

There Are Too Few Women in Computer Science and Engineering

It's not that they aren't interested; it's the culture of these fields and how they exclude women and girls

By Sapna Cheryan, Allison Master, Andrew Meltzoff on July 27, 2022



Credit: skynesher/Getty Images

Only 20 percent of computer science and 22 percent of engineering undergraduate degrees in the U.S. go to women. Women are missing out on flexible, lucrative and high-status careers. Society is also missing out on the potential contributions they would make to these fields, such as designing smartphone conversational agents that suggest help not only for heart attack symptoms but also for indicators of domestic violence.

Identifying the factors causing women's underrepresentation is the first step towards remedies. Why are so few women entering these fields? A common explanation is that women are less interested than men in computer science and engineering. This explanation is technically accurate and supported by women's and men's own responses. But, it is incomplete in problematic ways, and worsens the very disparities it seeks to explain.

shortsighted. A better solution is to understand how the cultures of these fields dissuade many women and young girls from becoming interested in this important work. Focusing the explanation on currently existing interests suggests that girls and women are deficient and need to change. Instead, we think that changing the male-oriented image and cultures of engineering and computer science will draw more young women into these fields. The status quo makes it clear that these fields and societal institutions still have a long way to go.

In a paper we recently published, we found that young children and adolescents in the U.S., like adults, believe that girls are less interested than boys in computer science and engineering. Girls who strongly endorse these stereotypes show the lowest interest in computer science and engineering. How do these gender stereotypes become self-fulfilling prophecies in this way?

Two subsequent experiments in this paper uncovered the underlying causal mechanisms. We found that girls' choices are negatively affected by hearing stereotypes that other girls aren't interested in these fields. Describing a computer science activity as something that "girls are less interested in than boys are" caused girls to feel a lower sense of belonging with that activity and made them significantly less likely to choose it. When the computer science activity was not marked with a gender stereotype, girls and boys were equally interested in it.

When girls hear the message, "people like you (i.e., other girls) don't enjoy this," they assume they won't be interested in the activity, and it changes their behavior. In this way, noting differences in interests without giving the broader context of why these differences exist can itself contribute to girls' underrepresentation.

A more complete explanation for girls' and women's lower interest entails highlighting societal and structural influences, such as the male-oriented images and culture of these fields. The images that students have in their heads of computer science and engineering matter. When asked to describe computer scientists, American students often think of images like those from TV shows like *Big Bang Theory* and *Silicon Valley*. They imagine mostly white and sometimes Asian male geniuses who are socially awkward, play video games and like science fiction.

Experiments conducted by us with college and high school students show that these images can have profound effects. We compared young women's interest in taking a computer science class when a highly stereotypic versus a less stereotypic image is salient in the classroom (for example, when Star Trek posters versus nature posters are displayed). Many young women express more interest in pursuing computer science when their classroom does not reflect current stereotypes. Men and boys, in contrast, do not shift their interest as strongly in response to these two images.

Of course, many computer scientists and engineers do not fit the stereotyped images. Many are socially skilled with a broad range of interests and hobbies. Yet until current images are diversified, we may continue to see more women than men feeling that they don't belong in these fields.

also contributes to women's underrepresentation. In our research, we document that computer science and engineering have "masculine defaults." These are features that reward, or set as the standard, characteristics and behaviors commonly associated with being male. Examples include rewarding aggressiveness, overconfidence and self-promotion.

At Google, women were getting promoted less often than equally qualified men. Google realized this was because getting promoted required putting oneself up for promotion. This policy was biased because women in the U.S. tend to be socialized to not self-promote and may even receive social and economic backlash when they do. Other examples of these masculine defaults in computer science and engineering include masculine words such as "dominant" and "competitive" in job ads; policies that do not compensate service and emotional labor, which are tasks that often fall to women; and providing networking opportunities to those who participate in sports associated with men, such as kiteboarding. Masculine defaults can also be challenging for many men and people who identify as nonbinary because they force people to fit a narrow mold.

Noting current gender disparities in interests is only the beginning. We need to also consider historical and contextual reasons for *why* these current gender disparities exist. We should remove the blame from women and girls for their current lower interest, and instead focus on what society can do to create cultures that are more welcoming to women and girls. Current computer science stereotypes became ubiquitous in the U.S. during the PC revolution. Before that, women earned a significantly higher proportion of undergraduate computer science degrees—37 percent in 1984— than they do today.

Today, more women pursue computer science careers in countries with less male-oriented images of computer science, such as Malaysia and Armenia. Other strategies to improve the cultures of computer science and engineering could include balancing masculine defaults in tech companies by elevating norms and traits that are not stereotypically masculine. For example, companies could reward mentorship and collective achievements. Universities could revamp their computer science curriculum to be more inclusive like Harvey Mudd College. Harvey Mudd implemented more inviting pathways into computer science by creating a separate entry into the major for students with no prior programming experience, instead of only rewarding those with experience prior to college.

Creating more welcoming cultures is a systemic problem that is the responsibility of the tech industry and society more broadly. Key is changing the narrative that pins gender disparities on girls' and women's lower interests. Instead, we need to articulate the role that the perceived and actual cultures of these fields play in creating these patterns. Until we change the narrative that girls' lower interests are to blame, it will be hard to make tech more reflective and inclusive of our entire population.

This is an opinion and analysis article, and the views expressed by the author or authors are not necessarily those of Scientific American.

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