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# Computer Science and Engineering Need Women

Tech culture and stereotypes dissuade them

By Sapna Cheryan, Allison Master and Andrew Meltzoff

**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 lucrative, high-status careers, and society is missing out on the contributions they might make to these fields. For example, women might improve smartphone conversational agents so that they are able to suggest help not only for heart attack symptoms but for indicators of domestic violence.

Why are so few women entering these fields? A common explanation is that they are less interested than men in computer science and engineering. Though technically accurate, this explanation is incomplete and worsens the very disparities it seeks to explain. Focusing on interest suggests it is the girls and women who need to change. We think changing the male-oriented cultures of the fields will draw in more young women.

Young children and adolescents in the U.S. believe girls are less interested than boys in computer science and engineering. And girls who strongly endorse such stereotypes show the least interest. How do these gender stereotypes become self-fulfilling prophecies?

We found that girls are significantly less likely to choose a computer science activity after hearing that girls are less interested in it than boys are. The message convinces them they won't be interested in the activity—and changes their behavior. Noting differences in interest without giving the broader context of *why* these differences exist can contribute to girls' underrepresentation.

One reason for girls' lower interest in these fields is their male-oriented imagery and cultures. When asked to describe computer scientists, for instance, American students often imagine white and sometimes Asian male geniuses who are socially awkward, play video games and like science fiction. Experiments we conducted with college and high school students show that these preconceptions can have profound effects.

We investigated how salient images in classrooms affect young women's interest in computer science by showing them images ei-

ther more or less stereotypically associated with men (for example, *Star Trek* posters versus nature posters). When their classroom did not reflect these stereotypes, young women expressed increased interest in computer science. Men and boys, in contrast, did not shift their interest as strongly in response to the different images.

Many computer scientists and engineers do not fit the stereotypes, but until those depictions are diversified, we may keep seeing more women than men feeling they don't belong in these fields. We have documented that computer science and engineering have “masculine defaults.” These features reward or value behaviors commonly associated with being a man, such as self-promotion and hypercompetitiveness. At Google, women were getting promoted less often than equally qualified men because of a policy that required putting oneself up for promotion. This policy was biased because women in the U.S. tend to be socialized not to self-promote and may even receive social and economic backlash when they do.

History and context also matter. Before the rise of modern computer science stereotypes, women received a significantly higher proportion of undergraduate computer science degrees—37 percent in 1984, compared with 20 percent in 2018.

Women are most likely to pursue computer science in countries with less male-oriented computer science imagery (such as Malaysia).

Rather than blaming women and girls for their current lower interest, we should focus on what society can do to create more welcoming cultures. Strategies could include elevating norms and traits that are not stereotypically masculine. For

example, companies could further increase rewards for promoting others' achievements and working toward collective goals. Universities could implement more inviting pathways into computer science that do not require prior programming experience, as done at Harvey Mudd College. Popular media could more often promote images of computer scientists who do not fit traditional male-oriented stereotypes.

The need for more welcoming cultures is a systemic problem, and creating them is the responsibility of the tech industry and society more broadly. We have to articulate the role that the perceived and actual cultures of these fields play in generating these patterns. Without that change, it will be hard to make tech more inclusive of our entire population. ■

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FEBRUARY 2023