Understanding Online Discussion Experiences of Blind Screen Reader Users

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Online discussions have become commonplace, where people engage in anonymous or non-anonymous conversations on an assortment of topics. However, little is known about the user experiences of blind users in online discussions. Unlike sighted users who can visually skim through voluminous conversations, blind users have to rely on a screen reader that facilitates mostly linear navigation and vocalization of text, which can potentially impact their experience in these conversations. Therefore, we conducted an interview study with 20 blind participants who were active users of online discussion forums. The study illuminated participants' issues, needs, and preferences, notably, the difficulties in situating themselves in ongoing conversations, finding responses to their prior posts, and interpreting context-dependent posts; need for standardized texts, sub-thread summarization, and sub-conversation links; and preference for longer posts and focused conversations. We finally discuss implications of our study findings and explore potential ideas to improve user experience of blind screen reader users in online conversations.

1 INTRODUCTION

Online discussion platforms including social media and community forums (e.g., Reddit, Quora) have become a dominant medium for socializing, debating, exchanging information, and seeking answers [10, 32, 45, 129, 135, 136, 175]. According to recent data, as of 2024, there are approximately 5.22 billion active social media users globally, representing roughly 63.8% of the world's population [2, 48]. Social media platforms such as X (formerly Twitter) and Facebook have also been crucial in distributing important information in real-time to the public in times of natural catastrophes or crises [42, 109, 125, 183, 187, 219]. Moreover, these platforms have also emerged as vast reservoirs of knowledge, feeding several downstream applications including sentiment analysis [130, 185], disaster management [77], question-answering [27, 71, 133], and market research analysis [12, 141].

Given the importance of online discussion platforms, prior works have focused on making discussion content more accessible for people with visual disabilities [114, 182, 213]. These works have predominantly focused on the general web accessibility aspects of online discussion forums [24, 197, 207, 226], such as container webpage layouts [58, 59, 106, 107, 155, 191], thread navigation [8, 9, 23, 53], and visual-content accessibility [97, 156, 167, 172], whereas the conversation-specific experiences, needs, and preferences of blind screen reader users in online discussions have been

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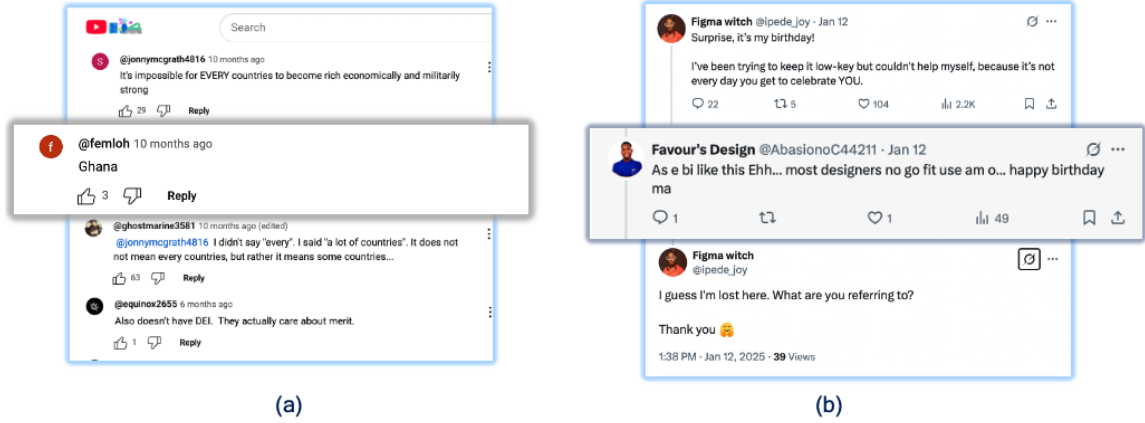
Fig. 1. (a) Difficulties in understanding posts due to missing or assumed context, (b) Need for standardization of posts to enhance listening comprehensibility.

largely overlooked. We fill this knowledge gap in this paper via an interview study with a diverse group comprising 20 blind individuals (severe to complete as per WHO definition [192]) who are active users of various online discussion platforms.

The study specifically focused on addressing the following research questions:

- **RQ1**: What are the blind users' overall conversational experiences in online multi-party discussions?
- **RQ2**: What do blind users need to be more effective and productive in online discussions?
- **RQ3**: What preferences do blind users have with regard to the posts and dialog in the discussions?

Analysis of the interview data revealed that blind users are often subjected to unpleasant experiences when participating in online discussions. For instance, many participants said that they found it cumbersome and mentally taxing to join an ongoing conversation and that they also faced issues in tracking even their own prior posts and relevant replies. A majority of the participants also reported difficulties in understanding posts that lacked or *"assumed"* context, where the context was specified in an earlier post higher up in the thread (see Figure 1a).

For effective participation in the forums, most participants expressed a need to *"standardize"* posts for enhancing listening comprehensibility of thread posts (see Figure 1b). The participants also stated that they needed *"some kind of summarization"* capability, which would enable them to quickly situate themselves in an ongoing discussion without having to listen to numerous posts. As for preferences, the participants said that they liked listening to longer, verbose posts over shorter, concise posts. The participants also preferred conversations that stayed focused on the main topic, with fewer digressions.

Addressing these needs and preferences of blind screen reader users can significantly promote inclusive environments in online discussion platforms and consequently empower them to avail the numerous benefits of these platforms like their sighted peers. For example, it has been shown that engaging in discussions with people from diverse backgrounds and perspectives can significantly enrich individual creativity [74, 142].

In sum, our paper makes two primary contributions. First, through an interview study with 20 blind users, we uncover the perspectives, needs, and preferences of blind screen reader users regarding online discussions, including those on social media and community forums. Second, we discuss ideas for how these uncovered requirements can

be fulfilled by leveraging the reasoning power, immense embedded knowledge, and generative capabilities of large language models such as GPT-4o [79] and Llama [195], thereby laying the foundation for future research in this area.

2 BACKGROUND

2.1 Screen Readers and Web Accessibility

Screen readers are essential tools for individuals who are blind, providing them the means to access digital content in software applications, including the Web. Commonly used screen readers such as JAWS, NVDA, and VoiceOver transform the on-screen text into synthesized speech or Braille output [72, 210, 212], allowing users to navigate and engage with content using keyboard shortcuts. Nonetheless, the fundamental one-dimensional 'press-and-listen' aspect of screen reader navigation frequently clashes with the two-dimensional visually-rich design of contemporary websites, resulting in notable accessibility and usability issues [17, 52, 58, 105, 123, 181].

The accessibility investigations have primarily centered around visual content such as images, videos, GIFs, and emojis [68, 91, 110, 144, 172, 193]. For instance, Gleason et al. [68] examined 1,198 pictures on social media platforms, and found that only 91 pictures had accompanying ALT-TEXT necessary to make them accessible with a screen reader. Solutions to improve accessibility of web content have also been presented in the literature, which include methods targeting both web developers and end users. The developers can refer to web accessibility guidelines like the Web Content Accessibility Guidelines (WCAG) [29] to improve the accessibility of their content. Several automatic accessibility checkers are also available, and they assist web developers in identifying accessibility violations in the websites [3, 63, 147]. Despite these initiatives, studies have shown that web developers and content creators are inconsistent in their application of these guidelines due to their enforcement complexity, thereby leaving many accessibility issues unresolved in their websites [30, 44]. On the end-user side, the accessibility-enhancing techniques have mostly focused on generating textual/audio descriptions for visual content (e.g., captions for images) [139, 162, 174]. While most of these techniques have relied on generative-AI models such as LSTM networks [162, 174, 216] and large language models [55], there also exist non-AI approaches that have explored crowdsourcing [164, 227], i.e., relying on sighted volunteers to provide informative descriptions to blind screen reader users.

Compared to the plethora of studies and solutions addressing web accessibility, there have been significantly fewer efforts to investigate and improve web usability, i.e., the ease, efficiency, and satisfaction with which blind screen reader users can interact with web content [15, 33, 65]. Studies have shown that the web experience of blind screen reader users is often unsatisfactory and moreover they need to expend significant time and effort to do everyday web tasks such as e-commerce shopping, social media surfing, and collaborative editing, even if the websites themselves are highly accessible [38, 62, 101, 102]. The extant usability-enhancing techniques for web screen reading too have been relatively scarce [80, 105, 153, 154], with the proposed techniques ranging from third-party input modalities [21, 148, 161], to automation agents [11, 93, 146], to even virtual assistants [64, 134, 151, 184]. For instance, Billah et al. [21] explored the use of a commercially available Dial input device as a non-visual substitute for a computer mouse, allowing users to navigate semantically meaningful sections of a webpage, such as menus, forms, and data records—through simple rotational and press gestures. Similarly, Soviak et al. [179] introduced a novel tactile input device that allowed blind users to perceive the structure and layout of a webpage by conveying tactile feedback on the boundaries of distinct page segments. On the other hand, Gadde et al. [61] and Ashok et al. [11] proposed natural language-based interfaces that enabled blind screen reader users to automate web-navigation tasks using simple voice commands, thereby obviating the need for blind users to memorize complex screen reader shortcuts and navigation strategies.

A common aspect underlying all the above approaches is that they predominantly focus on webpage navigation and information search [28, 149, 150, 178]. Therefore, these usability-enhancing techniques have limited use in online discussion forum websites (e.g., quickly navigating between different threads, quickly locating the relevant thread); they largely overlook the conversation-specific interaction needs of blind users in online discussion forums (e.g., quickly join an ongoing conversation, follow up on previous dialog exchanges). Research focusing exclusively on the accessibility and usability of discussion forums are few and far between, as explained next.

2.2 Accessibility and Usability of Discussion Forums

Discussion forums including social media play a vital societal role in facilitating online conversations, enabling users to exchange ideas, seek information, search for jobs, and build communities [35, 70, 124, 143, 208], with prior research also highlighting the significant importance of these platforms for blind individuals [49, 60, 99, 112, 189, 230]. For instance, Wu et al. [208] found that blind users participate in social media forums like Facebook to the same extent as the general population, and additionally they received more feedback (on average) to their posts or comments. Despite the importance of online forums, efforts on promoting accessibility and usability of these forums have received very little attention from the research community [7, 69, 75, 98]. For example, a fairly recent investigation of the Meta's Threads social forum revealed several interaction issues including inaccessible images, navigational inconsistencies, and a general lack of sufficient structural markup for convenient screen reader interaction [1].

There do exist a few extant works that have proposed methods to address the aforementioned accessibility issues with discussion forums for blind screen reader users. Apart from the artificial intelligence (AI)-based and crowdsourcing techniques to tackle visual content such as images, intelligent interfaces have also been proposed to improve screen reader navigation within discussion threads. For example, Sunkara et al. [182] presented an intelligent interactive system that enables screen reader users to selectively navigate a subset of posts in a thread by filtering out irrelevant posts containing hate speech, profanity, and other objectionable content based on user-specified criteria. Similarly, Aiyer et al. [7] developed an intelligent interface that is capable of disentangling sub-conversations within a discussion thread, thereby enabling users to easily and selectively navigate sub-conversations without having to listen to all the posts in the thread. Akin to these works, there also have been other efforts to improve screen reader navigation within a discussion thread [14, 16, 18, 94, 205].

While these existing works focus on and provide valuable insights regarding the general navigation and structural issues in discussion forums through user studies, they do not delve in-depth into the actual conversational experiences and dialog challenges of blind individuals (e.g., how easy is it to join and contribute to ongoing conversations, what are the challenges involved in tracking the underlying context in a conversation), nor do they uncover their unique linguistic and social interaction needs regarding the conversations' content and dialogs (e.g., how 'listenable' is user-generated content in the posts, what is their perception of productivity and effectiveness in forum conversations); prior research on language usage and experiences in social media have instead predominantly focused on sighted users [81, 82, 85].

2.3 Conversational Aspects of Discussion Forums

Given the wealth of information in discussion forums, significant efforts have been made to understand the characteristics of content in forums as well as the users' user-interface needs and preferences regarding the forum (including social media) content [57, 73, 131, 199], in order to not only inform the design of better forum user interfaces but also capture the design requirements for downstream applications such as chatbots [13, 51, 76, 92, 171, 186], sentiment analysis [41, 128, 157, 166, 204, 225], and question-answering systems [89, 176, 198]. However, all these works have
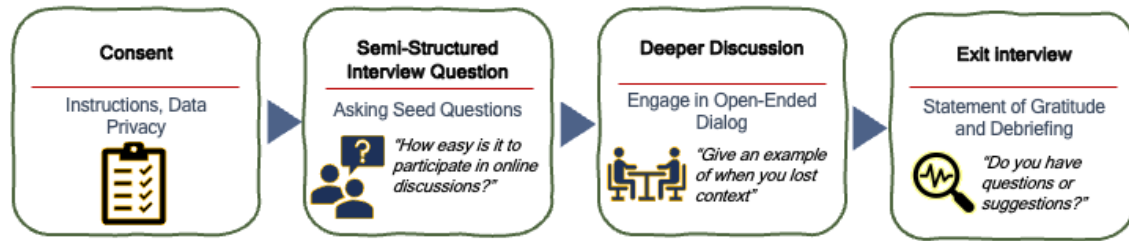
Fig. 2. Illustration of the interview study process.

centered around sighted users, and as such, there is still a significant gap in knowledge concerning the conversational experiences, needs, and preferences of blind screen reader users in discussion forums.

The very few existing works specifically targeting blind users [196, 208] have mostly focused on passive data-driven analysis of forum content generated by blind screen reader users. For instance, a seminal work by Wu et al. [208] analyzed the content (i.e., status updates, photo uploads, comments, and likes) generated by 50K screen reader users, and found that blind users are more likely to include words (e.g., cane, audio) pertaining to their impairment in their status updates, they openly talk about disability and accessibility, and their photo uploads are mostly connected to popular accessibility apps and listening-related activities such as radio podcasts. In another work, Venkatraman et al. [196] performed linguistic comparison of discussion threads randomly sampled from dedicated screen reader accessibility forums (e.g., JAWS and NV Access) and general forums (e.g., Reddit, Yahoo). They found that the language in accessibility forum conversations is more task-oriented and concrete, featuring a significantly higher frequency of descriptive action verbs compared to conversations in general forums. They also observed that users on accessibility forums exhibited unique linguistic patterns, including a higher frequency of first-person pronouns, reflecting a stronger sense of personal engagement with the community.

While these studies provide high-level insights regarding content generated by blind users in online forums, they do not capture the blind users' thread-level conversation-specific experiences and needs, especially in multi-party discussions. Moreover, these studies were based on passive 'offline' analysis of existing public data scraped from online forums and therefore they did not involve active and direct engagement with blind people with lived experiences to obtain first-hand accounts of their needs and challenges. In this paper, we fill this knowledge gap through active engagement with blind screen reader users who have prior experiences in online public forums and social media conversations.

3 MATERIALS AND METHODS

To address the earlier research questions, we conducted an IRB-approved **interview study** with blind participants. Drawing from prior approaches to studying blind users' interaction experiences in different domains [34, 47, 197], we opted for a semi-structured interview setup, where the experimenter engaged in discussions with the participants guided by carefully-crafted seed questions. The study focused on capturing the unique experiences, needs, and preferences of blind screen reader users in online multi-party discussions. Figure 2 illustrates the overall process of the study. Details of the study are as follows.

3.1   Participants

We recruited 20 blind participants[1] with the assistance of the Lighthouse Guild (New York City, USA), a non-profit organization that caters to around 5000 persons with visual disabilities annually. The 146 blind persons who signed up for the study were subjected to a Zoom call screening process based on the following eligibility criteria: (i) Familiarity with web browsing; (ii) Familiarity with online discussions with active involvement for at least the past 6 months; (iii) Familiarity with using a screen reader for web interaction; (iv) At least 18 years of age; and (v) Fluency in English. Out of the 63 candidates who met these criteria, we finally selected 20 participants by balancing (to the best extent possible) the age, gender, and screen-reader proficiency variables. In our final sample, the distribution of participants based on these variables was as follows: (a) Gender: 11 female, 9 male; (b) Age: 10 people ($\leq$ 50 years), 10 people ($>$ 50 years); and (c) Proficiency: 12 non-expert, 8 expert. All personal information including screen reader proficiency was self-reported by the participants. Table 1 presents the full demographic details of the study participants. The participants reported using various online discussion platforms, including Facebook, Reddit, YouTube, Yahoo, JAWS[2] and NVDA[3] forum comment sections. All participants also stated that they were active in online discussions at least once a week, and that they accessed these forums mainly for entertainment, influencing, opinion sharing, and seeking information about various topics.

3.2   Study Design and Procedure

The design of the semi-structured interview was influenced by prior studies [83, 206] that examined effective ways of conducting interview studies. The interviews commenced with the researcher reading the consent form to the participants. This form outlined the study's objectives, confidentiality assurances, and expected time commitments. After obtaining consent signatures, the participants were asked to complete a basic demographic questionnaire. This questionnaire captured details such as participants' age, educational background, screen reader proficiency, and experience with discussion platforms. The subsequent interview questions were explicitly designed to align with and address the research questions of the study, ensuring consistency and relevance throughout the process. With the seed questions guiding the conversation flow, the semi-structured interview transitioned into open-ended discussions, allowing participants to elaborate on their experiences and challenges in online forums. Below are some of the seed questions we asked the participants to kick-start discussions pertaining to the earlier research questions:

- How easy is it to participate in online discussions? What aspects of online discussions do you like (don't like)? What challenges do you typically face when trying to follow and contribute to online group discussions?
- What is your perception of productivity in online discussions? Are you presently happy with your productivity in online forums? How could online platforms improve their content presentation to make group conversations easier and more intuitive for you? What other improvements do you suggest that will help you be more effective in discussions?
- Is it easy for you to comprehend the posts? What is your opinion regarding the current organization of posts in threads? How do you prefer the posts in the discussion to be organized?

We also posed follow-up clarification questions for responses that were unclear or particularly unique. These discussions provided valuable insights into potential design improvements for online platforms. The interviews lasted

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[1]Studies involving blind users typically include between 10 and 20 participants [84, 86, 108].
[2]https://jfw.groups.io/g/main
[3]https://nvda.groups.io/g/nvda

ID	Age/ Gender	Age of Vision Loss	Education	Main Purpose of Using Discussion Forums	Screen Reader Proficiency	Familiar Platforms
P1	52/M	Since Birth	High School	Entertainment	Non-expert	Reddit, Yahoo, Facebook
P2	30/F	Since Birth	Bachelor	Influencing	Expert	JAWS, Yahoo, Youtube
P3	53/M	Since Birth	High School	Entertainment	Non-expert	Facebook, Bluesky
P4	40/F	Cannot remember	Bachelor	Information	Expert	NVDA,YouTube, Facebook
P5	54/F	Cannot remember	High School	Opinion Sharing	Non-expert	X, Facebook
P6	38/M	Since Birth	Vocational	Entertainment	Expert	X, Reddit, Yahoo, Facebook
P7	40/F	Age 4	Masters	Entertainment	Expert	JAWS, Yahoo, X, Youtube
P8	45/F	Age 8	Masters	Information	Non-expert	JAWS, X, Youtube
P9	51/M	Cannot remember	Bachelor	Entertainment	Non-expert	Reddit, YouTube, Yahoo
P10	49/F	Age 6	High School	Entertainment	Expert	Facebook, YouTube, X
P11	55/M	Since Birth	High School	Opinion Sharing	Expert	JAWS, YouTube
P12	40/M	Since Birth	Bachelor	Information	Non-expert	Facebook, Reddit
P13	53/F	Age 25	High School	Opinion Sharing	Non-expert	Reddit, Facebook, X
P14	58/F	Age 12	Bachelor	Entertainment	Non-expert	Facebook, Youtube
P15	41/F	Cannot remember	Bachelor	Influencing	Expert	JAWS, Yahoo, Fox News
P16	32/M	Since Birth	Masters	Information	Non-expert	Facebook, NVDA, Bluesky
P17	60/M	Cannot remember	High School	Entertainment	Non-expert	YouTube
P18	30/F	Age 5	High School	Entertainment	Expert	JAWS, Facebook, YouTube, X
P19	51/F	Cannot remember	High School	Information	Non-expert	Facebook, Yahoo, X, Reddit
P20	59/M	Age 2	Bachelor	Information	Non-expert	Reddit, X, Yahoo

Table 1. Participant demographics for the interview study. All information was self-reported by the participants.

approximately one hour, facilitating comprehensive and nuanced discussions. As a token of appreciation, participants received an Amazon gift card valued at $20.

3.3 Data Analysis

All interview discussions were recorded with the consent of the participants for qualitative analysis. These interviews were transcribed using the OpenAI Whisper model [152], and the resultant transcriptions were meticulously validated and corrected for errors by the second and third authors. The transcriptions resulted in a comprehensive document of 529 single-spaced pages, with a maximum of 50 lines per page.

The transcribed data was qualitatively analyzed using the standard open coding [163] followed by axial coding [170] methods, where we iteratively went through the transcripts to identify recurring patterns or themes that reflected the participants' conversational experiences, challenges, and needs in online discussions. Specifically, the first and second authors independently conducted an initial round of open coding in Delve platform[4], applying in-vivo (e.g., 'can't follow who's replying to whom', 'feels like I'm always behind') and descriptive codes (e.g., 'difficulty tracking replies', 'sense of lag in conversation') to three seed transcripts without consulting one another. The two provisional codebooks were then compared in a reconciliation meeting facilitated by the third author. Through discussion, duplicate labels were merged
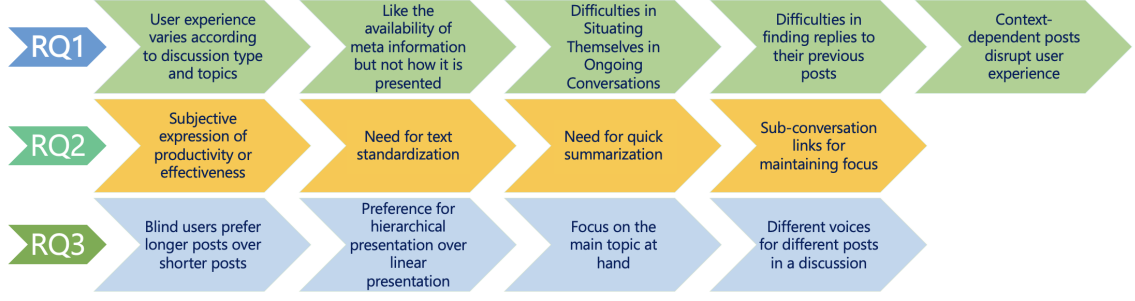
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[4]https://delvetool.com/

Fig. 3. Top themes uncovered for each of the research questions.

and ambiguous code definitions were clarified, and exemplar quotations were attached to anchor meaning, producing a shared codebook. Inter-coder agreement, calculated as Cohen's $\kappa = 0.82$, exceeded the 0.80 threshold commonly used to indicate reliable coding in qualitative studies [158]. For the axial coding phase, all three authors met after every five transcripts to explore relationships among the open codes. Candidate axial categories (e.g., Context-dependent posts disrupt user experience, Need for text standardization) were proposed in shared Delve memos and represented as nested folders in the software. Whenever new axial categories emerged, earlier transcripts were revisited so that coding remained synchronized with the evolving codebook. This iterative process continued until theoretical saturation was achieved, i.e., no new axial categories appeared in successive interviews.

3.4   Positionality

This study was conducted by a team of seven authors: the second, third, fourth, and seventh authors are from India; the first author is from Bangladesh; the sixth is from South Korea; and the fifth is from Sri Lanka. The first, second, third, fifth and seventh authors identify as men, while the fourth and sixth identify as women. All researchers are from ethnic minorities in the United States and specialize in Human-Computer Interaction (HCI), with four researchers focusing primarily on accessibility research. Conceptualization and data collection were primarily done by the first, second and third authors, with support from the fourth author. The fifth, sixth and seventh authors were instrumental in refining study design, while all authors contributed to deriving insights from semi-structured interviews. All authors were involved in interpreting results, discussing implications, and proposing future research directions. To ensure objectivity, the authors actively worked to minimize biases, maintaining open discussions and documenting any preconceptions. This reflective practice was applied consistently throughout data collection, analysis, and interpretation.

4   RESULTS

Figure 3 lists the main themes or patterns uncovered from the qualitative analysis of the transcribed interview data, for each of the three research questions investigated in this work. We discuss these themes and the associated sub-themes in detail next.

4.1   Experiences of Blind Screen Reader Users in Online Discussions (RQ1)

User experience varies according to discussion type and topics: A majority (16) of the participants (7 experts, 9 non-experts) mentioned that the overall conversation experience largely depended on the type and topic of discussions.

More than half (12) of the participants stated that they often had a very poor experience on 'live' discussions (e.g., YouTube live) compared to regular 'offline' discussions (e.g., Reddit, Facebook). A closer inspection revealed that this sentiment was shared by both experts (4 participants) and non-experts (8 participants). These participants mainly attributed this to the pace of the conversations; they explained that the conversations on live forums were 'too fast' for them to keep up using their screen reader. Specifically, the participants mentioned that the constant influx of new messages caused them to feel overwhelmed, as it became difficult if not impossible to identify which comments were directed at them and which ones were worthy of their attention. Seven participants, mostly non-experts (6), noted that the prevalence of low-effort responses like one-word replies or emoji sequences exacerbated the problem by creating a noisy environment that reduced their motivation to engage. For instance, one non-expert participant P14 said,

> "There is no way a screen reader can handle the rapid stream of messages in live chats. By the time I reply to someone's comment, there are already ten new comments in the chat. As for people's replies to my comments, I rarely bother checking them ... there are too many of them, most without any actual substance ... just saying thank you or a bunch of emojis. I wish there was some way to only access meaningful, I mean serious replies and comments in the chat."

Regarding the discussion topics, many (14) participants mentioned that they were more comfortable participating in conversations pertaining to sports and science than in conversations relating to politics and entertainment. This group included both experts (6 participants) and non-experts (8 participants). For instance, P7, an expert user who heavily frequents Yahoo and X platforms, said,

> "There is a lot of trolling in discussions, especially those attached to political news. A lot of hate and irrelevant content all over the place. I have to press a lot of keys to skip this stuff. I wish there was a way to filter these out and keep only the useful content in discussions."

Like the availability of meta information but not how it is presented: Most (15) participants stated that they appreciated the additional meta-information present in the discussion forums, especially the time of each post and the explicit 'reply-to' links in the posts. The expertise distribution among these 15 participants was also approximately balanced (7 experts, 8 non-experts), thereby signaling the agreement between these two participant sub-groups regarding the importance of meta-information in online discussions. However, many (8) of these participants, mostly experts (6 participants) further described that they did not like the present 'rigid' presentation of such content in forums, especially since this meta content was 'not optional,' i.e., the participants had no easy way to avoid listening to meta-information while perusing posts in a discussion. Towards this, P14, a non-expert participant, said,

> "It is certainly very useful to know which post is responding to which other post, but many times it is obvious, and I don't need this information... but there is no way to avoid it other than manually zip through it using [screen reader] keys. I wish there was a toggle button to turn these features on and off."

This sentiment was also echoed by most expert participants, including P6:

> "Initially the additional information was helpful. I was new to Reddit and didn't know how the discussions were laid out in the webpage. After a while, when I was already familiar with Reddit, these additional things started becoming more and more annoying. I mean, why do I need to repeatedly hear 'toggle comment thread expanded button group' or '2 more replies button', over and over again as I go through the user comments. Can't it just read out who said what one by one. There are a lot of promotional stuff too in between comments, which adds to the frustration. Because of all this, I sometimes get tired easily."

Difficulties in situating themselves in ongoing conversations: Nearly all (18) participants (12 non-experts, 6 experts) mentioned that it was challenging to join and contribute to ongoing conversations. These participants attributed this

primarily to the large amount of listening effort required to go through the numerous posts and understand 'where the conversation is going' before posting their content in the corresponding discussion thread. For instance, an expert participant P6 stated,

> "Joining in the middle is always hard. A lot of people are posting, and the conversation is already deep. By the time I finish listening to the posts and understand what is going on, new posts are added to the conversation, so I am always playing catch-up. By the time I do catch up, people have already lost interest and moved on, so I often notice that there are very few replies after my post before the conversation is dead."

Related to this, 10 participants, mostly non-experts (9), stated that it was relatively easier to either start a conversation themselves or join in very early stages than join the conversations that have progressed 'for quite some time.' For example, P9 said,

> "If I have to listen to more than five comments to contribute my two cents, I ain't doing it. People like to type long [expletive] comments on Reddit which is too tiring to listen. If I have something I want to say, I just start a new discussion. At least that way I more or less control the narrative. There are so many people out there, so I usually don't face any problem getting quick responses to my threads. I stay for some time, drop a few responses, and then log out."

Only 2 participants, both experts, had differing opinions compared to the rest of the group, i.e., these 2 participants stated that they did not face much difficulty in joining ongoing conversations. These participants mostly attributed this to the high speech rate and the audio-skimming skill they had developed over the years, which helped them quickly peruse posts in a discussion and get an overview. One of these participants, P18 explained,

> "For me accessibility is the main issue. As long as the content is accessible, I can somehow manage to join the discussion provided it is not live where hundreds of people are posting every second. I use a high speech rate and I have also learnt to skip comments after listening to their first few words ... you know, after some time, it becomes predictable ... how people type ... some of them just parroting some previous dude's point, some just copy pasting stuff again and again, and some just adding a long sequence of laughing emojis ... It is easy to skip most of the posts quickly."

Difficulties in finding replies to their previous posts: Nearly half (9) of the participants, mostly non-experts (8) stated that it was sometimes difficult to locate follow-up replies to their posts in threads and 'continue the conversations.' These participants mostly attributed this difficulty to the absence of a reply-to organization of posts in some of the forum websites. Towards this, P9, a non-expert participant, said,

> "The structure of discussions is different on different websites. Reddit and Yahoo have a nice structure where the posts are organized [hierarchically] based on replies, whereas YouTube discussions are mostly a list with only the first comment having the replies. So, on YouTube, it is very difficult to find replies to my comments. I have to depend on others tagging my username in their replies, and many people are too lazy to do even that, so I often end up listening to all comments posted after mine to figure out which ones are relevant to my comment."

Another non-expert participant, P5, echoed,

> "If they can have a previous comment attached to a comment to show the replies, why can't they do it the other way round... have links to the subsequent comments replying to the comment."

Almost all (7) expert participants did not explicitly state that they faced issues in finding replies to their posts. However, 3 of these participants did mention that they often find it frustrating to locate 'meaningful' replies to their

posts. These participants further explained that there was plenty of noise in the discussions and that people do not strictly adhere to the reply-to layout supported by online discussion platforms. For instance, P2 said,

> *"Yahoo has this nice way of organizing comments based on which comment is replying to which other comment. It has a reply button associated with each comment to let you respond directly to that comment. Yet people do not take advantage of this. Every time I post something on Yahoo, I see plenty of replies to replies included in the responses. I also see many replies that are intended for an earlier post by someone else. Why can't they just press the reply button of the exact comment to which they are responding to? Why do I have to go through a lot of irrelevant comments to fish out the meaningful ones that are actually responding to my comment?"*

Context-dependent posts disrupt user experience: All participants stated that they frequently encountered posts that were hard to comprehend due to the lack of appropriate context. The participants also mentioned different types of contextual information that were usually missing in posts, which included: (i) No indication of the previously-raised topic that the post is referring to (14 participants); (ii) No description of the content in the image or video of the post, that provides the context for the textual portion of the post (18 participants); (iii) No specified connection to prior comment(s) which provides the necessary context for interpreting the post (15 participants); and (iv) No explicit indication of the portion of the news article that the comment is implicitly targeting in its narrative (7 participants). For example, one non-expert participant, P8, explained the importance of context in posts as follows:

> *"When I am listening to the comments one by one, it takes so long that it is easy to forget what was said in the early comments. So, if I listen to any comment that replies to some other comment from way before without providing any context, it is hard to understand what the commenter is trying to say. I almost always have to go back and listen to much earlier comments again to make sense of it ... this doesn't work all the time because I don't know how far I should go back. The funny thing is, sometimes, as I go back, after some time, I forget what was said in the comment, which made me go back in the first place."*

Twelve participants, mostly non-experts (9) and some experts (3), further mentioned that such context-dependent posts caused frustration and additional cognitive burden by disrupting their concentration and 'flow.' For instance, P2 said,

> *"Vague comments are always a buzzkill, especially when I am enjoying and deeply focused on the discussion until that point. It takes the joy out of the whole thing. I go to these discussions for entertainment ... to share and vent ... to hear what other people are saying about stuff I am interested in. Then, when somebody writes something without much description, I start losing interest, and the relaxed feeling switches to frustration, as now I have to spend time thinking about what the person is trying to say. Annoying, many times I cannot just skip such comments, because then the next comments after those too become hard to understand."*

Platform-Specific User Experiences. While most feedback from the participants was generic and platform-agnostic, there were a few comments that were directed towards certain platforms. While the participants did not explicitly indicate that their poor experience with live chats was tied to any platform, most of the examples they provided in this regard were regarding either the YouTube platform or the Facebook live platform. This indicates that the corresponding usability issues are relevant only to platforms that support live conversations. The participants' feedback regarding the discussion structure and presentation too included platform-specific issues in addition to the aforementioned generic platform-independent challenges. For instance, some participants mentioned that there was too much metadata in Reddit and Facebook discussions that disrupted the user experience by inducing additional listening effort. On the other hand, some other participants mentioned there was not enough meta information in YouTube discussions. Although

such individual comments exclusively targeted issues with content presentation on specific platforms, collectively they illuminate a generic platform-independent issue, i.e., blind users presently do not have support for configuring the meta information in discussion forums. In the interviews, the participants also described interaction difficulties and experiences that were mostly targeting visual content-heavy platforms such as Instagram and Bluesky. The issues included mostly platform-specific accessibility issues such as a lack of descriptive alternative texts for images, memes, and videos, as well as difficulties in accessing ephemeral content such as "stories" that often disappeared before a screen reader could narrate the content. These issues align with earlier research that underscores ongoing disparities in alt-text usage and accessibility on visually-oriented platforms [66].

4.2 Conversational Effectiveness and Productivity Needs of Blind Screen Reader Users in Online Discussions (RQ2)

Subjective expression of productivity and effectiveness: All participants equated productivity and effectiveness in online discussions to either user 'satisfaction' or a sense of 'accomplishment.' This was best explained by P4,

> "To me, productivity is dependent on how satisfied I am with the discussion. If I feel like I have said everything I wanted to, and others have understood and replied to me, engaging in a fun back-and-forth exchange, then I consider it to be a productive discussion."

Another participant, P18, stated,

> "To be productive is to have your thoughts and opinions heard and acknowledged. I feel bad when my comments are ignored, or there are very few replies to my comments. This happens to me often because I am always late to the discussions, and it takes a long time to understand and post something; by that time, people have moved on to other topics. Only on rare occasions do I feel like I have achieved something."

Echoing this, most (16) participants (5 experts, 11 non-experts) mentioned that they do not feel they are productive or effective enough in online discussions. The participants mainly attributed this self-assessment to either presentation issues with the discussion (e.g., lack of reply-to structure), listening and mental fatigue due to voluminous or incomprehensible content, a constant sense of 'lagging' in the discussions compared to other users, or a lack of support for quickly perusing and responding to others' posts. Regarding this, P15 expressed,

> "I hardly feel satisfied when commenting on news articles on Yahoo. With a lot of people posting, you don't get much time to listen to everything and respond. I wish there was a way to scan through information quickly so that I too can respond on time and actively participate in the conversation."

We also did not observe any distinction in the participants' perception regarding productivity and effectiveness. Traditionally, effectiveness relates to how well users achieve their goals, measured via metrics such as success rate, accuracy, and usability, whereas productivity is concerned with the amount of output over time, with efficiency, speed, and volume being some of the representative metrics. The participants however did not make any such clear distinction, and they used these terms interchangeably. This lack of distinction may due to the nature of interaction in discussion forums, where there are often no clear start or end goals, i.e., people can join anytime, peruse a few comments, discuss for some time or asynchronously over several days, and leave anytime, without any pressure to finish the conversations.

Need for text standardization: Eight participants (2 experts, 6 non-experts) mentioned that the listening comprehensibility of posts also depended on the language used in the posts. These participants further explained that many posts were informally written with plenty of 'non-standard' or 'made-up' words, which were not properly pronounced by their screen reader, thereby making it hard to understand these posts. Indeed, there have been a few prior works that have specifically investigated the presence of out-of-vocabulary words (e.g., wordplays, abbreviations, initialisms) in

user-generated content on social media [90, 115]. A fairly recent work [103] also showed how the presence of such out-of-vocabulary words negatively impacted the comprehension of screen reader users on X (formerly Twitter) social media platform. The participants' feedback in our study is in accordance with the prior findings while also indicating that the same issue carries over to discussion forum threads as well.

To address this problem, the participants expressed a need for standardizing posts, i.e., replacing incomprehensible words with standard dictionary equivalent words. For instance, P3 said,

> "Sometimes there are words that I don't understand in posts. I do know quite a bit of fun words like lol, rofl, brb ... but there are many others that I cannot recognize and I have to look up to understand what they mean. The screen reader also doesn't provide much help; often, it just speaks out some gibberish instead of recognizing these words. I wish my screen reader in the future has the capability to automatically convert these words into something I can easily understand."

Need for quick summarization: Several (14) participants, both experts (5) and non-experts (9), emphasized the need for a summarization feature to improve their user experience in online discussions. These participants specifically mentioned different scenarios for summarization in the form of queries they would like their screen reader or new assistive technology to support in the future, which included "Summarize everything until this post", "Summarize all replies so far to my previous comment", and "Give me a summary of all comments related to the [abc] topic". For example, P9 said,

> "Consider the situation where I am in a Reddit discussion on environmental issues, where the main topic is global warming. Within this thread, different people are talking about different topics like renewable energy, legislation, geopolitics, and community initiatives. Navigating this complex, intermixed list of comments can be daunting without filtering or summarization. Ideally, I would like a feature where I can simply say show me only comments about fossil fuels or what people are saying about climate-change laws and get the appropriate response I desire without much manual effort."

The participants also further described the potential benefits of such a summarization feature and explained its positive impact on their experience in online discussions. These included reduced listening time and fatigue, decreased mental burden, comprehensive knowledge of conversation content and flow, decreased 'joining time' in ongoing conversations, fewer hotkey presses, increased user satisfaction, and a more focused and personalized discussion experience. For example, P4, an avid Facebook user, illustrated the benefits through an interaction scenario:

> "Imagine you are joining a conversation late and trying to catch up. Right now, I spend a lot of time going through each post individually from the beginning to understand the context, which obviously is very exhausting with a screen reader. But if the platform provided a brief summary at the top of each sub-thread, clearly stating who responded to whom and the key points raised, it would save me a lot of energy and confusion, and I can then directly jump into the dialog."

Sub-conversation links for maintaining focus: Quite a few (7) participants also desired the inclusion of additional meta-information in the discussions that would help them easily navigate the various sub-conversations in the discussions. Regarding this, P18, a frequent JAWS screen reader forum user, said,

> "Sometimes, I wish that there was a link at the end of a comment which would just let me jump to the next post that continues the conversation while skipping all the irrelevant and digressive comments in between."

Some (3) of these participants further stated that the hierarchical structure of discussions based on reply-to connections was not adequate enough to properly disentangle the inherent sub-conversations that occur within a discussion. These participants attributed this inadequacy to the behavior of forum users, explaining that many users often ignored the

reply button before posting their responses and sometimes even initiated new sub-conversations with their comments. Regarding this, P12, a Reddit user, said,

> "People just post what they want. They are too lazy to start a new discussion, instead, they simply choose to post in the current discussion. Whats worse is that many other people reply to that irrelevant comment and continue the conversation, leading to a discussion within a discussion. I hate it whenever I have to go through comments that have nothing to do with with main topic of the discussion."

Platform-specific needs: While most feedback from the participants were generic, i.e., highlighting their needs across all platforms, there were a few comments that targeted specific platforms. For instance, a few participants expressed a need for a feature that "slowed down" the pace of live conversations on YouTube and Facebook live, by filtering out posts irrelevant to the participants' topic of interest. Similarly, a few other participants suggested a configuration panel to customize the metadata provided in Reddit discussions. Some of the participants even suggested inclusion of "sub-conversation bookmarks" that persist across Reddit sessions, to enable screen reader users to seamlessly resume their participation in threads despite the presence of digressive posts in these threads. A few participants also asked for more AI-driven assistive tools to be available for conveniently accessing visual content such as pictures and videos on Instagram and X platforms. Specifically, these participants stated that conversations on Instagram and X were heavily dependent on the visual context, i.e., accompanying images or videos in posts, therefore, they wanted AI tools that could comprehensively describe the visual content. Although all these needs were expressed by the participants for specific platforms, at a high-level they carry a generic platform-agnostic flavor. For instance, it is important and desirable for blind users to be able to configure meta information on all platforms, not just on the Reddit platform. Similarly, making visual content in discussions more understandable is essential across all platforms, not just on Instagram and X.

4.3   Preferences of Blind Users Regarding Online Discussions (RQ3)

Blind users prefer longer posts over shorter posts: A majority (14) of the participants, including both experts (5) and non-experts (9), mentioned that they preferred fewer and longer posts in discussion threads over plentiful and shorter posts. This observation is in accordance with the findings of prior work [196] which found that the posts in accessibility forum threads (dominated by blind screen reader users) were generally longer and self-contained compared to the posts in general forum threads. Most (11) of these 14 participants attributed this preference to comprehensibility, stating that longer posts provided more contextual cues for them to properly understand the content in posts. For instance, P6 said,

> "Longer posts give you some flexibility. Even if some of the words are not properly narrated by a screen reader, you can still understand the content overall, based on other words which are clearly voiced out."

A few (4) participants also said that longer posts served as 'anchor points', which reduced their mental burden and effort while sifting through the conversations. One of these participants, P19, explained this as follows:

> "Longer posts usually contain a lot of contextual details that help you figure out what has been discussed so far and where the conversation is heading ... so, I don't need to go back and listen to each of the previous posts to refresh my memory."

Preference for hierarchical presentation over linear presentation: Nearly all (18) participants preferred the hierarchical organization of discussion posts based on reply-to connections over the simple linear organization of posts. Subgroup analysis showed that 7 of the 8 experts participants and 11 of the 12 non-experts participants endorsed this threaded, reply-to organization, indicating strong consensus across both experience levels. The main reason they provided to justify their preference was the reduced listening and mental fatigue. This was best explained by P13:

> "I always feel like I am putting more effort on YouTube than on Reddit. On Reddit, I can simply look at some of the replies while ignoring a lot of others that I don't care about, but on YouTube, I am forced to go through a long list of comments, most of which do not contain anything worth listening to ... I don't know why YouTube decided to put reply button only for the first comment and not to others."

A similar reasoning was provided by P13 regarding the discussions on X:

> "It is always a long list of comments with plenty of distracting buttons and links in-between them. Most of the times, you have no idea who is responding to whom, so it is a hit or a miss ... you either understand what someone is saying or you don't."

Focus on the main topic at hand: Fifteen participants (5 experts, 10 non-experts) stated that they preferred conversations that 'stick to one topic' over those that have 'multiple people discussing multiple topics.' The reasons provided by the participants included reduced listening fatigue, lesser cognitive burden, and decreased back-and-forth navigation within a thread. This was best explained by P4:

> "Websites allow you to create your own discussion, so I don't understand why people choose to start their own discussion in others' discussions. Maybe it doesn't matter to others [sighted people] as they probably can easily skip through it, but we have to listen to everything, which is annoying."

On the contrary, the remaining 5 participants (3 experts and 2 non-experts) mentioned that it was better for discussions to touch upon 2-3 topics, as focusing on only one topic would make the discussion 'too serious,' 'unnatural,' and 'rigid,' thereby diminishing the 'fun' aspect of participating in online discussions. However, 4 of these 5 participants also clarified that there should be some screen reader support for easily switching between the topics or even avoiding comments related to a specific topic.

Different voices for different posts in a discussion: Some (6) of the participants (all experts) expressed that they would like to hear some variations in screen-reader voice and tone while going through the posts one by one in a discussion thread. These participants mentioned that their current experience with online discussions was not that 'engaging' due to the monotone voice of the screen reader. They further explained that having multiple voices assigned to different posts or comments would make the discussions more engaging and immersive, but they were unsure if it was possible to achieve this in a future version of their screen reader. For example, P2 said,

> "Ideally, I would like online discussions to give me the same feeling as real-life discussions. The joy and satisfaction I feel when chitchatting in a room full of people ... I don't get the same feel on YouTube or Yahoo when I listen to comments with my screen reader ... It feels like the same person is talking all the time ... It would be nice if the screen reader can recognize and use different sounds and pitch ... that will certainly make it more exciting and engaging."

5 DISCUSSION

Our study revealed different conversation-specific challenges, needs, and preferences of blind screen reader users in online discussion forums, which go significantly beyond the generic web accessibility and usability issues uncovered in prior studies [87, 100, 182]. Moreover, while prior research on blind users' participation in online discussion forums was focused on the linguistic, social, and navigational aspects [196, 208], our work shifted attention to how blind users engage with these forums from conversational and participatory viewpoints. Although there were a few points of alignment, such as Venkatraman et al.'s [196] similar observation that blind users tend to write more descriptively, preferring longer self-contained posts, our findings illuminated new perspectives on the conversational challenges and needs/preferences of screen reader users that plugged the knowledge gaps previously unaddressed by prior data-driven

analyses. Specifically, our findings substantially and meaningfully extended prior research [196, 208] in two ways. First, our interview-based methodology elicited first-hand lived-experience accounts that uncovered conversational challenges such as the difficulty of situating oneself in ongoing conversations as well as tracing replies to one's own posts – challenges that cannot be captured through passive data-driven content analyses done in prior work [196, 208]. Second, our study revealed several previously unrecognized user needs such as calls for sub-thread summarization, sub-conversation links, and standardized text processing, that are unique to interaction with online discussion forums. These new insights will serve as the foundation for the development or improvement of assistive technologies for significantly enhancing blind screen reader users' experiences in online discussion forums. Informed by these insights, in this section, we discuss design ideas and suggestions for potential solutions to address the uncovered needs and challenges, as well as elucidate the limitations of our study, highlighting opportunities for future research.

5.1 Design Suggestions for Assistive-Tool Developers

Accessibility support for blind users remains uneven across the web development ecosystem [43]. Web application developers often approach accessibility late in the development cycle [46], typically as a compliance task rather than a core design principle [165]. While platforms may technically support screen reader access, they frequently fall short in terms of usability [19]. Key aspects, such as navigation flow, information hierarchy, and cognitive effort, are often overlooked, resulting in experiences that are technically accessible but practically difficult to use [20]. Studies have shown that web developers are inconsistent in their application of WAI-ARIA [26], resulting in websites and discussion platforms that are only partially accessible.

Assistive technology developers, particularly those building screen-reader plugins, therefore play a critical role in addressing many usability issues in applications. However, this ecosystem is small and fragile. A limited number of individuals, often recognized figures within the blind user community, are responsible for most screen reader and plugin development plus maintenance [121]. These developers often work independently and face structural challenges, including inaccessible programming tools and a lack of formal support. As a result, plugin development is slow, documentation is inconsistent, and long-term maintenance is rarely guaranteed [22, 121].

Given the slow rollout process of screen reader plugins, many research-driven developers have begun to develop alternative non-plugin assistive tools that work in tandem with screen readers to enhancing usability of web applications [120, 188, 220]. Advances in AI have enabled such usability-enhancing tools that restructure web content for efficient screen reader navigation [149, 177, 194], describe visual media for screen reader users [78, 118, 217, 218, 228], and convert inaccessible formats into screen-reader-compatible narration [96, 126, 140, 169, 201]. These technologies offer scalable solutions that can address both application-level and screen-reader limitations.

In this paper, we therefore provide design suggestions for developing a third-party assistive tool that can elevate blind users' experience in online discussion forums. Based on our findings, we identify critical usability gaps that persist despite existing accessibility efforts, and then propose practical, user-centered strategies to improve the screen reader experience in these forum environments. We believe these suggestions will also be useful for software and assistive technology developers, by guiding them towards building inclusive and screen reader-friendly discussion platforms that go beyond accessibility compliance. These suggestions are discussed one-by-one next.

5.1.1 Semantic Structuring of Conversations. The study findings illuminated the various issues and needs of blind screen reader users regarding sub-conversations in discussions. Prior studies have shown that online users in discussion forums do not restrict themselves to the main topic at hand [215, 229], instead, they freely create branches with their

digressive comments [36, 117]. Consequently, most online conversations are usually a mix of multiple sub-conversations, with their comments interspersed or 'entangled' with each other. Our study also found that the present solution adopted by the online platforms to address this issue, i.e., the hierarchical organization of comments based on their reply-to relationships, is inadequate in its ability to semantically disentangle the sub-conversations, mostly due to the incompliant behavior of the users who do not use this reply-to feature appropriately as intended. Therefore, additional intelligent methods need to be devised to semantically separate the comments, i.e., disentangle the sub-conversations in a thread.

Such conversation disentanglement of sub-conversations in a thread requires: (i) automatic detection of conversation topics and digressions in a thread; and (ii) automatic detection of semantic connections and subsequent clustering of comments in a thread based on the identified topics. The recent advancements in this area [7, 88, 180], particularly the use of large language models [50, 119, 190], provide an opportunity to address these technical challenges underlying conversation disentanglement and develop assistive interfaces for satisfying blind users' interaction needs regarding sub-conversations. With clever instruction or 'prompting' strategies such as ReAct [211] and few-shot learning [113, 202], the powerful reasoning capabilities of LLMs can be harnessed to identify core topics and then extract the comments pertaining to each distinct topic, thereby disentangling the thread into topic-driven sub-conversations.

Building on this foundation, we suggest an LLM-supported assistive interface that enables users to 'semantically' navigate forum discussions. For example, the interface should provide a list of all detected topics, allowing screen reader users to explore posts or comments pertaining to each topic individually without the distraction of unrelated content. Our findings also point to the need for a configurable, adaptive interface that empowers blind users to personalize their forum-discussion interaction. The assistive interface should therefore allow users to pre-select relevant topics, dynamically reorganize the discussion layout based on their preferences, filter out irrelevant content, and apply sorting mechanisms to preserve conversational flow. This way, upon entering a discussion, users will be able to invoke a keyboard shortcut to access a customizable control panel with options such as "select", "filter", "hide", and "sort". As our findings indicate the participants preferred hierarchical organization of discussion posts over the linear arrangement, the interface should also be able to apply disentanglement and automatically arrange posts based on the detected reply-to relationships between posts. Based on the user-specified configuration, the interface should automatically re-render the content to reflect the user's preferences, thereby ensuring a more personalized and cognitively-manageable experience. Developing such adaptive, topic-aware interfaces tailored for screen reader users constitutes an important direction for our future research.

5.1.2 Adapting Discussion Language for Listening Comprehensibility. While many prior works have focused on the accessibility of visual elements such as pictures, emojis, gifs, and videos, in online user-generated content [67, 110, 172, 193], they have largely ignored that the user-generated text itself can be practically inaccessible due to the presence of numerous out-of-vocabulary (OOV) words such as wordplays, abbreviations, acronyms, emoticons, shortenings, and initialisms [40, 95, 111, 115, 132]. As these OOV words do not have any associated standard dictionary pronunciation, screen readers are unable to interpret and vocalize them properly, thereby affecting the listening comprehension and cognitive load of blind users [103]. Our study participants, too, highlighted this issue with OOV words, stating that it impacted their ability to concentrate and seamlessly engage in fluid and coherent discourse. Therefore, there is a need to adapt or modify the raw user-generated text in discussions in order to make them 'consumable' with a screen reader.

Akin to conversation disentanglement, the 'standardization' of text too can be accomplished by leveraging the state-of-the-art LLMs, given their proven effectiveness in sequence-to-sequence text comprehension [127] and normalization [224] tasks across a variety of domains [25, 173]. With a diverse set of few-shot examples capturing different

standardization scenarios and different types of OOV words, LLMs can be instructed, e.g., via a chain-of-thought prompt [37, 200], to convert a given input post with OOV words into a semantically equivalent post with only standard dictionary words. Assistive user interfaces can then be designed on top of such an LLM-based standardization technique to help blind users better understand posts in online discussions.

To operationalize this capability, we suggest an assistive interface that gives users control over how text is presented and read aloud. For example, upon encountering a post, users should be able to invoke a keyboard shortcut (e.g., Shift+S) to toggle between the original and standardized version of the post. Furthermore, an optional setting should allow users to hear both versions consecutively, helping them contextualize informal terms without losing the original tone of the discussion. Additionally, a "term clarifier" feature should allow users to pause on specific words or phrases and retrieve spoken definitions or expansions (e.g., "idk" spoken as "I don't know"). This feature should also offer an auditory preview mode where all OOV terms in a post are highlighted and described before narration begins, thus preparing users for potentially unfamiliar content. Exploring the LLM prompting strategies for accurately standardizing text and designing such screen reader-friendly interfaces are also part of our future work.

5.1.3   Dynamic Voice Profiling in Threads. The auditory experience of screen reader users on online discussion platforms [145] is limited to a single, robotic, or monotonic voice narrating extensive reams of text, lacking expression [54] and diversity [31]. Our study revealed that this lack of variation in prosody is particularly frustrating and disengaging for screen reader users while navigating dynamic, multi-perspective online discussions, where diverse opinions and tones shape the discourse. To address this, our study participants suggested using multiple voices and tones for narrating different posts in a discussion, in order to foster a more engaging conversational experience in discussions.

A multi-voice experience can potentially be supported with a novel interface-design framework that leverages an LLM-driven agent acting as a virtual participant in the discussion. The LLM agent should be able to analyze inter-comment relationships, discern the conversational flow, and then contextually assign *personalized voice profiles* for the comments by selecting attributes from predefined categories: voice gender, accent, age, preference, and tone. Specifically, given a comment in the discussion, the agent should start by randomly assigning a gender (e.g., AI-generated male or female), specify an accent (e.g., American, British, or Indian), and fix an age range (e.g., Young Adult, Middle-Aged, or Senior). The agent should then dynamically assign the voice preference (e.g., Casual, Neutral, or Formal) and tone (e.g., Personable, Confident, Empathetic, Engaging, Witty, and Direct) based on the conversational flow and the preceding context, which captures how comments are related – whether they extend, contrast, or reinforce ongoing topics. Therefore, by modeling the conversational structure, the agent should ensure that voice selection for comments is contextually aligned with the emotional and discursive dynamics of the discussion.

An intelligent assistive interface providing such a multi-voice experience for blind users should support direct embedding of semantic voice metadata within each comment element in the webpage structure. These metadata attributes can take the form of standardized data fields such as voice tone, voice style, and voice accent. These fields should be automatically populated by a language model that analyzes the structure and content of the discussion thread. The module should consider factors such as the relationship between comments, the degree of agreement or disagreement, and emotional or rhetorical markers that reflect tone and intent. Based on this context, the model should assign appropriate values to each metadata field. For example, an emotionally supportive comment may be assigned a warm and engaging voice profile, while a contrasting argument may be delivered using a more assertive or serious voice. Developers can use these metadata fields to inform external speech synthesis tools, such as text-to-speech engines that accept expressive voice parameters. Tools like the Speech Synthesis Markup Language or Web Speech Application

Programming Interface can be adapted to read these values and render voice output that reflects the specified tone, style, and identity. Alternatively, assistive technologies like screen readers can also be enhanced to recognize and interpret these fields, passing them to a compatible voice engine for expressive audio output. From an end-user perspective, to support efficient and personalizable interaction, the interface should allow users to invoke shortcut keys for controlling the multi-voice experience. An example set of supported keys for this interface can be as follows. Pressing the V key should toggle voice variation to On or Off. The P key should present a preview of the assigned voice for the next comment. Pressing T key should allow users to cycle through tonal categories such as serious, empathetic, or witty. The combination of Control and the Left/Right arrow keys should facilitate skipping between comments that share similar voice profiles or tones. Shift combined with the Up/Down arrow key should replay the current comment in a different available voice, helping users compare expressive interpretations. The exact set of keys for the different actions should be determined via a user-centric design process, e.g., an interview study.

From a usability standpoint, this interface will provide blind users with greater control over how they experience threaded conversations. By combining contextual language analysis with accessible voice-switching options, this approach transforms online discussions into richer, more engaging, and emotionally-resonant auditory experiences. In our future work, we will investigate the practicality and effectiveness of these interaction strategies in real-world settings and explore how they can be tailored to match user preferences.

5.1.4 Quick Summarization and Skimming in Discussion Forums. Our study revealed that blind users experience significant cognitive load and listening fatigue while trying to situate themselves in ongoing discussions. To mitigate their interaction burden, the participants expressed a need for summarization support that would enable them to quickly grasp the essence of different sub-conversations in a discussion thread. Such summarization support can easily be provided using LLMs, which have been shown to generate accurate and creative summaries for a wide range of natural language tasks [39, 223]. Their strength lies in their ability to internalize complex semantic relationships and discourse patterns from vast corpora, allowing them to generate summaries that approximate or even exceed human performance in both coherence and informativeness [221]. In particular, prompting strategies such as chain-of-thought (CoT) reasoning have been shown to significantly enhance the summarization process by encouraging models to articulate intermediate reasoning steps before producing the final output [203]. This capability can be further extended into element-aware summarization, wherein the model is explicitly instructed to enumerate key facts or arguments from the input text before synthesizing a cohesive abstract. Such techniques help ensure that the generated summaries maintain comprehensive content coverage and logical flow. Building on these advancements, we discuss a summarization-enhanced assistive interface tailored for screen reader users navigating online discussion forums.

Such an intelligent assistive interface should directly integrate summarization features directly into the discussion forum experience. For example, when a user navigates to a discussion thread, the interface should present a summary of the entire thread at the top, which can be read aloud automatically or activated via a keyboard shortcut (e.g., Alt+T). Additionally, each comment or sub-thread should include a "summary preview" button as meta data that the users can activate with a dedicated keystroke (e.g., Alt+S), allowing them to hear a condensed version of the thread up to that particular comment or sub-thread, before choosing whether to participate and engage with the rest of the discussion. This would enable users to prioritize content based on relevance and importance, reducing unnecessary listening time and fatigue.

Beyond basic summarization, skimming [116, 214], a speed-reading technique that enables users to extract key information and acquire high-level comprehension rapidly without engaging with the entire text, can also potentially

help screen reader users quickly sift through the information in discussion comments [5, 6]. To support this feature, the interface should include a skimming mode that narrates only the first sentence or key phrases from each comment in response to a key shortcut (e.g., 'Ctrl+Shift+Down'). This mode should also include configuration options to skip repetitive or less-informative comments automatically, based on LLM-generated relevance scores. Users should be able to adjust the verbosity level through an interactive slider or keystroke command, customizing how much detail they hear during the skimming process. Additionally, the platform should provide an option to convert the default threaded view of a discussion into a flat chronological view, in order to facilitate more convenient and rapid linear skimming.

In our future research efforts, we will investigate the suitability of these summarization and skimming techniques for discussion forum threads and assess their efficacy through user studies.

5.2 Cross-Platform Challenges and Opportunities

5.3 Limitations

A limitation of our study was its relatively small sample size, with participants largely recruited from New York City, which limited the demographic and geographic diversity. While most studies [47, 104, 138, 168, 197] involving blind people typically have similar sample sizes as our study due to recruitment challenges, we believe further large-scale studies with higher number of participants are needed to validate the generalizability of our results.

The second limitation of our study was its reliance on self-reported data gathered through semi-structured interviews. While semi-structured interviews are valuable for capturing participants' detailed reflections and personal experiences, this self-reporting approach can introduce biases, such as recall bias [122] or social desirability bias [56]. Participants may inadvertently alter their responses based on perceived expectations or have difficulty accurately recalling past interactions, particularly if those experiences were not recent. To address these potential biases, follow-up studies are needed to collect screen reader interaction data from blind participants over an extended period. Analysis of the collected can then help validate our findings.

The third limitation of our study was that we focused only on individuals who are blind or have severe vision loss and, therefore, rely heavily on screen readers. We excluded another key group within the visually impaired demographic: individuals with low vision (with visual acuity below 20/70) [4]. These users often depend on screen magnifiers or a combination of screen readers and magnification technologies to access digital content. Given their unique needs and interaction styles, the results of our study may not be applicable to this group. Future research targeting this demographic is needed, potentially uncovering distinct user experiences, challenges, needs, and preferences.

Our study was also limited to an assessment of discussion platforms accessed via desktops and laptops. Research indicates a growing trend of users relying on smartphones to engage in online discussions [137, 159, 160, 197], highlighting the need to adapt our study for mobile platforms.

The fifth limitation of our study was that our interview questions were generic and platform-agnostic, i.e., we did not specially tailor our seed questions and associated conversations for any particular platform, e.g., Reddit, Facebook. Each platform has its own unique interface and threading features that can potentially impact blind users' experience in ways not possible on other platforms. Although, the feedback from our participants was based on their lived experiences in a diverse set of platforms and it did include a few comments specific to certain platforms, we did not manage to collect sufficient data separately for each of the platforms (Table 1) to be able to identify meaningful patterns specific to each of these platforms. Future studies can focus on this gap in our work and derive deeper insights connecting platform-specific interface features to usability and conversation engagement.

The sixth limitation of our study was that we leaned towards gathering perspectives of blind users as 'consumers' on discussion forums. As such, our interview questions did not focus much on the other important aspect of online discussion engagement, namely content creation. Authoring content presents unique accessibility barriers, such as navigating text editors, formatting posts, and managing multimedia elements [222]. Future work should explore how blind users engage with the authoring features on discussion platforms and investigate the extent to which present assistive technologies support their participation as content creators.

Lastly, our study ignored the impact of censorship in discussion forums, which can significantly alter the nature of language used in posts and responses. We did not investigate how blind users adapt to various levels of censorship or moderation across different forums [209]. Additionally, our study did not explore how specific linguistic variations, such as sarcasm, regional slang, or idiomatic expressions, affect comprehension for blind users. We considered these research questions to be beyond the scope of this paper and will be addressed in future work.

6 CONCLUSION

In this research, we conducted semi-structured interviews with 20 blind participants to explore their conversational experiences, challenges, and needs in online discussion forums. Qualitative analysis of the participants' feedback revealed that blind users often struggle to join ongoing conversations, face difficulties in locating replies to their posts, and experience considerable mental and listening fatigue while perusing online conversations due to the absence of adequate contextual cues. In lieu of these challenges, the participants expressed a need for novel assistive technology features that provided real-time summaries of select posts in discussion threads, standardization of non-dictionary text in posts, and additional meta information to selectively navigate the threads. The participants also indicated their preference for longer context-rich posts, multi-voice narration of conversation dialog, and topic-focused shorter discussions. Informed by the study findings, we lastly discussed AI-driven solution ideas that can potentially address the users' interaction challenges as well as accommodate their needs and preferences regarding online discussions, thereby setting the scope for future research in this area.

7 AUTHOR CONTRIBUTIONS

CRediT: **Md Javedul Ferdous**: Conceptualization, user study design, methodology development, data collection, writing – original draft, review & editing. **Akshay Kolgar Nayak**: data collection, transcription, cleaning, and writing – review & editing. **Yash Prakash**: Qualitative data analysis and writing – review & editing. **Nithiya Venkatraman**: Literature review, qualitative data analysis and writing. **Sampath Jayarathna**: study design and participant recruitment **Hae-Na Lee**: Conceptualization, study design, and writing – review & editing. **Vikas Ashok**: Conceptualization, technical oversight, provision of resources, supervision, and writing – review & editing.

8 DECLARATION OF INTEREST STATEMENT

The authors report there are no competing interests to declare.

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