# Gender in Open Source Software: What the tools tell

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## ABSTRACT

This position paper considers what studying Open source Software tools can lend to understanding the topic of Gender Diversity in Open Source Software. More specifically we investigate the GenderMag method, a Gender Inclusive method and how it can help increase gender inclusiveness in the tools that are used by OSS communities.

## CCS CONCEPTS

• **Software and its engineering**;

## KEYWORDS

gender, open source software, newcomers

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## 1 GENDER DIVERSITY IN OPEN SOURCE

Diversity is important for the growth, richness and productivity in any field, and technology is no different. Here we look into the lopsidedness of one type of diversity in the technology - gender diversity. Prior research has shown that Gender Diversity can lead to increased productivity in Open Source Software(OSS) communities[39].

In recent years, many papers on gender in OSS have been published. They have attempted to learn more about gender in OSS [13, 26, 39], explain some of the contributing factors [35, 36], and propose changes and improvements that could potentially bring more women into OSS [37].

There is a growing amount of insightful research about social/cultural issues that effect women in Open Source communities. As an example, most Open Source communities function as so-called "meritocracies" [13], in which female OSS developers report experiencing the "imposter syndrome" [39]. Participant observation of OSS contributors found that "men monopolize code authorship and simultaneously de-legitimize the kinds of social ties necessary to build mechanisms for women's inclusion" [26]. In general, cultures that describe themselves as meritocracies tend to be male-dominated cultures that seem unfriendly to women [38]. In fact, acrimonious talk about which code piece should get incorporated leads to the system being a "pushyocracy" instead of a meritocracy, and is a prime reason why women leave OSS communities [26].

All these contributions are important, but it is important to not overlook any of the factors present in OSS, especially when they provide understanding into all the aforementioned areas. To this end, the tools that make up technical online communities, like Question Answer(QA) forums or OSS tools are an area in need of more research.

One example of promising research being done in this area is Ford et al., who identified 14 barriers that affect women by interviewing female newcomers and experienced female online contributors to the QA forum Stack Overflow [16]. They grouped these barriers into three subgroups: 1) Muddy Lens Perspective (how perceptions and expectations serve as barriers); 2) Impersonal Interactions (lack of personal and positive interactions); and 3) On-Ramp Roadblocks (usage barriers that undermine interest) [16]. One of the female participants even confessed to having a male profile on Stack Overflow to avoid facing bias [16]. A later investigation by Ford et al. showed that, because of the dearth of women in technical online communities, women disproportionately experience a lack of a notion they term "peer parity" (seeing other women contributing to their community) [15], but peer parity is important to women's continued contribution to the community.

An example focused even more on the tool side of these technical online communities is our recent study of OSS tools, including Github, which revealed tool issues that were biased against women [23]. The study presented three insights into OSS tools that warrant further exploration: 1) Tools and infrastructure revealed issues far beyond tool bugs and UI issues; rather, they revealed a wide range of issues across a socio-technical spectrum 2) Tool issues were implicated in newcomer barriers, encompassing six categories of newcomer barriers. 3) The tools and infrastructure were implicated in gender biases. This may play a role in why women are underrepresented in OSS.

## 2 THE GENDERMAG METHOD

In our study the methodology was having OSS professionals use a method called GenderMag to evaluate the OSS tools [23]. GenderMag uses gendered personas which have embedded facets of problem solving that have been found to cluster by gender to find gender inclusiveness issues in software [3]. The five facets of problem solving are:


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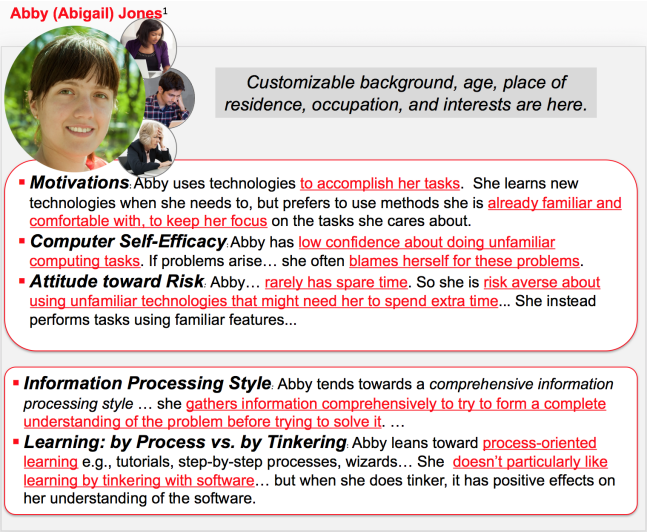
**Figure 1: The Abby persona used in our study [23]**




(1) The *motivations* of females to use technology are statistically more likely to be for what it helps them accomplish, whereas for males it is more likely to be for their interest and enjoyment of the technology itself [2, 4, 6, 14, 18, 20, 32].

(2) Females statistically have lower *computer self-efficacy* than males within their peer sets, which can affect their behavior with technology, causing females to be less confident in their ability to complete tasks and blame themselves if there is a problem. [2, 4, 7, 14, 17, 19, 28, 29, 33].

(3) Females tend statistically to be more *risk-averse* than males, and risk aversion in technology can impact users' decisions as to which feature sets to use. [9, 12, 40]

(4) Statistically, more females than males *process information* comprehensively — gathering fairly complete information before proceeding — but more males than females use selective styles — following the first promising information, then backtracking if needed [10, 11, 24, 25, 30].

(5) Females are statistically more likely to prefer learning software features using process-oriented *learning styles* and less likely than males to prefer learning new software features by playfully experimenting ("tinkering") [2, 5, 8, 18, 31].

GenderMag uses these personas along with a specialized Cognitive Walkthrough (CW) to systematically evaluate software [34, 41].

The CW is an inspection method that allows for a wide array of people, from software developers to designers to identify usability issues that would effect new users of a software. Based on empirical research, CW's have a low false positive rate, meaning that a high percentage of the issues identified are valid usability issues. For example, Mahatody's survey reports false positive rates ranging from about 5% to about 10% [22]; meaning that CWs are about 90% reliable at finding issues. The GenderMag CW has also shown higher than 90% reliability at finding issues and has shown 81% reliability at predicting which of these issues are gender inclusiveness issues [3]. Further, following up on the problems found by GenderMag can lead to more inclusive tools and environments [1, 3, 21].

Our study used the gendered persona "Abby" and gave her the background of OSS newcomer (Figure 1). Using GenderMag with Abby, the software professionals in our study found not only gender inclusiveness issues, but also newcomer issues, suggesting that the process was useful on both fronts. One possibility is that by performing GenderMag, the participants gained knowledge about gender inclusiveness [3] and by using it in an OSS setting, the participants – and we – gained new understanding of problems relating to OSS newcomers, especially problems that would disproportionately affect men or women in OSS.

## 3 CALL TO ACTION: SHATTERING THE GLASS FLOOR

From these two examples it is clear that OSS tools are a contributing factor in the gender disparity in OSS.

If the tools are a contributing factor to the gender disparity in OSS, they should be fixable. It can be an immense task to make a community more inclusive, but by comparison, making software inclusive is more tractable.

We believe that by starting to investigate how we can make the tools and infrastructure more gender inclusive, we may not only help increase gender diversity in OSS communities, but also in other areas of tech development. This increase may in turn create a feedback loop that promotes additional diversity in the tech community. According to the data published by the Bureau of Labor Statistics Employment Projections and the National Center for Education Statistics, 71% of all new jobs in STEM are in computing, but only 8% of STEM graduates are in the area [27]. Learning to contribute to OSS has been successfully used as learning steps in software engineering classes. Therefore, making the tools and technology used in OSS more inclusive may not only foster gender diversity, but also may increase the number of individuals joining the tech workforce.

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