Understanding Audio Production Practices of People with Vision Impairments

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ABSTRACT

The advent of digital audio workstations and other digital audio tools has brought a critical shift in the audio industry by empowering amateur and professional audio content creators with the necessary means to produce high quality audio content. Yet, we know little about the accessibility of widely used audio production tools for people with vision impairments. Through interviews with 18 audio professionals and hobbyists with vision impairments, we find that accessible audio production involves: piecing together accessible and efficient workflows through a combination of mainstream and custom tools; achieving professional competency through a steep learning curve in which domain knowledge and accessibility are inseparable; and facilitating learning and creating access by engaging in online communities of visually impaired audio enthusiasts. We discuss the deep entanglement between accessibility and professional competency and conclude with design considerations to inform future development of accessible audio production tools.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in accessibility**.

KEYWORDS

Accessibility, audio production, blind, vision impairment

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1 INTRODUCTION

From contemporary pop music to award-winning musical masterpieces to educational podcasts, professionally produced audio begins as a few raw, untouched audio tracks that undergo hours of intricate polishing stages, such as editing, mixing, and mastering. This complex and detailed set of workflows, commonly known as *audio production*, is a skilled practice and a cornerstone of all types of audio content creation, including music, podcasts, audio drama, radio shows, sound art and so on. In modern times, audio content creation has increasingly become computer-supported – digital instruments are used to replicate sounds of physical instruments (e.g., guitars, drums, etc.) with high-fidelity. Likewise, editing, mixing, and mastering tasks are also mediated through the use of digital audio workstations (DAWs) and effects plugins (e.g., compression, equalization, and reverb). This computer-aided work practice is supported by a number of commercially developed DAWs, such as Pro Tools[1], Logic Pro[2] and REAPER[3]. In addition to these commercial efforts, academic researchers have also invested significant attention towards developing new digital tools to support audio production tasks (e.g., automated editing and mixing) [29, 57, 61].

Despite a growing interest in computer-supported audio content creation within industry and academia (e.g., dedicated communities such as NIME, AES and ACM IMX), one area that has not received much attention is how people with vision impairments perform audio production tasks using computer-based tools. While emerging literature within HCI and accessibility has studied other forms of computer-supported creative work (e.g., photography [3, 40], drawing [9, 56], making and fabrication [5, 19], 3D printing [24, 64] and writing [20, 51]), accessibility in audio production remains relatively under-explored. The limited prior work that does exist has revealed that people with vision impairments face accessibility challenges in using digital audio production tools due to an often-exclusive use of visualizations (e.g., waveform and graphic equalizer) to represent audio information [50, 68]. Consequently, researchers have focused on creating accessible representations of this information by developing novel multimodal interfaces [26, 36, 50, 53, 68]. However, less is known about how people with vision impairments use mainstream audio production tools in their personal and professional practices. Understanding how people with vision impairments navigate existing tools and the associated challenges to achieve their audio production goals is essential in designing sustainable solutions and establishing a holistic view of how computer-based tools can better support both hobbyists' and professionals' work.

To help bridge this gap in the literature, we report findings from semi-structured interviews with 18 visually impaired professionals and hobbyists who produce audio content using various software and hardware tools. Our analysis reveals three main aspects of the audio production practices of people with vision impairments: (1) piecing together accessible and efficient workflows through a combination of mainstream and custom tools; (2) achieving professional competency through a steep learning curve in which domain

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[1] https://www.avid.com/pro-tools
[2] https://www.apple.com/logic-pro
[3] https://www.reaper.fm

knowledge and accessibility are deeply entangled; and (3) facilitating learning and creating access by engaging in online communities of visually impaired audio enthusiasts.

The present paper makes three primary contributions. First, our work presents an empirical understanding of the audio production practices of people with vision impairments. While prior work focuses on introducing accessible visualizations for digital audio interfaces [36, 50, 53], it leaves open questions around how blind people uniquely experience and navigate mainstream audio production tools to support their work. Second, our analysis provides evidence of the intertwined nature of professional competency and accessibility, in which developing domain specific skills and capabilities is inseparable from the work of mastering a complex set of largely inaccessible tools. Creating a more inclusive audio production industry, a profession our informants feel should be an ideal career path for people with vision impairments, requires understanding that accessibility currently constrains but is critical for professional success. Finally, we provide considerations for the future design of accessible audio production tools and resources to better support this community of professionals and hobbyists.

2 RELATED WORK

In grounding the present paper, below we review prior research on accessibility in audio and other forms of creative content production as well as literature on audio production tools and practices.

2.1 Accessibility in Creative Content Production

Our work is situated within a growing body of literature that focuses on understanding and designing new systems for improving accessibility in different forms of content production. One area of creative work that has garnered much attention recently is accessibility in photography and photo editing. Researchers have explored how people with vision impairments capture, edit and share photos using existing applications [1, 3, 27, 33, 40, 43]. Prior work has also developed tools to help people with vision impairments frame and capture photos using audio cues [1, 33, 40, 43] and browse the photos at a later time using automated labeling [33], tactile representation [43], voice memos and ambient audio recording [1, 27]. Similarly, researchers have also focused on developing accessible digital drawing interfaces for people with vision impairments by incorporating haptic and tactile feedback [8–10, 35, 48], audio feedback and sonification [25, 48], and gesture-based interaction [42].

In addition to studying and designing for accessible photography and digital drawing, prior work has also studied the way visually impaired individuals engage in other forms of creative work, such as weaving [19, 22], writing [20, 51], sculpting [67], digital game design [66], 3D modeling [24, 64] and digital fabrication [5, 47]. Overall, this growing body of work points to the importance of understanding and designing new tools to support accessible content creation practices. We extend this literature through our detailed account of how people with vision impairments create and produce audio content using a variety of computer-supported tools.

2.2 Accessibility in Audio Production

In line with the growing interest in accessibility in content production, researchers within HCI and assistive technology have recently started exploring accessibility in audio production for people with vision impairments. As an example, researchers [49, 50, 68] organized participatory design workshops with visually impaired people to design multimodal interfaces for three different DAW features: recognizing automation line anchor points (through sonification and pitch modification), peak meter (through sonification) and audio amplitude curve (through haptic feedback). Haenselmann et al. [26] designed a multitrack MIDI (Musical Instrument Digital Interface) sequencer that allows visually impaired users to execute all MIDI sequencer functions using the keys on an electronic musical keyboard, thereby eliminating the needs of interacting with computer keyboard and display. Others have designed audio editing and music production interfaces that visually impaired users can control using voice [14], game controllers [34], and tangible [36] and tabletop objects [53]. Much of this emerging research focused on designing novel tools to improve accessibility of specific audio production tasks leaving open questions around current practices of screen reader users. Our work contributes to this literature by developing an understanding of how blind professionals and hobbyists make use of mainstream audio production tools and thus informing future accessible design in this space.

2.3 Audio Production Tools and Practices

While research on accessibility in audio production is still at an early stage, there is a large body of work in digital audio and musical expression literature that investigates how sighted people interact with digital audio production tools and how the design of these tools shape their work practices [6, 18, 30, 69]. As an example, Terren [69] developed a conceptual framework for understanding sighted users' practices associated with DAWs and investigates the negotiation between critical listening, intricate workflows and conceptual burden in using DAWs. Bennett [6] highlights how a musician's creative decisions and activities may be both improved and disrupted by the DAWs they use. Others have investigated how the advent of digital audio tools has democratized the audio production industry by empowering independent and amateur musicians [28, 30] and facilitating creativity in new learners [18].

In addition to studying audio production practices, researchers have also delved into designing new interfaces to support audio production workflows. As an example, Mycroft et al. [52] designed a multimodal interface for audio mixing to reduce the complexity and amount of visual feedback and allow users to pay more attention to critical listening. Researchers have also developed tools to improve users' audio production efficiency by automating certain tasks [21, 57] and recommending appropriate workflows [60]. Still others have developed systems to support audio production for novice users [29, 57, 61]. A separate thread of research has also designed new forms of digital musical instruments to facilitate interactive and intuitive musical performances [17, 32, 44, 46, 63].

Collectively, this body of research investigates audio production practices of sighted users and informs the design of state-of-the-art

digital audio production tools. We extend this literature by specifically studying the practices of blind audio professionals and hobbyists, whose work may reveal unique perspectives and challenges and deepen our understanding of audio production processes and systems more broadly.

3 METHOD

To understand how people with vision impairments use computer-supported tools to produce audio, we conducted in-person and remote interviews with blind audio professionals and hobbyists.

3.1 Participants

We conducted interviews with 18 individuals with vision impairments who work with audio (age 26-65 years old, all identified as male). Four of the interviews were conducted in person in the Midwest region of the United States. The in-person interviews lasted approximately 90 minutes where we observed how participants worked in their studio and asked questions about their practices. We also took photographs and written notes while they worked. In addition, we conducted interviews with 14 additional participants with vision impairments who were located in throughout United States, United Kingdom, and Italy. These interviews were conducted via audio conferencing software and lasted about 35-110 minutes.

Participants were recruited through our research network and snowball sampling. We were able to interview prominent members of the blind audio production community (e.g., those who teach accessible audio production and run accessible production studios) and the developers of influential scripts that support accessibility in DAWs. All participants use audio production software using screen readers such as VoiceOver, NVDA and JAWS. Our participants produce many different forms of audio content, including music, podcasts, radio shows, soundtracks for movies and commercials, sound art and audio drama. See Table 1 for participant information.

We acknowledge that there is a lack of gender diversity among our participants. Our all male identifying sample may primarily have been a result of the fact that the audio industry is generally a male-dominated one. Between 2004 and 2015, the percentage of women audio engineers in the US hovered between only 8.4% and 15.6%, averaging around 9% [45]. A separate study on popular songs from 2012-2018 estimated the percentage of women producers to be 2.1% [65]. This disparity was also reflected during our recruitment through snowball sampling, as we received information of only one audio professional who identifies as an woman and unfortunately did not get a response from her.

3.2 Procedure

We obtained approval to conduct the interviews with blind professionals from the Institutional Review Board of our university. Before the start of each interview, we obtained consent from the participants. We followed a semi-structured interview format where the participants could freely walk us through their process of audio-related work. Through the span of the interviews, participants were asked about the tools and applications they use for their work, the challenges they face during audio production, and the resources they use for learning and receiving support. We asked them about different strategies and tools they use related to accessibility. We also asked our participants about their experience of doing audio production on a professional capacity, if they performed such work professionally. All interviews were audio-recorded and transcribed for analysis. Participants received compensation for their time.

3.3 Data Analysis

We followed a thematic analysis approach [13] for data analysis. During early coding, our goal was to identify practices and challenges that relate to the design of accessibility features in audio production software and their social and professional experiences as blind audio professionals. Our early analysis focused on the software and hardware tools that participants use in producing their audio content and how they receive and provide support. We refined our initial codes based on memos and insights from subsequent interviews. We examined these codes and grouped relevant ones to conceptualize prominent themes. After generating these initial themes, we went back to our transcripts and looked for instances that supported and contradicted these themes. We reworked the themes such that they were distinct and merged others together in case of overlap. We arrived at the findings presented below through an iterative process of examining transcripts, codes, and themes.

4 FINDINGS

Below we report findings from our analysis, but first we provide context with an overview of common tools and processes of audio production. Our informants described audio production as a detailed and complex process that consists of several stages and involves the use of a variety of software and hardware tools. Generally, the process can be divided into four stages: recording, editing, mixing and mastering. During the recording stage, speech, vocals and instruments are recorded and saved as separate raw audio tracks. The editing stage involves trimming the raw audio tracks, removing unwanted clicks and noise, applying pitch correction and so on. Next, the mixing stage is about making sure that all the different audio tracks sound good with each other and involves optimizing the audio levels of different tracks, removing muddiness and boominess (i.e., unclear sound due to multiple instruments or vocal tracks covering the same frequency range), applying effects to the tracks (e.g., equalization or EQ, reverberation and compression) and combining all the tracks into a two-channel mix. Finally, mastering is the post-production stage where subtle changes are made including level adjusting, equalization, reverb, compression etc. to ensure the audio sounds consistent throughout an album.

For handling these different stages of audio content production, Digital Audio Workstations (DAWs) are the primary and essential software tools for audio professionals and hobbyists. Commonly used commercial DAWs include Pro Tools, REAPER, Logic, SONAR, etc., while free-of-cost options such as GarageBand or Audacity are also available. In addition, there are two other types of software tools that are widely used alongside DAWs. The first one is digital instruments, which allow users to create and replicate high-fidelity instrument sounds electronically on their DAWs. The second one is effects plugins such as EQ, reverb and compression, which can be used for producing creative effects on sound. On the hardware side, people use recording microphones, electronic keyboards, recording interfaces, mixing boards, and more depending on their needs.

Table 1: Details of interview participants (All names are pseudonyms; *RP = Retinitis Pigmentosa)

Name	Self-reported Visual Ability	Type of Work	Experience level and primary DAW
Aaron	Totally blind	Sound engineer, podcast host	Professional, REAPER
Alex	Totally blind	Sound engineer, producer, audio production trainer	Professional, Pro Tools
Bill	Legally blind (due to RP*)	Musician, producer, sound artist, sound designer	Professional, Pro Tools
Daniel	Totally blind	Musician, composer, producer	Professional, SONAR
David	Totally blind	Musician, composer, producer, Pro Tools trainer	Professional, Pro Tools and REAPER
Ethan	Totally blind	Podcast host	Novice hobbyist, GoldWave
Fred	Some light perception	Podcast editor, REAPER trainer	Professional, REAPER
Henry	Totally blind	Musician	Expert hobbyist, Pro Tools
Jack	Totally blind	Audio engineer, REAPER trainer	Professional, REAPER
Jim	Totally blind	Podcast host, musician, accessibility script developer for SONAR and Samplitude	Beginner hobbyist, SONAR and Samplitude
Liam	Totally blind	Music writer, professor (assistive music tech), accessibility script developer for Pro Tools	Advanced hobbyist, Pro Tools
Max	Very little vision in one eye	Musician	Beginner hobbyist, REAPER
Mike	Some light perception	Musician, composer, producer, accessibility script developer for REAPER	Hobbyist, REAPER (advanced) and Pro Tools (beginner)
Nick	Totally blind	Musician, music producer, REAPER trainer	Expert hobbyist, REAPER
Noah	Some light perception (RP*)	Musician	Beginner hobbyist, REAPER
Oliver	Totally blind	Musician, audio engineer, podcast host	Professional, REAPER and Pro Tools
Paul	Totally blind	Musician, music composer, producer	Expert hobbyist, Logic Pro
Ryan	Some light perception	Musician, audio engineer	Professional, Logic Pro

4.1 Piecing Together Accessible and Efficient Workflows

To reap the benefits of these complex audio production tools used widely in the industry, blind audio professionals and hobbyists must learn to circumnavigate a number of accessibility and usability issues, often requiring the use of additional software and hardware. People with vision impairments primarily use screen readers to get on-screen information via speech or braille feedback and interact with computer software via keystrokes. The extent to which blind audio professionals and hobbyists can access all the necessary actions and information on their DAWs, effects plugins, and digital instruments varies depending on the screen reader support in these tools. Some DAWs like Pro Tools and Logic offer native screen reader support, meaning most features and information are available through the screen reader. In contrast, other DAWs, such as REAPER, do not provide native screen reader access and require the installation of unofficial accessibility scripts to make them screen reader compatible. Similar to DAWs, third-party effects plugins and digital instruments have varying degrees of screen reader support. Jack said that *"the best way to access a plugin, ideally, is if it's interface is accessible"* out of the box. Alternatively, some plugins and digital instruments with inaccessible interfaces can be accessed using accessibility scripts only if the plugin's parameters are properly labeled and fully automatable i.e., the parameter values of the plugin are readable and modifiable by a DAW.

While audio itself is a non-visual medium, many aspects of audio production have become *"less and less about what you hear and a lot about what you see,"* Mike said. The complicated graphical user interfaces of audio production tools (see Figure 1, left) and the audio visualizations (e.g., waveform and equalizer) are not designed with screen reader users in mind [50, 68]. Referring to the varying degrees of screen reader support in audio production tools, Ethan lamented that *"almost none of this stuff is totally 100% accessible."*

Our participants face several considerations in choosing their software tools. First, the extent of screen reader support of the same DAW may vary across different operating systems. For example, our informants explained that Pro Tools is quite accessible on Mac but offers little accessibility support on Windows. Even the unofficial accessibility scripts for a DAW may not always be available across multiple operating systems. Similarly, the choice of plugins and digital instruments is also limited for screen reader users. Many plugins do not provide native screen reader support or do not have automatable parameters and thus, cannot be used by blind users at all. Jack reported, *"There is a disconcerting sort of tendency for plugin manufacturers to create their own installers"* that do not have screen reader support. He adds that some of these plugins can be *"very pleasant to use once they're installed"* but navigating the inaccessible installation and registration process is *"so tedious that it's frustrating and it's just not worth my time"*. Due to these restrictions and challenges, our participants are left frustrated by having their choice of software tools dictated by their screen reader support, as opposed to how suitable the tools are for their needs.

> *"I guess the challenge is I would like my software choices not to be dictated by what is accessible for me. I would like them to be all accessible as they ought to be, and then I would like them to be dictated by my needs and...which software actually best meets that need. And we are not anywhere close to that." – Ethan*

Although some DAWs, effects plugins, and digital instruments are seemingly accessible in terms of screen reader support, our participants report that reaping the benefits of this access can be extremely difficult, because screen reader support alone does not always translate to the desired or required level of speed and efficiency in performing audio production tasks. Participants explained that a key factor in achieving speed and efficiency in audio production tools is quick and real-time access to a host of information. This includes figuring out which tracks are muted, whether any clipping (i.e., the audio levels being amplified beyond maximum limits) is occurring during recording, getting the volume of multiple audio tracks at the same time and so on. For sighted users, access to such information is distributed across the graphical user interface (GUI) of a DAW in the form of buttons, sliders, knobs and other visual markers, and this wide array of information is readily available at any given moment for sighted users from a quick glance.

The convenient and fast informational overview afforded by visual interfaces is somewhat lost for screen reader users when the extent of accessibility implementation does not go beyond simply making the GUI elements readable to a screen reader. The reasons are twofold. First, the linear navigation and announcement of on-screen elements in screen readers often makes getting the desired information time consuming. For example, according to Alex, Pro Tools is *"about 98% accessible"* in terms of screen reader support, but the task of getting information such as identifying the muted tracks from a large list of tracks in a Pro Tools session *"takes a long time"* according to Liam, because if *"you have like 70 tracks and you just want to find out, 'Oh which one is the muted?' You have to go through each track and find out if the button is on or not."* Secondly, the ephemerality of auditory announcements makes it difficult to capture and interpret the same rich stream of information afforded by the glanceability [59] of visual interfaces. For example, the mixer console of a DAW visually represents the audio levels of different tracks using a series of vertical sliders, which allows for easy, quick comparison of the different tracks' loudness relative to each other. However, according to Mike, getting and comparing these audio levels of multiple tracks for screen reader users involves listening to a lengthy list of numbers such as *"drums 50%, piano 60%, guitar 70%, vocals 90%"* and then comparing them like *"50%, that's less than 60, and... 90 is quite a bit more than 60."* As such, this process of memorization and comparison becomes a *"huge cognitive load"* and requires blind users to go through *"all sorts of mental gymnastics."* Besides, listening to the audio content being edited or produced already occupies the auditory senses of screen reader users, and the voice feedback of screen readers can be a nuisance if the audio content is playing at the same time. Thus, for our participants, access to audio production tools depends not only on having the user interface readable using a screen reader but also on being able to access and interpret information that is critical for performing editing and production tasks efficiently.

> *"There are two different levels of accessibility... The first one was, like I said, make all the buttons readable to a blind person and to their software. The second one is to make it practical and... where you can be productive and be just as fast as a sighted user, or as fast as possible compared to a sighted user."* – *Aaron*

For cases where the extent of available accessibility falls short of making fast retrieval and interpretation of information possible in audio production tools, our participants have to resort to external interventions like unofficial accessibility scripts (e.g., Flo Tools[4] for Pro Tools, OSARA[5] for REAPER) and external hardware tools (e.g., control surfaces and braille displays). In addition to improving or adding screen reader support to DAWs and providing keyboard shortcuts for additional actions, these accessibility scripts also monitor and extract relevant information from DAWs and report them dynamically or on-demand via screen reader announcements. Henry says that quick access to information like how many tracks are muted improves his workflow *"tenfold"*, while Jack says that the fast and dynamic retrieval of information afforded by OSARA is *"a confidence booster and a time saver,"* because *"it takes the guesswork out. If I hear something, for example, on the levels and it says that 'I'm clipping', well, I don't have to render the whole thing out and then listen to it back and say, 'Oh, yeah, it did actually...' I know when it tells me something it's happening. And so, I can make informed decisions on what needs to happen."*

As discussed previously though, screen reader feedback can be interruptive or cognitively overloading if audio content is playing at the same time, or if the user needs to obtain and compare multiple parameter values. Accessibility scripts alone are not enough to address these challenges. In such cases, our participants have to resort to hardware interventions. For example, Jim developed a set of scripts that can show audio meters (i.e., average instantaneous volume of a track at any given moment) varying real time on a braille display so that a blind user can receive tactile feedback of how the meters change in real time *"without having to use speech feedback and interrupt what you were listening to."* Another way to monitor audio meters or other information via tactile modality is to use a control surface (see Figure 1, right), a hardware tool with a set of motorized knobs, sliders and buttons that respond to different knobs, sliders and buttons on the GUI of a DAW software. Referring to the task of monitoring and comparing audio levels of multiple tracks, Mike says that a control surface provides a tactile representation of these different audio levels side by side and gives the user *"the ability to really get a picture of what your mix is looking like."* Alex reports that the tactile representation of information afforded by a control surface *"is texturally what a blind person really, really needs."* To underscore the importance of control surface, an experienced blind audio producer once told Mike that *"for a blind person to mix effectively, you need to have a control surface so that you can do hands-on mixing."* These control surfaces can cost $10,000 USD and are cost prohibitive for many individuals.

The above discussion illustrates that in performing audio production, our participants rely on a complex suite of software and hardware tools to ensure fast and efficient access to necessary actions and information. However, maintaining access and efficiency is a continuous battle that is often exacerbated by updates to both software and hardware tools. According to Jim, DAW updates may often force blind users to navigate a new, unfamiliar user interface, which makes it particularly challenging for blind users to identify

[4] http://flotools.org
[5] https://osara.reaperaccessibility.com

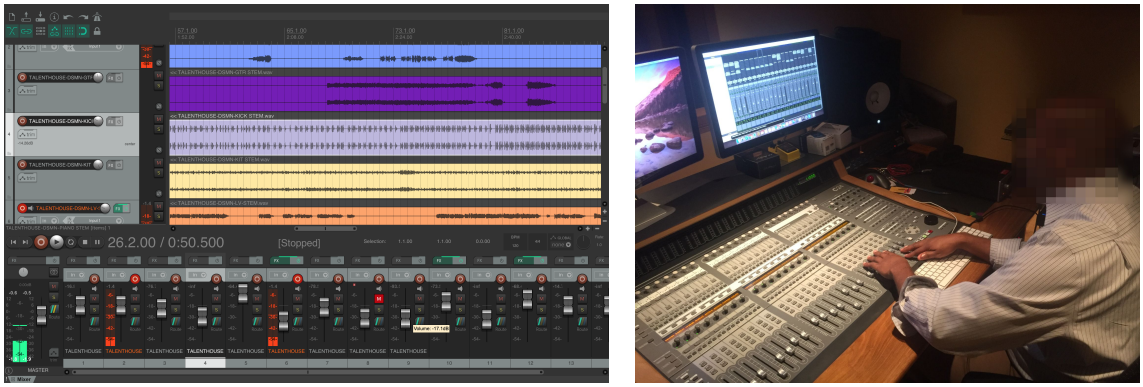

Figure 1: *Left:* A screenshot of REAPER's user interface showing 5 audio tracks above and the mixer console below ; *Right:* A participant uses his control surface to perform mixing on Pro Tools.

which UI elements moved and where. To make things worse, software updates and UI changes on a DAW can break not only its own accessibility but also the functionalities of the unofficial accessibility scripts. Liam, who develops accessibility scripts for Pro Tools, explains that *"if the UI changes the scripts break. Because it looks for all the UI, and if the UI elements change, it cannot find what it used to be able to find."* Jim and Daniel reported that there used to be a set of unofficial scripts that made it possible for blind users to use SONAR, a DAW that was otherwise inaccessible. However, a dramatic redesign of SONAR's user interface meant that *"all of a sudden, years of scripting work that people put in to make it accessible had to be thrown away and couldn't be used, because the UI so dramatically changed,"* said Jim. Since these scripts weren't updated anymore, subsequent versions of SONAR were inaccessible. This eventually forced Jim to start switching over to another DAW, while Daniel still continues to use a much older version of SONAR from 2008. This example illustrates that in case of software updates breaking accessibility, to ensure continued access, our participants face a choice between depriving themselves of the features and benefits of updates or the labor of switching to a new DAW. Hardware updates also sometimes come with accessibility issues of their own, because many developers are including inaccessible touchscreen interfaces in their latest generation of tools at the expense of *"buttons and knobs... that's what's important to a blind person,"*.

In summary, accessibility in audio production requires piecing together a complex suite of hardware and software tools, some custom-made by members within the blind audio communities, where challenges arising from any single tool may have negative implications for their entire workflow. As a result, some blind audio professionals and hobbyists seek to reduce the number of tools they rely upon. For example, David said that while he uses unofficial scripts with his DAW to make certain workflows and information retrieval faster, he also learned how to perform the same workflows and information retrieval without the help of accessibility scripts so that even if the scripts stop working, *"my workflow would not stop, I would still be able to do everything that I need to do."* As such, reliance on a large number of tools to increase efficiency comes with added risks of their workflow being hampered due to a failure in any of the tools. On the flip side, reliance on fewer tools may decrease the likelihood of such a breakdown, but at the cost of convenience, speed, and efficiency.

4.2 Achieving and Maintaining Professional Competency

Audio production is a meaningful career path and essential source of income for many of our participants. According to Jim, audio production is a great field for people with vision impairments, because they *"learn to develop the ears in such a way that this is the sense they rely on and they're good at it."* Ryan said that his motivation to pursue audio as a profession stemmed from *"knowing that I have the ability and capabilities to get it done much like anybody else that wanted to go out there and accomplish a similar task... thanks to audio being one of those things where I don't need to be able to see to do it."* Noting that his work with audio felt *"empowering,"* Ryan added that audio production can be a way for blind people to realize that *"they can monetize a talent of theirs to become a healthy part of the economy."* For others, audio is also a creative outlet and form of artistic expression. Mike attributed his interest in producing audio drama to its *"ability to paint with sound and tell stories with sound."*

Mastering the use of audio production tools, in addition to developing *"critical listening skills,"* is key to being competitive and successful in the art of audio production for sighted and blind professionals alike. While critical listening skills are necessary for audio engineers to identify what changes need to happen to audio content, it is equally important for them to be proficient in these complex audio production tools to actually implement these changes and produce high quality output. Our participants, however, revealed that the lack of accessibility in these tools poses significant barriers for people with vision impairments in their pursuit of audio production as a profession.

> *"We're trying to sell this [blind] client on, 'you can do this without vision. You can be employable. You can have your small business back. You can go to school.' But then I have to turn around and go, 'That interface won't work. That interface sucks. That interface is not accessible.' It's really a challenge for me."* – *David*

> *"Audio editing should be one of our fields. We should be the wizards. I think that we as a blind community allowed the sighted world to take something away from us that should be natural, that we should be doing... You get 90% of your information from sight, we get 90% of ours from audio. So, we should be doing those jobs. There's a lot of knowledge and economic prosperity that's denied the blind community because of what's been allowed to happen, frankly."* – Ethan

The complex set of tools necessary for a blind audio professional or hobbyist, as laid out in section 4.1, illustrates that *"you need more tools and you need to know them well if you're blind."* Thus, for people with vision impairments, an already steep learning curve of audio production becomes even steeper and is further exacerbated by access barriers. Since lack of accessibility support in many DAWs, plugins, and digital instruments limits the software choices available to people with vision impairments, Nick and Paul stressed that blind users have to learn to use their software tools *"very well, way better than their sighted counterparts. For you guys (sighted users) REAPER, Pro Tools, SONAR, Samplitude... they're the same. Pretty much you can do basically everything with everything. We cannot. So we need to be very skilled at what we know best."* Relatedly, Ethan revealed that in addition to learning how to use their audio production software, a blind user also has to *"figure out how that (software) works with your screen reader and be really skilled with your one or more screen readers that you know."* Nick emphasized the necessity of learning multiple screen readers, *"because one screen reader can be better at one thing than another one can be."* In addition, while many of our participants learn the use of unofficial accessibility scripts with their DAWs to make certain workflows and information retrieval faster, Mike revealed the necessity of learning how to perform the same workflows and information retrieval without the help of unofficial scripts, so that *"if you ever go to a studio and need to work in a studio that's not running Flo Tools, you'll actually know how to do it."*

The above excerpts highlight the additional work our participants need to perform to overcome access barriers in audio production tools. Learning to use these tools skillfully is essential to being successful in a highly competitive audio industry for sighted and blind professionals alike. Overcoming the access barriers of these tools, however, becomes just as important as learning the tools for blind people. Consequently, for some of our expert participants, the distinction between the learning curve and accessibility issues of audio production tools becomes ever-so-blurred that they come to view many of these issues as a part of the learning process itself. In Henry's words, *"using Pro Tools right from the get-go, sure it was overwhelming... I could tell there were some things that weren't accessible, but I think a lot of that was a learning curve... I think it's the user awareness, are they aware of this? And whether is it accessibility or is it understandability?"* Fred echoed this sentiment – *"it is about understanding concepts I think for a lot of people... They don't want to understand all the concepts, they just want to know that if I press this button or this button, or this button, this thing will happen... To me, that has nothing to do with accessibility."*

As such, challenges that were described as accessibility issues by some participants (e.g., inaccessible plugins or having to search for workarounds for an inaccessible workflow) were interpreted by others as *"perceived barriers"* that can be overcome through learning and practice. For example, Oliver thinks that the challenge of an inaccessible plugin can be circumnavigated by *"figuring out what that plugin is doing for people and figuring out a different way altogether."* Along similar lines, Jack thinks that as a blind audio professional his challenges are *"no more than anyone else who would do my kind of work."* Going one step further, Henry seemed to think that many of the challenges that are perceived as accessibility issues are products of *"user errors"* and *"misconceptions"* and added that *"it depends on your perception and if you've got that mental block blaming others instead of looking inside yourself... is that accessibility or is that within the user itself?"*

The excerpts above provide contrast to how some of our other participants viewed accessibility. Jim and Ryan thought that software should not only be *accessible* but also *usable* – *"a program may be accessible in terms of- you can get to every element on the screen [and] your screen reader will read every element on the screen, but if it takes you too much time to get to those things and you have to search for it, I don't consider it very usable."* Therefore, on one hand, the last excerpt places the responsibility of creating access on software developers by putting emphasis on the distinction between *accessibility* and *usability*, which has been previously studied and supported by prior work [7, 41, 58, 70, 71]. On the other end of the spectrum, Henry, Fred, and Oliver argue for a distinction between *accessibility* of the system and users' capability of understanding the system, and thereby place the labor of overcoming many of these access barriers on blind users. *"The program (software) doesn't work you, you work the program,"* commented Henry.

These two opposing views from our participants point to the same question – who should bear the additional labor of creating access? This additional labor, no matter who bears it, is critical to their professional success in a highly competitive audio production industry. As such, it appears that some of our expert participants come to internalize this added work as a part of developing their skills and efficiency, with Oliver saying, *"You've got to be really proactive about figuring out workarounds..."*

For blind audio professionals, there is additional work not only in developing efficiency but also in keeping up with the ever-present need to prove their efficiency to clients and collaborators in a predominantly sighted industry. Paul explained, *"I don't want them (collaborators) to go away with an impression that, 'oh, he's so slow. Never hire him. Never do anything with him.'... Image is everything. So if you have a bad image... or you're slow at doing your work, people just go elsewhere."* In their bid to prove their speed and efficiency to others, Oliver and Daniel underscored the importance of communication skills to navigate around people's stereotypical perceptions about vision impairments. In Daniel's words, *"I rely on communication skills heavily... I communicate my way into situations that I think I would have a high chance of being turned away from otherwise."* Echoing Daniel's sentiment, Oliver argues that *"you've got to be able to communicate your way around perceptions of... not necessarily just a visual impairment but if there's anything that makes you different."* However, Oliver recalled an incident where convincing the client that he can do a task *"took so much longer... than it did for me to actually do it, and it's just not a conversation that would ever have to happen with someone... if they could see."* These excerpts

illustrate that proving their efficiency and pushing back against ableist stereotypes and stigma becomes a never-ending process for audio professionals with vision impairments.

> *"They (clients) could hire you or the sighted guy down the street. You might be better at the job, but ... the human psyche works in a way that 'Well, let me just go to the guy who has all their senses', because that just makes sense. It makes sense to deduct IQ points from the guy that can't see because they (clients) just don't know any better." – David*

Beyond communicating with clients and collaborators to assert competency, our participants described additional considerations that shape their professional work. Most of our participants primarily work from their home using their own computer and hardware setup. There are times, however, when they go to work in an external venue or a studio they've never been to before, and Oliver feels that *"the barrier to entry in terms of working in an unfamiliar space is pretty high."* As an example, Daniel explains that *"you'd be called to do a wedding at one location or to work live sound in a bar and other nights for a rock band... but, I don't know everybody's sound system. I don't know everybody's exact stage parameters and stuff."* Oliver echoed this sentiment when talking about working in an unfamiliar studio, *"there's inevitably going to be a longer period of time where you are less effective in that space than a sighted person walking into it, glancing around, and going, 'Okay, the mics are over there, this amp's here,' you know what I mean?"* He further explained that negotiating for accessibility accommodations (e.g., accessible DAWs and screen readers) in a studio owned by another sighted person depends on establishing and leveraging a long term-collaboration with the studio owner by *"renting this space over and over again."* Thus, achieving a professional career in audio production involves working with sighted collaborators to co-create accessibility in ability-diverse workspaces [2, 11, 20, 73], from home work environments to shared studios to unfamiliar venues.

4.3 Learning and Creating Access through Community Efforts

Our analysis shows that for people with vision impairments, getting into audio production involves the use of multiple complex tools with varying degrees of accessibility support. Mike explains that when getting started in audio production and choosing a audio production software, a visually impaired person needs to know *"is the software going to be accessible?... Is it going to be accessible for the kinds of workflows that I might want to do?"* In addition, beginners also require guidance for learning how to accomplish basic audio production tasks. While resources such as instruction manuals, YouTube tutorials, and software-specific online support forums are available to help facilitate the early learning stages, Liam reveals that *"a lot of times... they'll describe how to use an interface [from the] perspective of a sighted person."* The use of visual-spatial markers such as *"click this thing"* is not helpful, because *"the way blind people use the DAWs with the screen reader is so different than how sighted people use DAWs,"* he says.

The excerpts above highlight the need for learning resources that are designed from a screen reader user's perspective. To help fulfill this need, visually impaired audio enthusiasts form and maintain an active collection of online communities in the form of email lists and WhatsApp groups. Oliver reports that *"every different DAW that has any sort of accessibility has a community of blind users helping each other learn the ropes and helping each other figure stuff out."* According to Jim, for beginners it is *"very helpful to have these communities of people who are familiar with the software, and if you have a simple question, they can get you started and say, 'Start here'."* Members of the WhatsApp groups exchange questions and answers through voice messages. Such voice based communication, in Mike's words, is *"a way more effective way of asking a question than trying to describe what's going wrong in an email,"* because it allows people to demonstrate the problems they are facing by sharing recordings of screen reader announcements. Ryan added that voice messages allow members to *"answer people's questions by just demoing something and sending to you"* and *"demonstrate little tricks they've just found out."* Jim, Nick, and Paul added that members of the online communities also create and maintain documentation and tutorials for software tools and accessibility scripts from screen reader users' perspective. Paul explained, *"When I make my YouTube videos, I do always try to explain the steps I'm taking... because I know that most of my audience is blind."*

Along with these considerable benefits associated with the community's role as a learning resource, however, come a number of challenges. First, for the uninitiated, knowing about the existence of these *"insular"* communities depends on prior connections with somebody already in these communities. Ryan finds this problematic because the knowledge and resources generated in these communities cannot be found anywhere else: *"If you're searching Google, you're never going to find this content. If you don't know that these mailing lists exist and you don't know that these WhatsApp groups exist, you're never going to find this content."* Furthermore, Mike felt that for a beginner, *"the WhatsApp groups might be way too much information... It would be pretty daunting to figure out how to sift through all the information."* Jack echoes this sentiment and further explained, *"you've got a lot of info – more than you could ever want, and you can be an information junkie because there's so much to learn. You could sit around learning things and never doing anything."* Therefore, to avoid the pitfalls of going *"from having no info to too much info,"* newcomers have to be very specific about what *"exactly you're trying to do"* when asking questions in the online communities. Even asking specific questions may sometimes fall short of avoiding information overload due to the confusion arising from *"everybody telling you how to do something, and everybody telling you a way that's slightly different,"* according to Jack.

Despite these challenges, the online communities of blind audio professionals and hobbyists play a major role in helping blind people learn the ropes of audio production. In Oliver's opinion, *"the community route is probably the strongest way to get started at the moment."* Similarly, Paul stated, *"without these kinds of internet resources, people would be a lot further back in their learning; I know I would. I might be my 2017 or '18 self instead of my 2020 self if I didn't have access to these email and WhatsApp groups, because there's only so much you can learn by yourself."* David, who offers paid Pro Tools training to blind people, said, *"I want these people to get in two weeks what took me ten years to learn. There is no reason to reinvent the wheel now. Nobody should have to go through what some of us went through, it's not fair."* These excerpts indicate that the knowledge

produced and shared within these communities is uniquely helpful to blind users in learning the use of audio production tools and navigating accessibility issues around these tools.

Beyond providing blind audio enthusiasts with much needed learning resources, the experienced members within these communities also provide inspiration to beginners: *"It's a place to realize you can do this because there are other people here like you that are doing it,"* said Ryan. For many of our experienced participants, helping the beginners is a way of giving back to the community they have benefited from and gives them a sense of accomplishment.

> *"I'd like to think that I'm helping the communities. They certainly help me... I literally love it. If I can help someone and they can achieve something that they couldn't do this time yesterday, that's a win. That's why I do my show... because if I am inspired by something, maybe someone else will be as well." – Paul*

> *"I tend to use it (helping others) as a way of rescuing a day that's gone bad. Because then, like I said, at the end of the day, I can look back on that afternoon or whatever and, yeah, okay, I didn't finish what I was intending to do and that sucks, but at least it's not a total write-off. I can safely say that I helped someone, so there was something good that came into the world as a result of that shitty afternoon. I don't know. For me, that makes a difference." – Oliver*

Still, accessibility issues continue to persist in different audio production software, as illustrated in section 4.1. Some blind professionals and hobbyists within these online communities take it upon themselves to circumvent these accessibility issues and enhance efficiency by developing unofficial accessibility scripts for these tools. Nick, Jim and Liam described that their participation in developing these unofficial scripts was motivated by their own needs and experiences with audio production tools as well as requests from fellow blind members of their communities. To underscore the importance of community development, Nick said that *"the accessibility grew with time because people [in the community] develop for it."* Jim explained that the online communities facilitate collaboration among members around the world who are interested in developing these scripts, and *"everybody can do a little bit of the work and combine their knowledge together"* in developing and maintaining these scripts. Nick mentioned fundraising efforts from community members to financially support their fellow community members who develop these scripts – *"we created... a GoFundMe page where people can donate and... they can get a Christmas album that we produced with basically all around the world, blind and sighted people. We produced two Christmas albums that are on Bandcamp and money is going to this GoFundMe so that we can pay the developers to keep developing the accessibility."* According to Henry, the effectiveness of the unofficial accessibility scripts developed by community members come from the developers' shared understanding of the community's accessibility needs. Oliver also shares a similar sentiment and accentuates the importance of advocacy and involvement of visually impaired people in developing for accessibility.

> *"It's a very different implementation of accessibility that you'll get from a blind person leading the way on that versus a sighted person implementing accessibility for blind people... I'm not saying that the latter is pointless by any stretch; I'm just saying that the accessibility that I've seen come into the world, the stuff that's been really effective, has either been as a result of advocacy led by blind people, or blind people have been very heavily involved right from the implementation being conceived. I think that's where effectiveness comes from." - Oliver*

The need for advocacy and involvement of blind people motivates the blind audio communities to play another important role in creating access by establishing connections with software developers. They use this bridge between the communities and software developers to communicate their feedback on improving accessibility in mainstream software tools by becoming beta testers or working as consultants. In addition, according to Ryan, sometimes community members who develop the unofficial accessibility scripts also maintain connections with DAW developers to ensure that both parties *"are aware of what each other's doing"* and the developer *"isn't going to change something on them that breaks what their tool (the accessibility script) is able to do."*

As we see above, the online communities of blind audio professionals and hobbyists play a pivotal role in creating and maintaining access by interfacing with software developers and in their doing so, interesting nuances and strategies appear around the communication between these two parties. First, underscoring the need of being strategic for the blind communities in establishing a fruitful relationship with developers, Ryan revealed that being *"too pushy in to demand"* improvements is not *"the right way to go about building a rapport and working with developers."* Moreover, Ryan and Nick highlighted the importance of translating their specific accessibility needs and questions in a way that is understandable and *"actionable to a developer,"* because sometimes developers may not know *"how they can help you out until one person [from the community] speaks their own language."* Therefore, according to Nick, the success of communication with developers sometimes hinges upon asking *"the right questions in the right way to the right people."*

In our conversations with participants, we identified dynamics within the blind audio communities that shape how their needs are represented to software developers. As seen in prior studies on user contributions in online communities, a common scenario is that a few active and experienced members answer most of the questions by the members of the communities [39, 55]. Ryan mentioned that usually these experienced members become *"the unofficial spokespersons to the blind community"* and they are the ones who establish contact with software developers. He also indicated that this power differential in advocacy may result in a homogeneous group of people representing the community, and the pitfall is that they may not be representative of the needs of other community members with different workflows and varying degrees of expertise. Thus, the varying needs and goals of different members within a community lead to the challenge of picking the *"right group of people"* who represent the community's needs to software developers:

> *"The right thing to do would be to have like... a team of people that are qualified to interface with the developers and kind of help guide the process along... but there is a few different workflows, people that are working on different types of things, but people that also are in*

> *different stages of their development. Because a beginner might come up with a use case that someone like me may not come up with because I would never think of doing that certain thing." – Ryan*

The process of communicating their needs to the developers sometimes comes with additional challenges despite the best efforts from community members, because the extent of success (or lack thereof) in their communication efforts vary from developer to developer. Oliver, who spends a fair amount of time doing advocacy efforts with developers shared that *"sometimes I manage to kickstart getting good stuff done, other times you get no response at all."* He added that getting the attention of big software developers is tricky, because *"it often takes quite a few people to make enough noise to get heard."* Similarly, smaller companies also sometimes express inability to accommodate accessibility improvements citing lack of financial resources and manpower. To add to the woes, some developers implement accessibility features without taking feedback from blind users, which often result in *"supposed"* accessibility improvements that are not useful in practice.

> *"A lot of people get this wrong. They make something and just sort of go, 'Well, we made this. It took so long, but we didn't ask anybody if it was going to be useful. You should be grateful.' I'm not. Sorry... People go out of their way, out of the supposed kindness of their heart, to do whatever it is that they do and say that this is for blind people. But they haven't done any testing. So how can you make something for a group of people that you haven't had a single one of those group of people test it for? And then you find out that nothing works as you intended. That's not helpful." - Paul*

These critical challenges in negotiating with software developers for ensuring accessibility in audio production further accentuates the importance of how online communities of blind audio professionals and hobbyists collaborate to create and maintain access through developing their homebrewed accessibility scripts, figuring out and sharing workarounds to increase accessibility and efficiency, creating documentations and tutorials, and overall, helping each other through an exchange of support and guidance.

5 DISCUSSION

We have presented one of the first detailed accounts of the tools and practices of blind audio producers. Here, we reflect on our analysis to consider the intertwined nature of accessibility and professional skill and discuss considerations for future accessible audio production technologies.

5.1 Accessibility and Professional Competency

As our analysis shows, accessibility and professional competency are deeply intertwined. That is, considerations and practices around accessibility cannot be disentangled from what it means to develop professional skill and mastery in working with audio. Learning in this domain is as much about figuring out accessible workflows that cobble together various hardware and software tools as it is about developing one's *"critical listening skills"* necessary for editing, mixing, and mastering professional sounding audio. With this, our participants had varying viewpoints on what *"barriers"* were and how they should be resolved. While some informants stated that certain software packages and configurations were inaccessible, others said that it's simply a matter of learning which tools work well for which tasks and piecing together one's own solutions. Thus, participants differed on whether challenges to accessible audio production resided in the technology being inherently inaccessible or one's determination to learn and figure out alternative workflows and accommodations. We argue both the tools and learning resources can be improved through design, which we discuss below.

Our findings also reveal the ways in which these audio professionals and hobbyists internalize ableist views and standards of productivity. The view that one can learn their way through and overcome inaccessible tools is deeply ableist, as the tools themselves were originally designed with little consideration for non-visual access given their highly complex graphical interfaces and visualizations (e.g., waveform, spectrogram) [50]. What's more, our informants described working harder than their sighted counterparts [12, 20] and showing mastery over the tools they use as part of displaying their competency to sighted clients. Demonstrating efficiency in one's work was key to displaying competency to clients, yet this becomes a never-ending process of pushing back against ableist ideals and stigma while keeping on top of the latest technology changes and accessibility workarounds.

In their bid to meet ableist productivity standards, some participants have come up with individualized solutions such as their own workarounds and multi-tool setups for inaccessible workflows. Yet, the success stories of a select few blind audio professionals with individualized solutions may further validate and reinforce ableist standards, gloss over underlying accessibility issues in audio production tools, and may not be representative of the unique needs and abilities of other blind audio producers. Ultimately, this could lead to a misguided notion of having achieved accessibility among software developers, absolve software developers of their responsibilities in creating access, and instead ask the larger blind community to meet ableist productivity standards using inaccessible tools. In our view, any step towards reconciling these tensions will involve shifting this power imbalance between software developers and visually impaired end users. Future work can draw upon critical disability studies literature and theoretical framings to rethink productivity standards and encourage developers and researchers to be accomplices in dismantling existing inaccessible systems that uphold ableist views and perpetuate inequality [37].

Through our analysis, we also detail the importance of community among these individuals. Coming together around their shared experiences and frustrations with available tools and resources, these blind audio professionals and hobbyists form an online and offline network of support for one another [62, 72]. Accessibility workarounds and skills are self-sustained through the different roles played by the community members: as content creators, allies, learners, trainers, tool developers, and accessibility advocates. The practices, tools, and workflows they have developed not only originate from their own challenges but are also designed to maximize efficiency for screen reader users, knowing the importance of this for professional success. One participant even runs his own studio and training programs for accessible audio production, knowing that learning accessible work practices is an inherent part of breaking into this industry. Yet, our data reveal that even within this

community of professionals and hobbyists, people hold differing views on who is to 'blame' for accessibility and who should bear the burden for software with poor usability and accessibility for screen reader users. Thus, there is much work to do—both in terms of technology design and shifting societal views—to create a more inclusive environment for those currently in or wanting to enter the field of audio production.

5.2 Design Considerations

Based on our analysis, we outline three key directions for the design of accessible audio production tools and services.

Generate nonvisual user manuals and tutorials. One of the key challenges our participants reported facing when looking for learning resources is that user manuals and tutorials are often written and recorded from a sighted perspective. For example, a manual might ask the user to find a button with a certain shape or icon on the interface, without providing instructions on how to access the button using keyboard navigation or shortcuts. In our work, we identified a severe shortage of inclusive learning resources provided by the software companies themselves. Developers of these tools should not only be mindful of screen reader users and write their manuals with accessibility in mind, but also look to the practices of community members to understand the unique learning experiences of blind audio producers [4]. To this end, software developers themselves may study the voice-based tutorials generated by blind users to gain insights about nonvisual audio production practices and learn about existing incompatibilities in DAWs, potential workarounds, and design opportunities.

Provide interactive tutorials within tools. Another possible way to improve learning and skill development is to incorporate interactive tutorials within software tools. Previously, researchers have explored the use of context-relevant and on-demand explanations for online code [15, 31, 38, 54] and automatic generation of mixed-media tutorials from user-generated screen captures and software logs [16]. Another potential research direction could explore ways to provide contextual suggestions and explanations for the next actions inside DAWs based on users' previous actions (e.g., offering guidance on how to start recording a new track when a new user creates their first project). Some participants commented that early learners could benefit from more readily available resources that would walk them through basic tasks when they are just getting started with a tool. Future research can explore ways to support the early learning process by implementing scaffolding within the audio production tools, such as customizable, interactive tutorials that are designed for the experience of a screen reader user.

Support consistent cross-platform workflows. One of the main challenges described by participants is that each software package has a unique configuration of keyboard shortcuts, buttons, and menus that are required for accomplishing a core set of common tasks in editing, mixing, and mastering audio. There is an opportunity to improve interaction around these key tasks by providing consistency in workflows across a variety of tools. Another challenge stems from the differences in accessibility APIs of different operating systems, which gets in the way of developing accessible software that will work across multiple operating systems. As an example, our participants reported that while Pro Tools has very good screen reader support on macOS, accessibility support on the Windows side leaves much to be desired. One way of solving this is to provide a common and consistent abstraction for the accessibility APIs across different operating systems [23] that will facilitate cross-platform accessibility of audio production tools.

Recognize and support community-developed solutions. Our participants revealed the voluntary yet unpaid labor required from blind audio communities to develop and maintain unofficial accessibility solutions. In addition, they also have to perform significant relationship labor in their advocacy efforts with software developers to get their needs heard. Future designs should recognize the labor of advocacy, script development, and other efforts from blind audio communities in creating accessible audio production practices. The involvement of blind audio communities and their contributions in the design process needs to be a standard expectation in accessibility research and software development, but so should also be the recognition of these communities as co-designers by attributing due credit and providing financial payment for their contributions. To this end, software developers can, for example, take steps to incorporate the community-developed unofficial scripts and voice-based tutorials into their DAWs and official support resources. Beyond giving appropriate recognition to the community-developed solutions, such steps could also help these solutions reach a wider group of screen reader users who may not yet be aware of the existence of these resources. In addition, software developers can help ensure the long-term functionality of community-developed scripts by actively maintaining the API features and dependencies in their DAWs that are used by these scripts, and keeping the blind audio communities informed of upcoming software updates or API changes that may affect these scripts.

6 CONCLUSION

Through our investigation of audio production practices of people with vision impairments, we provide one of the first empirical analyses of this important but under-studied career path, hobby, and form of content creation. Our analysis details the difficult processes of maintaining access and efficiency by piecing together a complex web of tools, learning audio production skills in tandem with accessible workarounds, and receiving and providing support through online networks. Although there is much work to be done in terms of improving software accessibility and shifting ableist norms in this industry, we argue that this must be done by coming alongside and centering the practices of the blind audio professionals and hobbyists who are already leading this effort.

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