belong. By examining the factors that contribute to this gender gap, steps can be taken to minimize them and encourage more women to choose the computer science field.

Environmental cues contribute to women's lack of a sense of belonging. A study was done by S. Cheryan, P. G. Plaur and C.M Steel titled Ambient Belonging: How Stereotypical Cues Impact Gender Participation in Computer Science in 2009 that studied what environmental cues could contribute to the gender gap between women and men in the computer science environment in colleges. They conducted an experiment to see how the environmental cues of a classroom contribute to the interest of the individuals in computer science. The main reasons behind their testing were that the environment of the classroom affected who wanted to join the class, that people decide if they belong in the group based on the classroom environment, and that the feeling of belonging to a group factors into the choice to join that group. The

researchers conducted a survey to see what individuals thought stereotypical computer science students would have in their classrooms. Then the researchers set up the classroom once with the objects that the survey found to be stereotypical items that would be found in a computer science classroom (things like junk food, video game magazines, and Star Trek posters) and once with objects that were the opposite of the stereotypical items (nature posters, a variety of magazines, healthy snacks). A group of mixed gender students were brought into the classroom and given a presentation on the computer science department. Then they were given a survey to see how interested they were to consider a major in the computer science department. The women in the group were most affected by the items in the rooms. Women in the neutral room were more inclined to want to join the computer science department. Women in the stereotypical room were less inclined to want to join the department. The men in both rooms had no significant difference either way. Evolutionarily, humans want to belong to a group to have more reproductive opportunities. This carries into the feeling of belonging in a group in the computer science field as well. If the computer science environment is stereotypically masculine, the majority of women will feel like they don't belong, so they will not pursue a degree in computer science or go onto the computer science field. A sense of belonging isn't the only evolutionary factor contributing to women choosing to join the computer science field, so is the desire to have children and raise a family.

When people are choosing what field they would like to go into when they enter the workforce, they often think about how that job will fit in with their desired lifestyle.

Women feel like they don't belong in the computer science field because they will not be able to balance family and career. For many, that includes finding a partner and starting a family. In a study by L. J Sax, K Lehman, et al titled Anatomy of an Enduring Gender Gap: The Evolution of Women's Participation in Computer Science, researchers studied the external factors that people considered when they chose computer science. The researchers used a survey given to all freshman students from 1971 to 2011 to research the trends in education. In order to narrow down the different factors, they grouped the external factors into broad groups that had similar impacts, like goal choices and background experiences. The researchers found that men and women who wanted to raise a family were not interested in having a computer science job. For women specifically, the researchers found that the lack of confidence in their math skills, their wanting to contribute to social causes, and wanting to contribute to science were not the major causes into staying away from the computer science field. The main reason that the majority of women avoided the field was that they felt that they could not care for their children and their community and still be a computer scientist. The masculine stereotype makes it difficult for women to think it is a field they can balance future children with. Also, not every woman aspires to have future children. Do these same studies hold up for people who do not fit in typical gender roles?

Another group of researchers studied computer science students to see how their sex role orientation (ranging from very feminine to masculine), and their self-direction contributed them to being a computer science major. If the women in the computer science field were more masculine, than they may feel a greater sense of

belonging. This would allow them to better fit into the stereotypical group. C. Brown, L. Garavalia et al in their research paper titled Computer Science Majors: Sex Role Orientation, Academic Achievement, and Social Cognitive Factors surveyed male and female computer science students to see how they rated their masculinity and femininity, their locus of control (when a person believes they are in control of themselves and their future) and their self direction. The researchers found unexpected results. In men, the difference between their locus of control and their sex role was not significantly related. In women, if they had an internal locus of control (they felt in control of themselves) they were more androgynous, and if they had an external locus of control (they were not in control of themselves), they were more feminine. Students who had lower masculine and feminine traits scored lower on their self-direction, but not in a statistically significant way. There were no significant sex differences found in the study. There were also no differences in the academic achievement of the different sex roles. Also, only one male out of 188 individuals identified himself as having a masculine orientation, in a field that is stereotyped as being very masculine. Even when considering a wide range of sex roles, there is no significant difference in self control, academic achievement, or self direction in computer science students. The gender gap is not caused by a specific gender-related reason, like men are better suited academically, or have more self control than women. This study reinforced the idea that the gender gap in computer science is related to a person's sense of belonging to the computer science group.

At the Carnegie Mellon, a top ranking computer science school, they used the findings from the previous studies to try and close the gender gap of computer science students. In the 2005 study by L Blum and C Frieze titled The Evolving Culture of Computing, Carnegie took steps to reduce the male stereotype and make it more women friendly. They were able to increase the amount of women in the field from seven percent to thirty four percent( Blum & Frieze, 2005). They changed their acceptance policy to allow all students to tailor their classes towards coding or more application based computing, which more women are interested in. Women in the computer science field at Carnegie took on identities that were both feminine and geeky, and they felt a greater sense of belonging. As more women joined the program, more women felt comfortable in joining. The college department also encouraged students to take on a well rounded set of interests, which made women feel more included in their cohort. Carnegie demonstrated that reducing stereotypes and creating a sense of belonging increased the number of women in the computer science field.

If colleges want to increase the amount of women they have in the computer science field, they should take steps to ensure they are not contributing to the masculine stereotype at their college. They should keep the environment free from masculine stereotypes. They should examine their class choices and add classes that might be more interesting to women and not purely programming related. Carnegie has implemented these changes and seen positive results. By working to reduce the masculine stereotyping of the computer science field, more women will feel welcome to join.

## Works Cited

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