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Gender Disparities in the Tech Industry: The Effects of Gender and Stereotypicaility on Perceived Environmental Fit

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Abstract

Women make up only 25% of employees in the technology industry (e.g., computer science careers, information technology, etc.). One possible explanation for this disparity is that hiring decisions are made based off cultural fit, or the perception of similarities between employers and job candidates. In previous research, we discovered no difference in hiring intention between male and female candidates, but male candidates were seen to fit better into the company environment than female candidates. The current research investigates whether perceptions of cultural fit are determined in part by the stereotypicality of the candidate, and if males are seen to fit better in computer science (CS) environments even when females express the same interests and appearance. In our study, undergraduates were asked to imagine that they were hiring a job candidate for a technology company. Participants read a description of either a non-stereotypical (e.g., art posters on the wall, etc.) or stereotypical (e.g., Star Trek posters, computer parts, science fiction posters, etc.) CS workplace, and then read a stereotypical (e.g., hobbies include Star Trek Trivia, Anime club, etc.) or a non-stereotypical (e.g., hobbies include intramural soccer, Music appreciation club, etc.) resume of either a male or female job candidate accompanied by a picture of the candidate. Participants then answered questions measuring perceived candidate fit into the company environment and hiring intention. We predict that stereotypical candidates will be seen to fit better into the company environment and be hired more often than either of the non-stereotypical candidates. We also predict that while stereotypical female candidates will fit better than non-stereotypical female candidates, they will fit less well and be hired less often than stereotypical male candidates. This would suggest that perceptions of the overall stereotypicality of the candidate prevent non-typical candidates from being hired, and women may be limited from entering the industry in this way.

Keywords: Stereotypes, Cultural Fit, Computer Science

1. Introduction

In 2010, only 18% percent of undergraduate degrees and 21% of doctoral degrees in computer science (CS) were awarded to women[12,13]. This gender disparity is also found in the workforce, with women making up only 25% of workers in technology fields[1]. Due to the limited number of women in the CS industry, there is a lack of diversity among product developers, and women are being deprived of lucrative careers[9].

A wealth of research has been conducted to explore the reason for this pervasive gender disparity, but results have pointed to no one conclusion. One body of research has found personal choice is a prevalent reason for women's underrepresentation in math-related fields[2]. Women may choose not to pursue computer science due to lack of interest, or because they don't see computer science or other science, technology, engineering and math (STEM) fields as fitting in with their personal goals[6,18]. Previous research by Cheryan et al. (2013) has shown that stereotypes of computer science can also drive women away from choosing the field in the first place[5]. Cheryan et al found that,

when confronted with the "nerdy, white, male" stereotype of the computer scientist, female students had less interest in taking a computer science class, and felt that they would not belong in the field[5].

Further research on stereotypes in CS have pointed towards the computer science environment playing a role in women's decisions to choose the field as well. Cheryan, Meltzoff and Kim conducted a study exploring the influence of environment on female students' class preferences, and *ambient belonging*, or feelings of "fit" into an environment[3,4]. Cheryan et al. used objects and decor generated and pretested by students as stereotypical (i.e., science fiction items, video games, etc), or non-stereotypical (i.e., nature posters, water bottles, etc) of computer science[3,4]. The objects and décor of the classroom environment were manipulated to either fit or not fit the stereotype of computer science. The findings of this study revealed that female students preferred non-stereotypical CS environments, anticipated they would do better in an introductory CS class held in the non-stereotypical classroom, and that the non-stereotypical environment increased women's feelings of belonging in CS[3].

Research on hiring bias shows that women's class choices and interests are not the sole reason for the disparity in STEM fields. A study by Moss-Racusin et al. found that science faculty were less likely to hire a female candidate than they were an identical male candidate[11]. Another study found that when hiring for tenure track teaching positions, participants were more likely to vote to hire a male applicant than a female applicant with an identical curriculum vitae[17]. These studies reveal a bias in hiring decisions based on gender, which could be another factor contributing to the gender disparity in CS and other STEM fields. Where this bias comes from is a more difficult mystery to solve. Moss-Racusin et al found that perceived lower levels of competence mediated the effect they found in hiring fewer female applicants, even though the male and female applicants were described the same[11]. Similarly, in Steinpreis, Anders, and Ritzke's study, participants found that the male applicant was more experienced than the female applicant, even though their curriculum vitaes were identical[17]. What factors could be influencing perceptions of the female applicants in STEM fields?

Many factors go into making hiring decisions. Along with perceived competence, skill, and qualifications, previous research has shown that attractiveness influences hiring decisions, and men that are more hireable than women[10,14]. Other research has shown that masculine or feminine stereotypes can play a role in the hiring process[8,16]. Gorman's study showed that when selection criteria for a position include stereotypically masculine characteristics, fewer women were hired[8]. However, when feminine characteristics were included in the selection criteria, women were better represented in new hires[8].

Recent research has pointed towards another factor that could be influencing hiring decisions: *cultural fit*, or the shared experiences, pursuits, self-presentations styles, shared tastes, and other commonalities between employers and job candidates[15]. Rivera's work shows if the employer sees that the person applying for the job is similar to them, the applicant is seen to "fit in" more, and are more likely to be hired[15]. We've seen in previous research on ambient belonging that environment affects perceptions of fitting in[4]: could ambient belonging be influencing perceptions of cultural fit? In other words, could cues in the environment be influencing employer's perceptions of applicant "fit", and could these perceptions be leading to fewer women being hired into computer science careers?

In order to explore this question, we conducted two studies. In the first study, we explored cultural fit as it pertains to perceptions of "fit" into an environment, or *environmental fit*. Particularly, we looked at the *stereotypicality* of computer science workplace environment, or how aligned to the "nerdy" stereotype of CS the environment seemed according to the types of items in the environment. We explored whether or not a stereotypical or non-stereotypical workplace would influence hiring decisions when presented with a male or female candidate, due to perceptions of fit. We predicted that male candidates would overall be seen to fit better into a CS workplace environment, and that male candidates would be more likely to be hired than female candidates. Additionally, we predicted female candidates would have higher perceived fit in the non-stereotypical environment, and that more females would be hired in a non-stereotypical CS environment than in a stereotypical one.

In the second study, we looked at whether a candidate's stereotypicality, whether or not they align with the stereotype of a computer scientist, influences perceptions of fit and employer hiring decisions. Our research tested if there is a connection between stereotypicality of environment and the stereotypicality of the candidate. We predicted that candidates whose stereotypicality matches that of the environment would be perceived to have higher environmental fit and be hired more often than non-matching candidates. We also predicted that while stereotypical female candidates would have higher ratings of fit than non-stereotypical female candidates, female candidates in general would have lower ratings of fit and be hired less often than male candidates, regardless of environment.

2. Methodology

2.1. Study 1

2.1.1. participants

We recruited 157 (97 female and 60 male) University of Washington students in an introductory psychology class to participate in the study. Participants were recruited via the UW Online Subject Pool Program. The majority of the participants were Asian or Asian American (n = 95) or White (n = 48). Participants were mostly freshmen (n = 89) and juniors (n = 27). The average age of our participants was 19.66 (*SD* = 1.94). The most prevalent current or probable major of the participants was Psychology (n = 17).

2.1.2. measures and procedure

Participants were administered the questionnaire via the online survey software, Qualtrics. The survey was completed in a single online session. After reading through the consent form, participants were asked to imagine that they were a recruiter for a technology company. They were then asked to read a company description to get a feel for the company they were hiring for. The company description listed items either stereotypical to CS (e.g., Star Wars and Star Trek items, electronics, tech magazines, computer parts, etc.), or non-stereotypical items (e.g., art pictures, nature pictures, water bottles, general magazines, plants, etc.)[3]. All items were pretested in and adapted from previous work by Cheryan et al.[3]. After they read through the description of the company, participants were shown a job description adapted from several entry-level position descriptions. They were then shown the resume of a male applicant, or a female applicant, the only difference between the two being the name (James or Jessica). Once the participants had read through the materials, they continued on the to the questionnaire. The questionnaire asked participants questions measuring perceptions of fit into the environment, perceived candidate competence, likability, and belonging in computer science, and hiring intention. Finally, participants filled out demographic information (gender, ethnicity, year, major, etc.).

2.1.3. perceived fit into the environment

Seven measures of environmental fit were taken (e.g., "How well do you think this applicant would fit in at this company?"). One measure was adapted from previous research on gender bias in hiring[11]. All items were rated on a 7-point Likert scale ranging from 1 "Not at all" to 7 "Very much." Perceptions of environmental fit were measured by averaging responses to the seven measures (α = .91).

2.1.4. hiring

We measured hiring with two items: "How likely would you be to recommend this candidate be hired?" and "How likely would you be to recommend this candidate not be hired?" Both measures were on a 7-point Likert scale ranging from 1 "Not at all" to 7 "Very much." The "not recommend" measure was reverse coded. The measures were only moderately correlated (r = .40), and so only the "recommend" measure was used to gauge hiring intention.

2.2 Study 2

2.2.1. participants

Participants were 247 (164 female and 79 male) University of Washington students in an introductory psychology class. Participants were recruited via the UW Online Subject Pool Program. The majority of the participants were Asian or Asian American (n = 157) or White (n = 77). Participants were mostly freshmen (n = 104) and sophomores (n = 78). The average age of our participants was 19.42 (*SD* = 1.72). The most prevalent current or probable major of the participants was Psychology (n = 28). Recognizing that our sample was dominated by Asian or Asian American

participants, the sample was spilt into two groups, Asian/Asian American participants (n = 157) and Other participants (n = 90), in order to explore any differences. There were no meaningful differences between the two groups, and data trended in the same direction for both groups. As a result, participants were analyzed and reported as a whole.

2.2.2. measures and procedure

The procedure for study 2 was identical to study 1, with one exception. Stereotypicality was added to the candidate's resume under a section titled "Leadership and Activities" describing stereotypical (e.g., Star Trek Trivia Team, etc.) or non-stereotypical (e.g., Intramural soccer, etc.) hobbies, adapted from Cheryan et al.[6]. A stereotypical or non-stereotypical picture was also added, adapted from previous work by Cheryan et al.[6].

2.2.3. perceived fit into the environment

The same seven variable measure of perceived environmental fit used in study 1 was used for study 2 ($\alpha = .93$).

2.2.4. hiring

One item measured hiring intention (e.g., "Would you hire this applicant?") and was a "Yes"/"No" response. We used this question in study 2 to more directly assess hiring decisions.

3. Results

3.1. Study 1

3.1.1. perceived fit into the environment

We performed a 2x2, gender by environment ANOVA to analyze perceptions of environmental fit. Analyses indicated that the male candidate ($M = 5.09$, $SD = .75$) was perceived to fit better than the female candidate ($M = 4.84$, $SD = .78$), regardless of environment, $F(1, 153) = 4.32$, $p = .04$. Both male and female candidates had higher perceived environmental fit in the non-stereotypical environment (Male: $M = 5.28$, $SD = .66$; Female: $M = 4.90$, $SD = .73$) than they were in the stereotypical environment (Male: $M = 4.91$, $SD = .80$; Female: $M = 4.78$, $SD = .83$), $F(1, 153) = 4.11$, $p = .04$. There was no significant interaction between gender of candidate and stereotypicality of environment, $F(1, 153) = 1.11$, $p > .05$. See Figure 1 below.

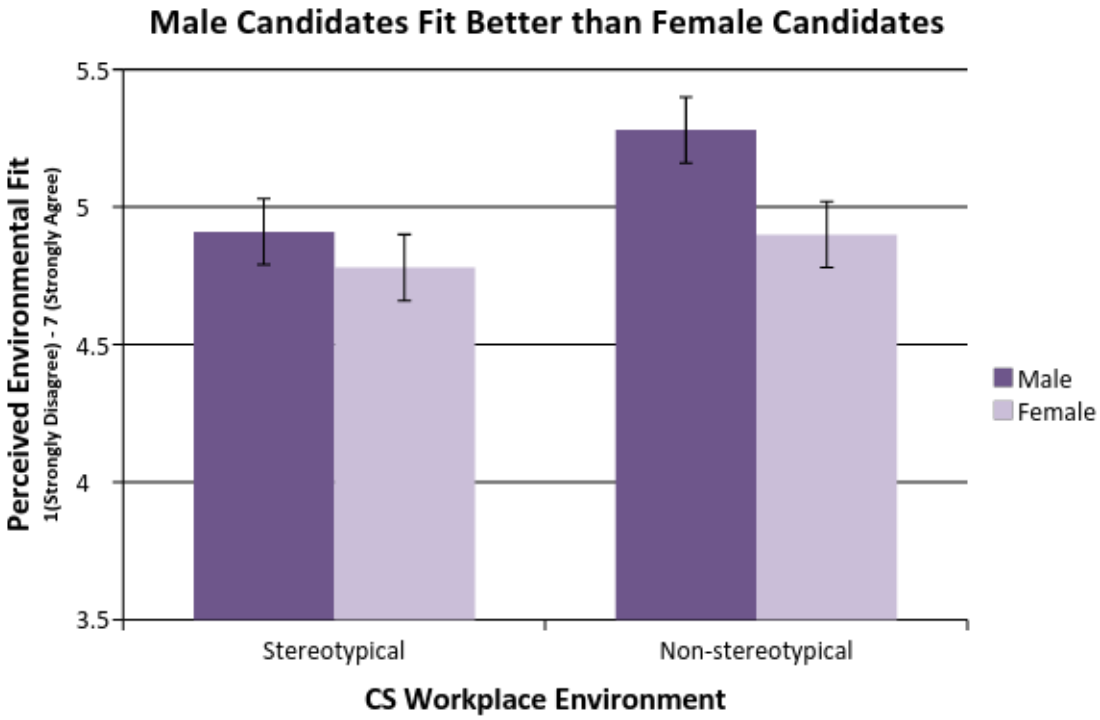

Figure 1. Graph depicting the differences between males and females for stereotypical and non-stereotypical environment. Gender: $F(1, 153) = 4.32$, $p = .04$; Environment: $F(1, 153) = 4.11$, $p = .04$; Gender*Environment: $F(1, 153) = 1.11$, $p > .05$, ns. Bars are standard error.

3.1.2. hiring

We performed a 2x2, gender by environment ANOVA to analyze hiring intention. Contrary to our hypotheses, we found no significant effect of gender or environment in hiring intention. Gender: $F(1, 153) = .25$, $p > .05$; Environment: $F(1, 153) = 2.69$, $p > .05$; Gender*Environment: $F(1, 153) = 1.59$, $p > .05$. Our results indicated that male candidates ($M = 5.13$, $SD = 1.02$) were no more likely to be hired than female candidates ($M = 5.05$, $SD = .98$), and stereotypicality of environment had no effect of hireability for male or female candidates.

3.1.3. summary

In keeping with our hypotheses, male candidates were perceived to have higher levels of perceived environmental fit than female candidates. All candidates, regardless of gender, were perceived to have better fit into the non-stereotypical environment. This was an unexpected finding: We had not anticipated that the male candidate would be perceived to fit better into the non-stereotypical environment as well. We found no significant results when looking into hiring intention. When planning study 2, we took our unusual results into account and decided to look less at the environment, and more at what factors about a candidate make a candidate seem to "fit" into the environment. Specifically, we wanted to see how we could make a female candidate fit in like the male candidate. To explore this, we decided to focus on stereotypicality of the candidate, with the idea that a more stereotypical candidate, one that seems "nerdy", would be seen to fit better than a non-stereotypical candidate, regardless of gender.

3.2 Study 2

3.2.1. perceived fit into the environment

We performed a 2x2x2, gender by environment by resume stereotypicality, ANOVA to analyze perceived fit into the environment. We found an interaction between all three variables, $F(1, 244) = 4.102$, $p = .04$.

In the stereotypical environment, there was no difference of perceived environmental fit between stereotypical candidates (Stereotypical male: M = 5.25, SD = .94; Stereotypical female: M = 5.32, SD = .72), $F(1, 236) = .10$, $p > .05$. Stereotypical male candidates were perceived to have better fit than non-stereotypical male candidates (M = 4.78, SD = .80), $F(1, 236) = 4.35$, $p = .04$. Stereotypical females candidates were perceived to have better fit than non-stereotypical female candidates (M = 4.20, SD = .95), $F(1, 236) = 19.11$, $p = .00$. Non-stereotypical male candidates were also perceived to have better fit than non-stereotypical female candidates, $F(1, 236) = 6.86$, $p = .01$. See Figure 2 below.

In the non-stereotypical environment, there was no difference of perceived fit into the environment between non-stereotypical candidates (Non-stereotypical male: M = 4.98, SD = .86; Non-stereotypical female: M = 4.39, SD = .71), $F(1, 236) = .03$, $p > .05$. There was also no difference of perceived environmental fit between the stereotypical candidates (Stereotypical male: M = 4.67, SD = .97; Stereotypical female: M = 4.39, SD = .98), $F(1, 236) = 1.17$, $p > .05$. There was no difference of perceived fit between the stereotypical and non-stereotypical male candidates, $F(1, 236) = 1.46$, $p > .05$. However, non-stereotypical female candidates were perceived to have better fit than stereotypical female candidates, $F(1, 236) = 6.04$, $p = .02$. See Figure 3 below.

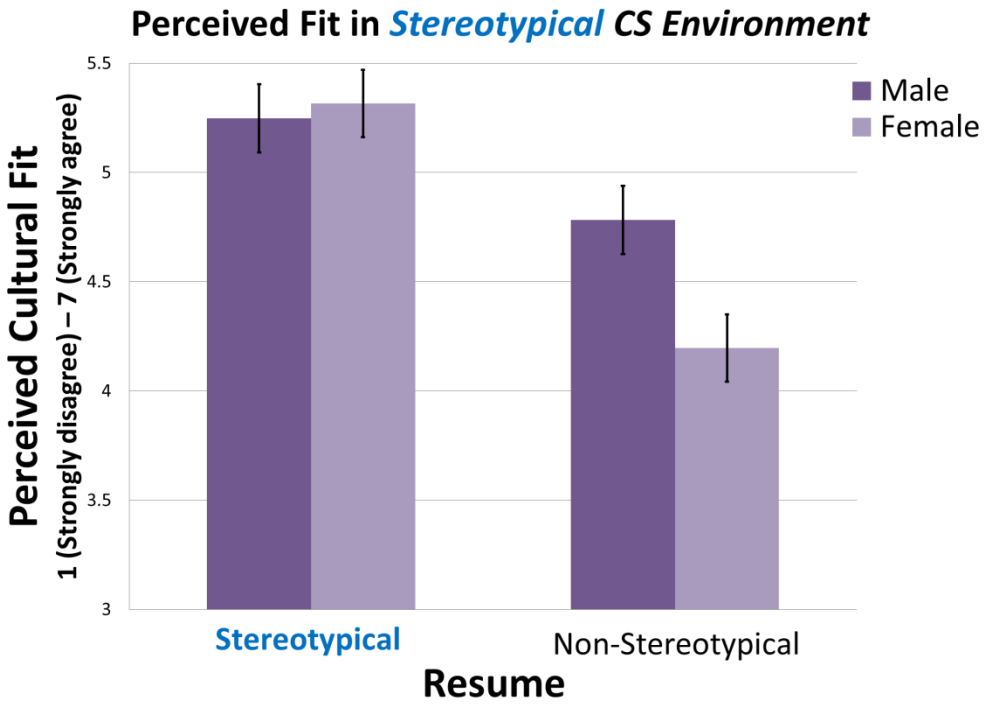

Figure 2. Graph depicting the differences of perceived environmental fit between stereotypical and non-stereotypical males and females in the stereotypical environment, $F(1, 244) = 4.102$, $p = .04$. Bars are standard error.

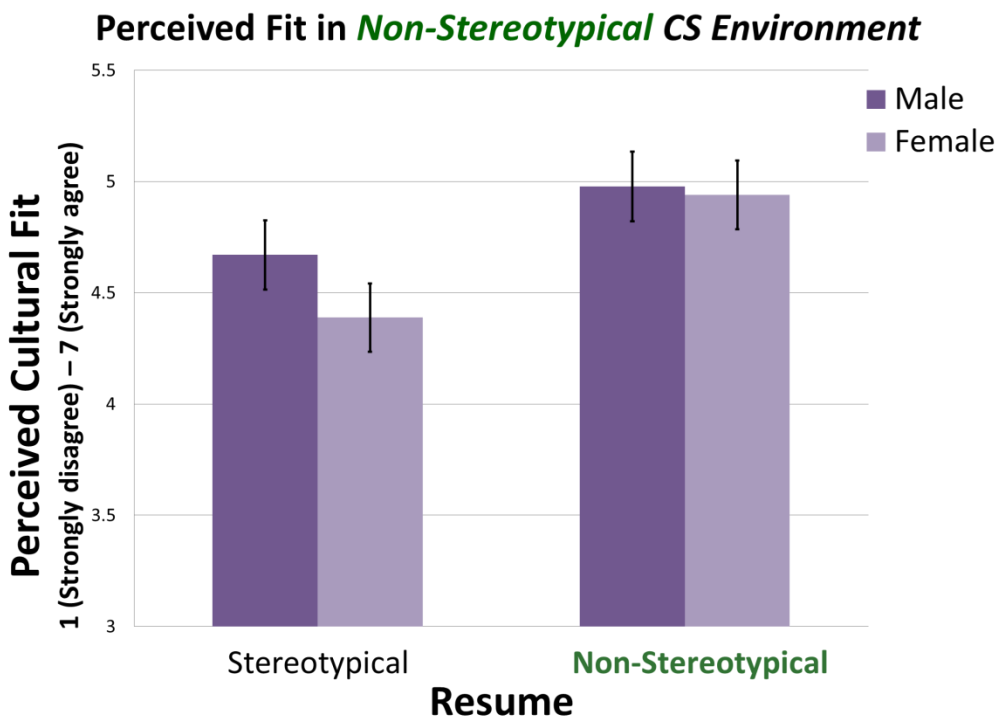

Figure 3. Graph depicting the differences of perceived environmental fit between stereotypical and non-stereotypical males and females in the non-stereotypical environment, $F(1, 244) = 4.102$, $p = .04$. Bars are standard error.

3.2.2. hiring

We found no effect of hiring in our sample, $X^2(1, N = 244) = .003$, $p > .05$.

3.2.3. summary

In line with our hypothesis, we found that candidates whose stereotypicality matched the environment were perceived to have higher environmental fit than the non-matching candidates. Contrary to our hypothesis, matching female candidates were perceived to fit just as well as matching male candidates. Although, in the stereotypical environment, we found that non-stereotypical female candidates were perceived to fit less well than the other candidates, and a similar pattern was found in the non-stereotypical environment for stereotypical females. However, there were no differences in hiring decisions among the candidates.

4. Discussion

In our first study, we found that male candidates were perceived to have higher levels of environmental fit than female candidates. However, we found no differences in hiring intention. This was unexpected, as previous research has shown us that there is gender bias in hiring – it is unusual to see no differences in hiring intention [8, 10,11,14,16,17]. We did find that all candidates, regardless of gender, were perceived to have better environmental fit into the non-stereotypical environment. This meant that even the male applicant was seen to fit better in the non-stereotypical environment than the stereotypical environment. Seeing as computer science environments are typically seen as having more masculine cues, we did not expect that the male candidate would be seen to fit better in the non-stereotypical environment. This lead us to wonder if it isn't gender that influences hiring decisions so much as other factors that might influence the candidate's perceived match with the environment, like interests, hobbies, etc. For study 2, we investigated the effects of stereotypicality of candidate, anticipating that the more stereotypical the candidate, the more they would be perceived to fit.

In study 2, we predicted that when the candidate's stereotypicality matched that of the environment, they would have higher ratings of environmental fit. We also predicted that females would fit less well than their male counterparts. In keeping with our hypotheses, we found that candidates with matching stereotypicality were perceived to fit better than non-matching candidates. Surprisingly, we also found that matching females fit just as well as matching males. Furthermore, we also found that in the stereotypical environment, the non-stereotypical females were perceived to fit less well than non-stereotypical males. However, in the non-stereotypical environment, stereotypical females were perceived to fit as well as stereotypical males. The stereotypical females were still perceived to fit less well than the non-stereotypical females, while the stereotypical males were perceived to fit just as well as the non-stereotypical males. This indicates that in both environments the non-matching female candidates may be at a disadvantage when compared to the non-matching male candidates. These results may indicate that one's interests, hobbies, etc. play a larger role in environmental fit when the candidate indicates having interests that align with the company's culture. However, we still did not find an effect of hiring.

Despite our successful findings regarding environmental fit, neither study found a difference in hiring intention. When attempting to make sense of our findings, we considered several different possibilities for why our results came out the way they did.

One possible reason that we found no differences in hiring intention is that there was actually no gender bias in our selection. Could this mean there is no gender bias in hiring? This seems unlikely given the research done previously on gender bias in hiring[8,10,11,14,16,17]. It could also be that environmental fit doesn't influence hiring intention in the way we expected it to. Previous research shows that cultural fit, or the shared experiences, pursuits, self-presentations styles, shared tastes, and other commonalities between employers and job candidates, does influence hiring[15]. While we were able to show differences in perceived environmental fit when candidate gender and stereotypicality were manipulated, we were unable to show that environmental fit relates to hiring in the same way that cultural fit does. A likely reason for our lack of effect of hiring is that the resume manipulation did not do what we expected. It's possible that the candidates seemed too hireable in general, due to their experience, their GPA, etc., and so participants felt the candidates were too competent not to hire.

A limitation of this study, and another possible reason for our unexpected results, is that it was conducted in a student population. Placing students in the position of recruiters is tricky: students don't have the training or experience that many employers would have in evaluating resumes, looking to see what would make a good employee, etc. Furthermore, a student may be less willing to reject an applicant. In order to explore if a student sample may have been the issue, a future study could be conducted using a sample from Amazon's Mechanical Turk (mTurk), providing a much wider variety of age and experience of participants.

- In the future studies we are hoping to explore more deeply the questions we were unable to answer: Do cues in a computer science environment influence employer hiring decisions? Could they be a source for gender hiring bias in STEM? Could changing workplace environments influence who gets hired?

Further research is needed to determine the true relationship between computer science environments and the gender disparity in computer science. The idea of cultural fit points towards the possibility that women simply aren't seen to fit in the field, which could be affecting hiring decisions. Research surrounding ambient belonging hints that environmental cues can influence perceptions of belonging. How or if these theories connect is still to be determined, but this research could lead to changes in the way companies design their spaces, and a change in hiring practices towards a more inclusive recruitment process.

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