Program-L: Online Help Seeking Behaviors by Blind and Low Vision Programmers

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Abstract—Although the number of blind or low vision (BLV) software developers is the largest minority population of developers with physical disabilities, they are often marginalized in mainstream online programming communities. We studied how BLV developers engage with a BLV-specific programming community called Program-L, by exploring the help-seeking behaviors of novices. We analyzed 173 messages written by 20 novices over a 4-year period and identified the kinds of help they asked for and their justifications for requesting that help. We learned that self disclosure, practical assistance, and community dynamics were all critical activities to support four types of novices: community, domain, programming, and accessibility. The findings of our work give insight into what support can look like for online communities for marginalized software developers.

Index Terms—accessibility, social Q&A, blind, software development, online programming communities

I. INTRODUCTION

Software developers seek help from one another with programming problems on social Q&A sites dedicated to answering technical questions. Although these global communities, like Stack Overflow attract a host of questions from a variety of people, there are several pockets of programmers who are barely represented in its set of active users. One in particular is the blind and low vision (BLV) programmers—only representing 1.6% in the Stack Overflow community survey [1]. This group and other "programmers in the margins" have developed strategic ways of not only getting the help they need from broader Q&A communities, but also curating specific communities that support their unique needs.

One such BLV-specific programmer community is Program-L: a mailing list, first started in the early 1990s, "for users of Access Technology involved in programming to discuss any technical problems which are related to either the hardware or software they are using." [2] Program-L provides connection, meaning, and safety for its members to meet one another, share technical knowledge, and ask for and receive help from one another. Most of the discussions found within are centered on the day-to-day lived experiences and needs of BLV computer users and programmers. This improves the value of the discussions here due to the members' specialized knowledge and implicitly understood context that all questions relate to BLV programming issues. For example, when one

member asked another how to find out what line they were on in their code in the VS Code editor, they responded that the Ctrl-G command (go to line) functions not just to jump to a new line, but also to cause screen readers to speak the current line upon invocation. Thus, a screen reader user can hit Ctrl-G and then back out of the command to hear the current line number. In a technical community forum with majority sighted developers, this question would have been answered by a suggestion to turn on display of line numbers in the editor, a solution that is in fact inaccessible to screen reader-using BLV programmers.

We investigated how Program-L provides value to BLV developers by studying novice users' help seeking messages. We filtered thousands of mailing list messages sent between 2016 and 2020 (with the permission of the list owner) down to 173, all written by 20 novices to Program-L. We analyzed these messages through the lens of legitimate peripheral participation [3]—as novices engage with the community for the first time, they learn how to behave and conform to expected social norms by observing others, by responding to their messages, and by starting their own threads. This enabled us to focus our analysis on the subset of messages that had the greatest likelihood of illustrating how BLV developers engage with technical communities when seeking help. In this work, we ask *how do novices in Program-L seek out help?*

In answering this question, we learned how specialized online communities can support marginalized communities (discussed in Section V). We present lessons drawn from our observations of individual community members' behavior to help designers, educators, and community leaders create innovative, vibrant, and safe technical Q&A sites for their users.

Our work contributes the following:

1) an exploration of help seeking behaviors demonstrated by BLV novices in an online programming community.
2) an understanding of how disability self-disclosure is an important aspect of communication even in a community already dedicated to those with disabilities.

II. Background & Related Work

Having a place to ask for technical help and discuss answers to hard problems has been the motivation behind many online communities for knowledge workers, especially for software developers [4]. Social Q&A platforms for software developers, such as Stack Overflow [5], R-Help Community [6], AskQuestions.tech [7], and recently GitHub Discussions [8], provide a space for developers to decipher errors, share their attempted solutions, and receive guidance on how to make progress on with technical tasks [9]. One advantage to these help communities is their size; notably Stack Overflow and GitHub surpassed 50 million users globally [10], [11]. Although there are many users available to answer questions, the large community size can be intimidating to those who prefer smaller, more intimate groups [12]. Lurkers are uncomfortable with relying on users they do not know, and fear they might be harshly criticized [13].

This caution with who and where you engage can be further enhanced according to research focused on marginalized experiences such as BLV programmers. Storer et al. studied the information-seeking strategies of developers with vision impairments and discovered numerous challenges related to accessibility in online information sources [14]. In addition to finding information in documentation, blogs, and textbooks, developers connected with others in online forums. However, BLV programmers faced significant challenges in receiving contextual accessibility-specific help. In Albusays et al.'s study on, they found that over 60% of their BLV participants were reluctant to seek help from sighted colleagues because they felt the need to prove that their visual impairments had no impact on their ability to code [15]. Asking for help is daunting enough—no developer should have to worry about their colleagues thinking they are incapable due to their disability.

To circumvent these barriers, some look for an intimate community where one can feel comfortable asking tough technical questions that are bespoke to a marginalized experience. However, many mainstream online programming spaces fail to create the necessary intimacy. Pandey et al.'s study of accessibility-specific collaboration challenges among BLV programmers demonstrated well. They found that as BLV programmers learned how to navigate the user interfaces of IDEs, they would also ask questions of other developers in online forums, especially ones were dedicated to other blind and visually impaired developers, such as Program-L [16]. They also report that forum members would share their personal experiences, not only technical knowledge, to provide more apt help than technical online forums geared towards a more general audience, such as Stack Overflow. As BLV programmers themselves, their advice was directly relevant to the needs of the askers and did not require anyone to explain why an understanding of accessibility or screen readers was important to their question. Inspired by these works, we investigate the rich value and approaches to asking for technical help in an online community for BLV programmers.

III. Methods

A. Research Setting: Program-L

Our study is based on a public archive of emails from a mailing list called Program-L, a discussion group for BLV computer programmers. The community's archive goes back to November 2004, however the group has been active since as early as the 1990s [17]. At the time of study, the mailing list consisted of 581 members. 338 of these (58%) have posted at least one message recorded in the archive. Before beginning our study, we received permission from the Program-L moderator to study this group. Our study design was approved by our Institutional Review Board (IRB).

B. Mining the Archive of Community Posts

1) Data Collection: We built a Python-based webscraper to identify and process message threads from the list's public archive [17]. We focused on messages from Jan-2016 to Jan-2020 (the time of our study) since this more recent activity would most accurately reflect the current status of the community. This filtered our collection from 25,222 archived posts down to 6,545. We included message metadata such as the sender, sent date, and subject, as well as the message body. Sender email addresses were already anonymized by the archive maintainer by obscuring their domain names.

2) Analysis: We used a combination of inductive and deductive methods to qualitatively code messages from BLV novices. Novices play an identifiable role as they navigate the community trying to understand others' messages and seeking out help in their posts. We used a multi-phase coding process to identify novices and their needs.

a) Phase One: Identify Newcomers: To identify the novices in our data set, we filtered the data by key phrases such as: "I am" , "Hello I am", "name is", "introduce", "trying to learn", "am learning", "a beginner", "beginner in", "Is <blank> accessible", "any accessible <blank>", and "novice'. We classified these novices into 4 types based on the context they provided to their question: *Domain Novice* which describes a specific domain within programming, *Accessibility Novice* which describes people who are new to accessible program or new to accessibility overall, *Programming Novice* which describes someone new to programming in general, and finally *Community Novice* which describes those who explicitly identified themselves as new to the Program-L community. We identified and characterized 20 novice profiles (see Table I), each of whom posted between 1–23 times. We should note that although three of these novice types have been recognized in prior studies [18], the *Accessibility Novice* in this type of community presents a new perspective on help-seeking behaviors. We computed the number of threads novices started along with the number of replies they made to other threads. A large number of responses to community members' posts can indicate a growing expertise level [19].

b) Phase Two: Identify Help Seeking Behaviors: The first author analyzed a 20% sample (35) of the 173 messages using open coding to classify types of help-seeking behaviors.

ID	Novice Type	Threads Started	Replies
N01	Domain Novice	5	23
N02	Accessibility Novice	1	2
N03	Domain Novice; Accessibility Novice	1	1
N04	Domain Novice	3	5
N05	Domain Novice; Community Novice	2	1
N06	Domain Novice; Accessibility Novice	2	10
N07	Domain Novice; Accessibility Novice	1	2
N08	Domain Novice	11	3
N09	Domain Novice	1	0
N10	Domain Novice; Accessibility Novice	12	8
N11	Domain Novice; Community Novice	3	1
N12	Accessibility Novice	9	2
N13	Domain Novice	1	6
N14	Domain Novice	1	6
N15	Accessibility Novice	4	5
N16	Programming Novice	2	7
N17	Programming Novice	1	6
N18	Community Novice; Programming Novice	0	3
N19	Community Novice	0	2
N20	Domain Novice	3	14

All of the authors met together to review and redefine those codes, if necessary. Afterwards, an additional sample of 20% more messages (35) was chosen and each author independently coded them. A Krippendorff's alpha [20] calculation showed that we were in 61% agreement. Codes and messages causing disagreement were further reviewed and redefined as a group. The first author then finished coding the rest of the data which was used in the qualitative analysis reported in the paper.

C. Study Limitations

Although we did gather years of data from the mailing list and receive consent from the list maintainer, our analysis is limited by a few constraints. For instance, our community post analysis was scoped to a four year period (January 2016 to June 2020) which does not include posts from when the mailing list was first conceived. We could not conduct follow-up interviews to gain direct perspectives from the posts in our sample since their identities were anonymized in the mailing list archive. We recognize that there are several more online communities for focused on BLV technical matters. We chose Program-L because it is the oldest and largest of these communities and is commonly cited in messages found in broader online programming communities [21].

IV. FINDINGS

Our data show that novices in Program-L followed a particular set of norms and behaviors when asking for help. They introduced themselves and their computing environment and reported their previous steps before asking their questions, a few of the items recommended by experts who evaluate bug reports [22].

Even as newcomers, they provided informational support to others. However, not only did they request information to answer their questions, they also asked for *practical* assistance from others (i.e., help them actually accomplish a task with which they were having difficulty).

In the following subsections we illustrate these behaviors in depth, highlighting questions and types of behaviors that are unique to this community.

a) Introductions: On Program-L, introductions tended to go beyond simply mentioning one's name and origin. Instead, subscribers were inclined to disclose their disabilities as well as their programming experience history and skill level.

- **Disclosure of Disability:** *"I'm going to introduce myself although I believe some of you already know me on this list. I am totally blind, wear a hearing aid, and use a cochlear implant." – (N11)$_{DC}$*
- **Programming interest and device set up:** *"Hello list, What is the best setup for Android development with? I am interested in only Java at this time. SO I want to learn/make some experiment." – (N12)$_A$*

Introductions also included the tools they used to accomplish tasks including screen reader types, IDE, and programming languages. Each of these components mentioned in a question are necessary in this community to help answer questions because the way to resolve a problem can vary with each combination of screen reader and IDE.

> *"I'm finding that the way sighted people test run applications onto a device they just click run and choose the specific device. As someone who uses a screen reader, specifically NVDA, what are the steps that you have used to run an app in <development environment>." – (N12)$_A$*

b) Steps Taken: When novices sought support, they often shared the steps they took before getting to a specific point. They typically included the IDE and screen reader as this information strongly influenced the detailed answer they received, similar to above.

> *"Hello everyone, I've found some helpful resources to help me learn front end development, but I'm having a challenge using the developer tools in the browser. I usually use Firefox because it seems to have a strong commitment to accessibility. The operating systems I am comfortable using is Windows 10 with NVDA. I found this link for dev tools with screen readers <link>, but I can't find anything for Firefox." – (N02)$_A$*

> *"Hello everyone, thoughts on what might be happening? I'm trying to append additional information to a date. How should I go about getting the updated date? To guide me I am using <programming language manual> and W3 schools <code snippet>.*

My code does the following: <explanation of code>. I do not have any syntax errors, so I am unsure what the issue is. <php code snippet>" – (N01)$_D$

c) Informational Support and Practical Assistance: The strongest norms observed in the community centered on requesting and providing both informational support and practical assistance. Informational support centers on a notion of knowledge; while experts tend to have knowledge in multiple areas, even the novices in our sample had knowledge to contribute at times. Practical assistance includes asking for tangible or specific, actionable support. Instead of asking for help with specific coding situations, like errors or bugs, novices asked for suggestions, recommendations, or advice of "how to" on topics including accessible IDEs, beginners' programming languages, beginning to code in Braille, and Braille vs screen-readers. For instance, N13 and N11 asked:

"Are there any recommendations for amazing resources about assembly language?" – (N13)$_D$

"If anyone has any suggestions/advice I would really appreciate it. I am trying to learn html with <website>, but something seems confusing with HTML 5 ... Are there certain things you can only do with html 5 that you cant do in html 4, like form elements?" – (N11)$_{DC}$

Prior work in online communities suggests that those who are new to a subject area are likely to seek more information than they provide [23]. This concept seems to hold true within the Program-L community as well.

Some novices sought practical assistance, for instance, N01 asked for someone on the mailing list to review their code.

"Hi all, Im currently a student working on databases. Is someone willing to review some code with me and give some suggestions?" – (N01)$_D$

N17 asked someone to help them fix a syntax error. This is practical assistance because the respondent will have to read through the code in order to help N17:

"I really feel this should be basic, but somehow it's not working. To me the four parts of the code looks the same, but the last part has a syntax error. Can someone help me with this? <link to code>" – (N17)$_P$

In the case of practical assistance, the only way someone would be able to help these individuals with their situation is for the respondent to actually look at the novice's code to help them figure out the problem together.

d) Common Question Types: Our analysis showed that beyond the general programming questions that users would see on mainstream Q&A platforms, such as

"On Stack exchange I saw that <programming language> was recommended to another blind person. Do any of you program using <programming language>? I wondered this language has been successfully used because I could try to learn another language again, but i am in the same place with both of these languages." – (N16)

"Hello everyone, thoughts on what might be happening? I'm trying to append additional information to a date. How should I go about getting the updated date? To guide me I am using <programming language manual> and W3 schools <code snippet>. My code does the following: <explanation of code>. I do not have any syntax errors, so I am unsure what the issue is. <php code snippet>" – (N01)$_D$

Novices commonly posed questions related to navigating accessibility (e.g., shortcuts, preferred languages, etc.).

"Hi all! I'm interested in <programming language> for mobile development, so I was wondering what would be the best setup for mobile development with NVDA." – (N12)$_A$

"Thank you all for the help! I'll try you all's suggestions. <IDE> is just like the rest. It was problems with cursor tracking and somewhat shaky speech. For instance if I move through a file sometimes it may not say the things that's on that line. I was also recommended another option that I will be trying out soon" – (N06)$_{AD}$

"Hello everyone, is there and way i can prevent Jaws from reading each letter I press? When using NVDA + <package> everything works correctly. I am using <programming language> with <supplemental packages>. Thank you!" – (N08)$_D$

V. DISCUSSION OF IMPLICATIONS

Our analysis of the Program-L archive showed some interesting help-seeking behaviors that differ from mainstream Q&A sites like Stack Overflow. When introducing themselves, Program-L novices described their personal experience with their disability and the hardware and software they use to program computers. In addition to asking others for help & responding to their questions about technology, they also reached further, asking others to contact them and help them directly with their task. Next, we discuss the implications of these findings.

A. Self Disclosure

Novices on Program-L commonly self-disclose their visual impairments. In other online communities where vulnerable experiences are shared, individuals are not as quick to self-disclose due to stigma attached to their experiences [24]. In the Program-L community, this is not viewed with stigma, since they assume that the entire community has some form of visual disability.

As many mainstream programming communities are tailored towards sighted majority audiences, when blind or low vision programmers ask questions without disclosing their disability and accommodation needs, they may easily receive non-helpful answers. To make these communities more effective, users should be prompted to include information about their assistive technologies (e.g., screen reader, Braille displays) along with more universal data about OS,

programming language, and the asker's level of experience. Given early, this kind of context information provided by questioner can speed up the process of getting answers [9]. Designers of programming communities could benefit from embedding these options when posting a question, but it also should be utilized in private, context-based communities for learning, such as Piazza, Canvas, Blackboard etc. to help make them more inclusive. In addition, communities unable to provide a full spectrum of accessible resources to blind or low vision programmers could instead aim to create a centralized repository of programming accessibility questions for blind or low vision novices (see quote below from N18). This could help support newcomers before they grow disillusioned and lose interest in programming.

> *"I agree, a centralized location for placing information would be helpful because currently when searching for things involving accessibility can take a long time." – (N18)$_{CP}$*

B. The Value of Program-L

Throughout its almost 30 years of activity, Program-L has been a safe and communal source for asking and answering technical questions about accessibility problems for programmers, and users generally do just that. Although members may ask non-accessibility-related technical questions on other Q&A platforms, they come to Program-L for accessibility, and are more comfortable and more likely to get an accessibility-centric answer. Program-L is a small community with a lot of expertise about accessibility on a variety of professional tools, which increases the likelihood that a community member will know the answer and share it.

By taking advantage of existing mechanisms, mainstream Q&A programming communities like Stack Overflow can evolve to offer a similar value as Program-L. For instance, the process of questions with the *blindness* tag (as of April 2021) [25] are particularly helpful for BLV programmers to find questions they can answer. It is defined as "anything related to issues concerning blind or low vision people. This covers software especially designed to help those people, or visual accessibility problems with software in general." When we looked at questions tagged *blindness*, we found many technical questions about how to make applications and websites accessible, but few questions from self-disclosed blind or low vision people asking technical accessibility questions. In most of those cases, the question was prefaced with self disclosure of visual impairment. There was also a question from a blind user asking for reassurance about their fear around pursuing a career in software development even though they had a passion for it. This question was marked "closed" to any answers because it was "opinion-based" on Stack Overflow, but similar questions on Program-L have opened up a conversation of supportive peers to encourage them on their journey. This rich nature of multi-dimensional support is what makes communities like Program-L unique and worth studying in-depth.

VI. Conclusion

In this paper, we have described our study of an online community intended to offer technical and social support for blind or low vision programmers. Examining the community's email messages from novices has given us insight into the types of novices within the community and the help seeking behaviors they presented. The community's small size and relative isolation may be the reasons why it has remained a safe place for BLV programmers to ask technical questions and offer one another informational and practical support.

Acknowledgment

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