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

What can studying Open Source Software(OSS) tools lend to understanding the topic of Gender diversity in Open Source Software?

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 OSS communities[40].

Computer Science is already a field where women are underrepresented, with NCWIT reporting that a mere 26% of professional computing positions are held by women, despite women making up 57% of the professional occupations workforce[16]. However, women are even more underrepresented in OSS than in the field of computer science as a whole, making up a small percentage (less than 10%) of OSS contributors in the OSS community [12, 33]. Ghosh et al. report an even lower figure: a scant 1.5% of OSS contributors are women [19].

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To investigate this problem, there is a growing amount of research about social/cultural issues that affect women in Open Source communities. As an example, most Open Source communities function as so-called "meritocracies" [14], in which female OSS developers report experiencing the "imposter syndrome" [40]. 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" [29]. In general, cultures that describe themselves as meritocracies tend to be male-dominated cultures that seem unfriendly to women [39]. 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 [29].

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 above 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.

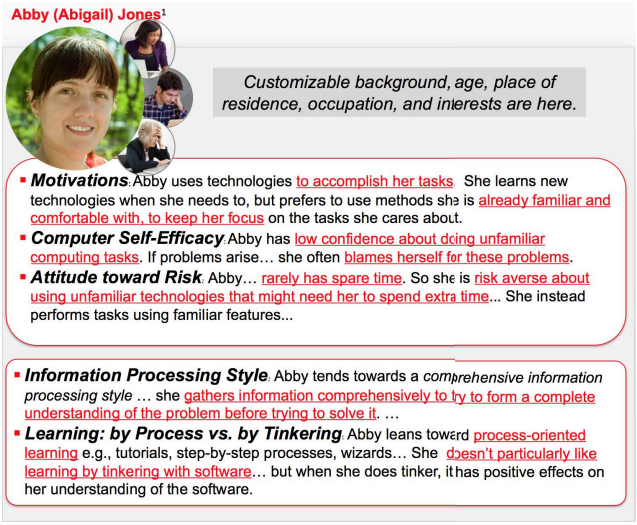
In one example of promising research in this area, Ford et al. identified 14 barriers that affect women by interviewing female newcomers and experienced female online contributors to the QA forum Stack Overflow [18]. They grouped these barriers into three subgroups: 1) Muddy Lens Perspective (how perceptions and expectations serve as barriers); 2) Impersonal Interactions (lack of personal and positive interactions); and 3) On-Ramp Roadblocks (usage barriers that undermine interest) [18]. 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), but peer parity is important to women's continued contribution to the community [17].

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 [26]. 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 sociotechnical 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 OSS professionals used a method called GenderMag to evaluate the OSS tools [26]. GenderMag uses gendered personas which have embedded facets of problem solving that have been

Figure 1: The Abby persona used in our study [26]



found to cluster by gender to find gender inclusiveness issues in software [3].

The five facets of problem solving in GenderMag are:

(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, 15, 21, 23, 35].

(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, 15, 20, 22, 30, 31, 36].

(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, 13, 41]

(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, 27, 28, 32].

(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, 21, 34].

GenderMag uses personas along with a specialized Cognitive Walkthrough (CW) to systematically evaluate software [37, 42]. 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 affect 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% [25]; 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, 24].

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 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.

The software professionals in our study found issues with their own OSS projects[26]. Some examples are shown in Table 1, which shows instances where facets and newcomer barriers emerged. The newcomer barriers are those discovered by Steinmacher et al. [38] where he discovered six categories containing 58 newcomer barriers.

These six categories are:

(1) Newcomers Orientation (NO)
(2) Newcomers Characteristics (NC)
(3) Reception Issues (RI)
(4) Cultural Differences (CD)
(5) Documentation Problems (DP)
(6) Technical Hurdles (TH)

What is notable is that all five of Abby's facets were used frequently across all teams and in different use cases. For example Team-V was working on cloud computing software and using Github issue tracker to find an issue when they mention information processing style and risk(row one of Table 1) whereas Team-Y was working to setup the environment of their graph database OSS project and also found problems pertaining to risk(row seven of Table 1). Overall, all six categories were tied to multiple facets.

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

Table 1: The software professionals found issues that mapped to both newcomer barriers and facets.

Team/Quote	Barrier Categories [38]						Facets				
	NO	NC	RI	CD	DP	TH	M	Info	SE	Risk	L-PT
Team V-P60: *"Yeah so instead of taking any issue and just trying to work on it she will find out more about it so* ***that is attitude toward risk and information process****..."*	✓	✓						✓		✓	
Team V-P60: *"...she might* ***blame herself*** *right now"* TeamV-P59: *"...that effects* ***how she might perseveres*** *with a task...though she's tried understanding, there is really not much she could work with"*	✓	✓	✓	✓	✓	✓			✓		
Team W-P52: *"Oh oh first thing's to sign the CLA. Didn't she (Abby) say something about taking* ***risk****? Something about...****she might be worried****."*	✓	✓			✓				✓		
Team W-P53: *"so she definitely likes to, umm* ***gather information before****..."*	✓			✓				✓			
Team X-P62: *"...Abby would probably prefer a* ***less daunting*** *task...[which] might take a while because she has* ***comprehensive information processing****...[and] her* ***computer self efficacy*** *might hold her back..."*	✓	✓						✓	✓	✓	
Team X-P62: *"...I think that maybe her* ***motivations*** *might be something because she...* ***learns new technologies when she needs to but she prefers to use methods already available and comfortable...****"*	✓	✓					✓				
Team Y-P55: *"Well it looks to* ***be cautious*** *because if she pushes something wrong she can mess-up..."*	✓				✓	✓				✓	
Team Z-P57: *"...she doesn't like to* ***learn by doing...she wants to follow the steps****"*	✓	✓			✓			✓			✓

create a feedback loop that promotes additional diversity in the tech community.

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