Gender in Software Engineering

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THE TOPIC OF gender in software engineering received significant attention during the most recent International Conference on Software Engineering (ICSE). Papers related to gender appeared in the main research track, the Software Engineering in Society (SEIS) track, and the second Gender Equity (GE) workshop (https://sites.google.com/view/ge-icse2019). Three of the papers summarized in this column are coauthored by the column authors.

Gender Bias in Software Development

“Implicit Gender Biases in Professional Software Development: An Empirical Study” by Wang and Redmiles reports on implicit gender bias and its impact on hiring decisions. The authors conducted an experiment with 142 professional software engineers from seven organizations to examine implicit gender biases such as associating software development professions, specifically technical leadership roles, with men rather than women and associating women with the home and family. The experiment consisted of several tasks including hiring based on a curriculum vitae (CV) where candidates had comparable CVs but different genders, evaluating technical contributions (semantically equivalent bug fixes by contributors of different genders), and a series of gender-related implicit associations and assessments based on the modern sexism scale. The results of the experiment led the authors to conclude that implicit gender biases are prevalent among software engineers of any gender and that these biases significantly impact hiring and contribution evaluation decisions. These findings suggest that software engineers need support in battling implicit biases, e.g., through continuous training. This article appeared in the ICSE-SEIS track and can be accessed at http://bit.ly/PD-2019-Nov-01.

Impact of Gender Bias on Open Source Developers

“Investigating the Effects of Gender Bias on GitHub” by Imtiaz and colleagues uses gender studies literature to formulate a series of hypotheses pertaining to the behavior of women and men on GitHub. For example, the gender studies literature postulates that members of a group that do not align with stereotypes are measured by a stricter standard than those who do. Therefore, members of the group that do not conform have to provide more evidence to demonstrate competence. Based on these observations, the authors hypothesize that the GitHub pull requests generated by women have the following characteristics:

- provide longer descriptions
- generate more discussion
- receive more change suggestions
- require more time for acceptance
- remain more concentrated in fewer projects and organizations.

In addition, they hypothesize that women on GitHub put more signs of competence on their profile. Similarly, the authors derive eight additional hypotheses and then performed manual and automated analyses of open source repositories to test these theories. Overall, the authors conclude that while most of the hypothesized effects cannot be observed on GitHub, the empirical evidence suggests that women tend to concentrate their effort on fewer projects and are more restrained in their communication than men. This work might hint at the reasons for the well-known underrepresentation of women in software development, particularly...

**Sustainability of Female Participation in Open Source**

In “Going Farther Together: The Impact of Social Capital on Sustained Participation in Open Source,” Qiu et al. examine the well-known issue that women are not only underrepresented in open source projects but also at higher risk of disengagement. The authors used social capital as a lens to study the sustained participation by women and men in open source GitHub projects. The authors observe that the more often people participate in projects with a great amount of potential for building social capital, their chance of prolonged engagement increases. Specifically, involvement on teams working with multiple programming languages increases the contributors’ chances of prolonged engagement. Moreover, women benefit more from involvement with such teams. Based on their findings, the authors envision creating tools to recommend to newcomers, women in particular, for which open source projects might be most beneficial. From the project maintainers’ perspective, designing tools that track worrisome trends in the factors negatively associated with developing social capital can be helpful (e.g., team expertise diversity and turnover). This article appears in the main research track of ICSE and can be accessed at http://bit.ly/PD-2019-Nov-03.

**Career Change Difficulties Faced by Women**

“The Underrepresentation of Women in the Software Industry: Thoughts From Career-Changing Women” by Hyrnsalmi reports on the experiences of women, later in life, who either change careers or plan to change careers into the software industry. The author conducted a survey of 134 Finnish women to understand the kinds of prejudices these women face and their risks of becoming self-critical. While strides have been made to make the software industry more welcoming, the results show that women still suffer from low self-esteem and imposter syndrome (a persistent fear of being exposed as a fraud despite external evidence of competence) when talking about their software engineering skills. The intersection of age and gender resulted in a specific fear of discrimination: women in their late 30s doubted their appeal to recruiters. Based on the findings, the authors call on the software industry to implement additional measures to encourage women to join the software industry and reduce the types of prejudice reported by the survey respondents. This paper appears at the 2019 GE workshop. Access it at http://bit.ly/PD-2019-Nov-04.

“Women Want to Learn Tech: Lessons from the Czechitas Education Project” by Buhnova and Prikrylova reports on a study of women in their 20s and 30s who changed their careers to software development. Czechitas (https://www.czechitas.cz/en/), a Czech nonprofit that brings girls and technology closer together, organizes hundreds of events per year across the Czech Republic. It also has influenced more than 10,000 women to change their career path to tech professions or use their tech skills to advance professionally. The authors surveyed 302 participants of events hosted by Czechitas and representatives of 36 companies to understand the factors that play a key role in hindering women from changing careers to the technology field. The results showed that the biggest obstacles to making these career changes related to the following issues for women:

- not understanding that software development might be an interesting career choice
- inadequate confidence in their knowledge or skills to succeed
- concern about the environment in which they would work
- a lack of guidance during learning and career change.

To address these challenges, the authors advocate creating a safe and encouraging environment, ensuring practical applications and hands-on exercises, highlighting role models, collaborating with companies, and providing career guidance. This article appears in the 2019 GE workshop and can be accessed at http://bit.ly/PD-2019-Nov-05.

**Gender Diversity and Community Smells**

“Gender Diversity and Women in Software Teams: How Do They Affect Community Smells?” by Catolino and colleagues investigates the impact of the presence of women and gender diversity on community smells, which are suboptimal circumstances and patterns in the organizational structure of the community or company building the software. Based on a large-scale empirical investigation that included repository mining and statistical analysis, the authors observe that the presence of women exhibits a statistically significant relationship with most community smells. Even when they are outnumbered on a project, women can act as mediators against the proliferation of specific community smells. This observation adds to the growing body of literature that stresses the importance.

Perceptions about Gender and Inclusiveness
“FLOSS Participants’ Perceptions About Gender and Inclusiveness: A Survey” by Lee and Carver examine open source participants’ perceptions of gender and inclusivity. Based on a survey of 171 developers, including 47 women, the authors observed that while the general sentiment toward involvement of women is positive, there is a vocal minority opposing “all this gender stuff.” It is interesting that those that hold this minority attitude tend to believe that they express the opinions of the entire project community or even the entire freely licensed open source software (FLOSS) movement. The authors conclude that while the attitudes of the FLOSS community are becoming increasingly positive, additional effort is required to make it truly welcoming for women. The presence of frequent microaggressions against female participants still hinders women’s participation. Projects that would like to retain female contributors should advertise that fact by making an explicit public statement, stating that they are welcoming toward female participants and have zero tolerance for any type of behavior contrary to this position. This article appears in the main research track at ICSE and can be accessed at http://bit.ly/PD-2019-Nov-07.

References

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