Understanding Digital Content Creation Needs of Blind and Low Vision People

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ABSTRACT

Creative activities play an essential role in everyday life. Recently, there has been increasing interest in the accessibility community to support blind and low vision (BLV) people's digital creative experiences. We conducted a mixed-method study to gain a comprehensive understanding of their creative needs to inform and focus this line of research. Through a large-scale survey ($N = 165$) and follow-up interviews ($N = 15$), we learned that BLV people are interested in a more diverse range of creative tasks than what is currently accessible. In particular, many forms of visual content creation and advanced expressions still remain challenging. Participants pointed out both accessibility improvements and social changes needed to fulfill personal creative pursuits. In turn, we discuss potential design ideas to move toward more inclusive creative practices, such as developing alternative, non-visual information-sharing methods and establishing visual information presentation guidelines specific to creative contexts.

CCS CONCEPTS

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

KEYWORDS

accessibility, creativity support, blind and low vision

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1 INTRODUCTION

We engage in countless creative activities in everyday life, and our ability to create influences opportunities for employment, entertainment, and socializing. As creative activities increasingly happen in the digital space, more people now have wider opportunities to create. At the same time, the shift to digital creation, with its reliance on screen-based interfaces, could also bring challenges for some groups, especially people who are blind or with low vision (BLV).

In the past few years, more HCI and accessibility research has begun to explore ways that technology can support BLV content creators' experiences in the digital space (e.g., [68, 70, 81]). So far, this body of research has revealed interests and experiences from a small number of BLV individuals on specific creative tasks. However, there has not been a large-scale, holistic exploration of the community's creative needs across different types of digital content. This knowledge gap could lead to practitioners and researchers making assumptions about BLV people's interests and thereby limiting exploration of new creation support for diverse content. As the field grows, we argue the importance of shaping its focus based on the lived experiences and needs of BLV creators, especially given the wide landscape of digital creative activities and varied opportunities for potential support [25]. In this paper, we study BLV individuals' interests, attitudes and experiences with creating different types of common digital content to inform and prioritize accessibility research efforts that fit the needs of the BLV creator community. We center our research on the following questions:

- RQ1: What types of digital content do BLV individuals want to create?
- RQ2: What types of digital content have BLV individuals been creating?
- RQ3: What accessibility improvements do BLV individuals desire?

We conducted a large-scale survey study ($N = 165$) and follow-up interviews ($N = 15$) with BLV creators about their experiences and needs across a range of digital content types, including text-based (e.g., formatted documents, blog posts), audio (e.g., podcasts, music), static visual (e.g., presentation slides, photographs), video (e.g., video blogs, films), and interactive (e.g., websites, mobile apps) content.

From the survey study, we discovered that BLV respondents' creation experiences primarily focused on digital content with little or no visual elements. However, respondents exhibited interest in a wide range of creative activities, including those that are more visually focused—such as static visual, video, and interactive content—despite those content types being particularly challenging to create. In probing for a more in-depth understanding of perspectives around visually heavy creative tasks in the interviews, we uncovered access barriers that are rooted in both technical and societal sources, such as a lack of feedback about visual content, difficulty operating visually complex creative tools, and struggles with social bias and ableist practices. Participants shared how these barriers impede their professional success, self-expression, and social participation. These findings allow us to reflect on the existing

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focus of accessibility research in the creative space and the role of technology design in BLV creators' experiences.

Overall, this paper contributes: (1) a characterization of BLV people's digital creative experiences and interests across common digital content types; (2) an understanding of BLV people's perspectives toward challenging aspects of their creative experiences; (3) a reflection and discussion of technology design approaches to improve digital content creation accessibility and enact related social change.

2 RELATED WORK

Accessibility of digital content with the BLV population has been an ongoing research focus for decades. While most work has focused on content consumption, there has been increasing attention on content creation. Below, we summarize research to support the digital creative activities of BLV people and the social context of those activities.

2.1 Accessibility Research and BLV Creators

Early accessibility research related to BLV people's digital creative activities centered on text authoring, computer programming, and photography, while the research community has more recently expanded to a wider range of creative pursuits, including audio creation, slide decks, video creation, and collaborative document creation.

Text authoring. Firstly, text entry accessibility used to garner great research interest (e.g., [61, 86, 91]), but with mainstream tools increasingly equipped with accessibility support (e.g., speech input, screenreader-friendly keyboards), it is now a largely accessible task [61]. Text formatting, however, is still a persistent challenge. Accessibility issues arise with word and line spacing, capitalization, character format, and font size [22, 23]. Consequently, many BLV people feel uncomfortable creating documents in which visual presentation is important [23, 90].

Computer programming. Existing work covers common challenges BLV programmers experience, including navigating inaccessible development environments, debugging, creating visual layouts, and so on [5, 40, 56, 60, 75]. Past studies have noted interests from BLV people with user interface design, but also challenges, such as lack of screen reader descriptions for visual information, independence, and understanding of visual semantics [47, 48, 65, 72]. Accordingly, this research proposed multimodal approaches to enhance access to user interface layout (e.g., shape changing devices, touch screen gestures, tactile print-outs) [47, 49, 73] as well as AI-based support for layout editing [71].

Photography. There has also been a longstanding effort to support blind photography, grounded in blind people's interests in and experiences with taking photos of human faces, nature, and objects [1, 14, 15, 27, 45] for memento keeping, artistic expression, social interactions, and visual interpretation purposes [2, 10, 27, 31, 37, 89]. In taking photos, blind people experience challenges evaluating the content and quality of their photos, encounter digital camera interface accessibility issues (e.g., label issues, magnification difficulty) [2, 10, 27, 31, 67], and have difficulty authoring alternative texts [55]. Researchers have thus proposed the use of computer vision to describe photo components (e.g., face, objects, texts) and directions to adjust the camera (e.g., [8, 15, 37, 43]), as well as speech, non-speech audio, and tactile cues to assist camera control, photo review and management [31, 94, 97]. So far, only a limited number of studies have explored BLV people's interests and challenges with photo editing tasks [6, 10, 67, 89].

Audio. Recent studies have explored how BLV people engage with digital audio creation [69, 79, 80]. While modern technology has made audio production more accessible, most mainstream tools still lack accessible features [57, 88]. BLV creators have formed accessible solutions as a community, including plug-ins, external hardware, and online learning materials [69, 80], but the need to additionally piece together workarounds poses significant access labor, and numerous challenges still exist (e.g., incompatibility with screen readers, lack of independence, inefficiency, cognitive overload, learning curve) [69, 79, 80]. Other work has proposed technological innovations, including tactile representations of waveform, peak meter, and notation [4, 57, 68], screen-reader accessible learning resources [79], as well as voice-based and physical control support (e.g, [29, 39, 64, 88]). So far, existing work focuses primarily on music production and is mostly informed by a small set of experienced audio producers.

Presentation slides and artboards. Presentation slides are ubiquitous but largely rely on vision to create, which poses professional and educational barriers to the BLV community [70, 81, 95]. Blind people primarily use a combination of screen readers and sighted support to access and author presentations slides [70, 81]. However, screen readers often provide insufficient descriptions, thus leading to high cognitive load, uncertainty, lack of control, and collaborative challenges [70, 81]. In turn, there are a number of technological attempts to improve accessibility of slide creation, such as providing spatial exploration affordances through touch and gesture [95, 96], involving speech input to ease control, as well as enriched audio descriptions of slide style changes and collaborative information through screen readers [70, 95].

Video. Video creation, mostly in the context of social media, has also recently received more focus. Many BLV creators use popular video-based social media platforms such as YouTube and Twitch to deliver accessibility related messages, publish tutorials, show daily life, connect with others, and gain profit [38, 46, 62, 77, 82, 83]. Past studies noted BLV creators' challenges with video editing interfaces (e.g., incompatibility with screen readers, missing descriptions) and difficulties of visually evaluating content [35, 38, 77, 83]. While a small group of creators do perform basic editing such as trimming, clipping, or adding filters, most creators stream or post raw videos to avoid editing tasks [35, 38, 77]. Their videos are further negatively impacted from biases in content moderation policies that favor the visual aesthetic standards of sighted people [77]. To date, technological innovations related to BLV people's video creation are still sparse (only one existing work explored the use of script to enable non-visual video editing [35]), and there is little attention on video creation outside of the social media context.

Collaborative authoring. Finally, recent research has revealed extensive challenges around inaccessible collaborative activities in document creation (e.g., document changes, real-time editing, high-level overview of collaborative actions, inaccessible practices of sighted collaborators) [20, 21, 44, 54, 66, 70, 74]. Consequently, this body of research calls for awareness of collaborators' access needs among sighted people [19, 21] and proposed design ideas around utilizing on-demand auditory feedback, keyboard commands, and message boxes to provide collaborative information [21, 42, 70].

Summary. Past work has explored BLV people's experiences with a range of content. Overall, they tend to involve the following accessibility barriers: failing to follow accessibility standards, providing little support for evaluation of visual content, lacking accessible collaboration features, and posing learning challenges. While existing work has provided exploratory insights with a set of specific digital creative activities, we lack a holistic understanding of what types of content BLV people are currently creating and what they desire to create. This understanding is critical for researchers to allocate resources based on BLV people's collective needs instead of researchers' personal judgment, without pre-imposing interest in a specific content type. We also know little about BLV people's creation goals and contexts, as well as issues preventing them from realizing their creation goals. This paper addresses this knowledge gap through an in-depth, large-scale empirical exploration with BLV content creators.

2.2 Social Context of Creation Practice and Disability

Disability and the ability to create are historically entangled concepts. In many cultures, disability is inaccurately characterized with an incapability of producing labor [3, 50, 78]. Such assumption has led to structural and social oppression toward disabled individuals' social standing. As a result, disabled communities experience a high rate of unemployment and limited access to education [3, 50, 78].

For the BLV population in particular, there has been a long-standing, exaggerated value that sighted people place on vision, which has led to ableist assumptions and oppressive practices [3, 30, 41]. One example is the myth that beauty is only rendered through visual means and that blind people could not perceive aesthetics (i.e., *'aesthetic blindness'*) [16, 59], despite that, in reality, many BLV individuals appreciate and practice arts [7]. Nevertheless, sighted people theorize about blind experiences through an *"ominous mark of otherness"* [41], ignoring the value and culture within the BLV community and socially excluding them from a range of creative activities, including design [12, 70, 81], research [52, 92, 93], art tasks [33], and so on [16]. Disabled bodies are often treated as *"non-designing bodies"* and disabled people's intellectual creations have historically been *"silenced"* [11]. In turn, everyday practices related to creative activities often perpetuate oppressive structures to BLV individuals [53], such as heavy use of inaccessible materials in school and at work [24, 70, 81], expectations for BLV people to read regular print instead of large print or braille [34], and discriminations related to hiring and work conditions despite disability rights activism to gain access to the mainstream labor market [17, 78]. These practices encourage the notion that disability is a negative aspect that disabled people need to overcome to be valued [34] and require extra access labor from them to accomplish the same task as non-disabled counterparts [36, 52, 84]. As such, disabled people often experience anxiety around disclosing access needs in hopes of *'fitting in'* the non-disabled world [36] and in certain cases lose confidence and become disinterested in inaccessible creative tasks [33]. Blind disability studies scholars thus call for less bias from sighted people and more recognition of valuable blind experiences besides the mere absence of sight [41]. Our paper extends this literature by exploring social considerations involved in BLV people's digital creation experience, in hope of informing accessibility support to shape a more inclusive creative environment.

3 FORMATIVE SURVEY

To broadly understand creation interests and experiences of the BLV community, we first conducted an online survey covering common digital creative tasks.

3.1 Method

3.1.1 Recruitment. We recruited survey respondents primarily through the National Federation of the Blind (NFB) mailing list as well as BLV-focused Facebook Groups, Twitter, and Reddit. Respondents had to be at least 18 years old and identify as having vision loss or visual impairment (e.g., blind, low vision). We offered respondents the opportunity to opt into a drawing for a $75 Amazon gift card (odds of winning: 1 in every 30 respondents).

3.1.2 Survey Outline. The survey was designed to take up to 25 minutes. The survey started with a question to screen out respondents who do not identify as BLV, followed by five sections (in randomized order) with focused questions on respondents' experience with creating five common types of digital content. These types included text-based (e.g., formatted documents, blog posts), audio (e.g., podcasts, music), static visual (e.g., presentation slides, photographs), video (e.g., video blogs, films), and interactive (e.g., websites, mobile apps) content. The survey concluded with a section on demographics and additional comments. We derived the five digital content categories by reviewing and coding through existing digital content glossaries [9, 26, 58, 76].

For each content type, we asked respondents to first indicate whether they had experience in creating such content. Based on that answer, they were then sent to either the "with experience" or "without experience" subsection. The "with experience" subsection focused on questions related to motivation, interest, frequency, and perceived difficulty with the creation of this type of content, followed up by open-ended questions that probe for descriptions on typical creation experience with this type of content, including the context in which it is created, a list of tools or support used for creation (optional), and an explanation of the selected difficulty level (optional). The "without experience" subsection asked respondents about what stopped them from creating the content type as well as potential motivation and interest with creating it, and followed up with an open-ended question asking for a description of potential challenges in the creation of the content type (optional).

The last section provided the opportunity for respondents to add additional content creation experience and content types that they want to create but find difficult. Respondents were then asked demographic questions—including degree of visual impairment or vision loss, education, computer access frequency and methods, age, onset of visual impairment, gender, occupation, and additional disability-related information—as well as contact information for opting into the gift card drawing and/or follow-up study recruitment. Please see supplementary materials for the full set of questions.

After seeking feedback on survey platforms from screen reader users and accessibility researchers in our institute, we decided to host the survey on Google Forms. The survey was piloted with six BLV individuals to ensure accessibility, and the study protocol was approved by an Institutional Review Board.

3.1.3 Data and Analysis. The survey initially obtained 181 responses, with 165 coming from private BLV organizations (NFB and private BLV Facebook Groups) and 16 from more public sources (authors' academic Twitter accounts and r/Blind Reddit forum). The first and second author collaboratively reviewed responses to screen out duplicate and malicious entries (e.g., entries with repeated demographic and contact information or nonsensical open-ended responses). This screening resulted in 165 valid entries.

For choose-all-that-apply and multiple choice questions, our analysis focused primarily on descriptive statistics (e.g., frequencies, percentages) to understand the trends and preferences of BLV respondents. We analyzed and presented responses across respondents' vision conditions, considering blind and low vision respondents' potential difference in computer and visual information access (as indicated in prior literature [87]). For open-ended questions, we performed a thematic analysis on all qualitative responses. Two researchers collaboratively developed an initial codebook and independently coded 25 respondents' data based on the codebook. Cohen's kappa was calculated to assess the inter-rater reliability between two researchers. The codes with low inter-rater reliability were then discussed and updated. With the iterated codebook (in supplementary materials), two researchers independently coded another 25 respondents' data, resulting in an average kappa of 0.84 (SD = .13) across all finalized codes. The second author then consistently applied the finalized codes on all remaining respondents' data, with input from other team members.

Below, we use percentages to report quantitative analysis results, whereas respondent counts are linked to qualitative themes. Percentages used for vision condition groups are based on the total number of respondents in each group (i.e., 79 for low vision respondents and 86 for blind respondents), except for perceived challenge levels, which are limited to the number of respondents who have experience creating the corresponding content in each group.

3.2 Results

In this section, we present BLV respondents' demographics, creation interests and experiences captured in the survey. In reporting quotes from respondents, we use the following acronyms to indicate self-reported vision levels alongside respondent IDs: TB = totally blind, SL = some light perception, LB: legally blind, LV: low vision.

3.2.1 Demographics and Background. Our survey respondents ranged from 19 to 75 years old ($Median$ = 40, M = 41.1, SD = 14.5), with 94 self-reported as women[1], 68 men[2], two non-binary, and one preferring not to reveal their gender. Around half of the respondents (52.1%, N = 86) self-reported as either "totally blind" or with "some light perception," while the other half (47.9%, N = 79) self-reported as either "low vision" or "legally blind." We refer to the former group as blind respondents and to the latter group as low vision respondents. Respondents' onset of visual impairment ranged from ages 0 to 58 ($Median$ = 1, M = 10.3, SD = 14.5). In terms of methods to access computers and smart devices, the most common option was screen reader (85.5%, N = 141), followed by screen magnification software (25.5%, N = 42), system settings (24.8%, N = 41), help from others (20.0%, N = 33), and other (3.0%, N = 5). Almost all respondents (86.1%, N = 142) used a laptop or desktop computer once a day or more, 8.5% used around once a week (N = 14), 4.8% around once a year or less (N = 8), and 0.6% around once a month (N = 1). Similarly, 91.5% of respondents used a smartphone or tablet once a day or more (N = 151), 4.8% around once a week (N = 8), 1.8% around once a month (N = 3), and 1.8% around once a year or less (N = 3). Please see supplementary materials for additional demographic information.

3.2.2 Overall Digital Creative Experience. As indicated in Figure 1, respondents showed an overall interest in creating all five general types of digital content. For blind respondents, text-based content was of the broadest interest (89.5%), followed by audio content (79.1%), video content (76.7%), static visual content(69.8%), and interactive content (57.0%). Fewer respondents had experience actually creating these varied types of content, with blind respondents' experience primarily focused on text-based (88.4%) and audio (76.7%) content (Figure 1). Notably, around 20% of the blind respondents who were interested in creating static visual, video and interactive content, had never had experience creating those types. Relatedly, as shown in Figure 2, static visual and video content were considered somewhat to extremely difficult to create by the majority of blind respondents who have experience creating these types of content (static visual content: 72.7%; video content: 65.9%), whereas only a small portion of blind respondents regarded text-based content and audio content to be difficult (text-based content: 9.2%; audio content: 19.7%).

We observed similar trends among low vision respondents (Figures 1 and 2). Text-based and audio content were also considered more interesting and less difficult by low vision respondents, and they had overall more experience in creating these content types than static visual, video, and interactive content. Interestingly, a higher percentage of low vision respondents shared interest in (74.7%) and experience with (62.0%) static visual content compared to their blind counterparts. As a result, static visual content was second-highest of the content types in both interest level and experience for low vision respondents, surpassing audio and video content—the second and third most popular content types among blind respondents.

Only a small number of respondents specified additional content types in which they had interest (N = 32) and/or experience (N = 14). However, these open-ended responses mostly indicated a

[1] including 88 responses of "Female", two "Woman", two "Cis-gender Female", and one "Biological Female"

[2] including 62 responses of "Male", five "Man", and one "Cis-gender Male"

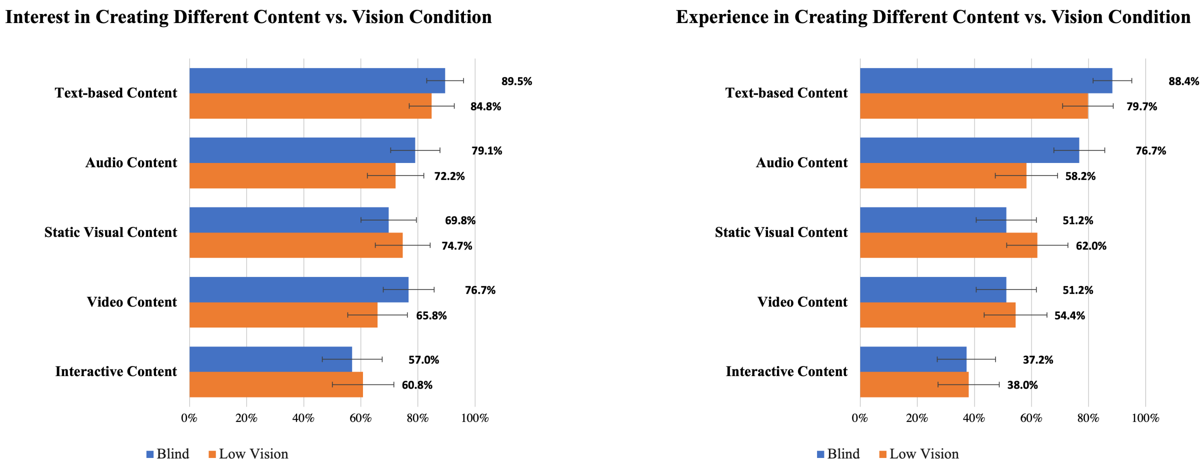

Figure 1: Percentages of respondents with experience and interest in five general content creation types across visual conditions, sorted in descending order. In summary, blind and low vision people's interest in creating digital content did not vary greatly across content types or vision condition, but their actual creation experience centered on text-based and audio content, especially for blind people. Error bars are 95% confidence intervals.

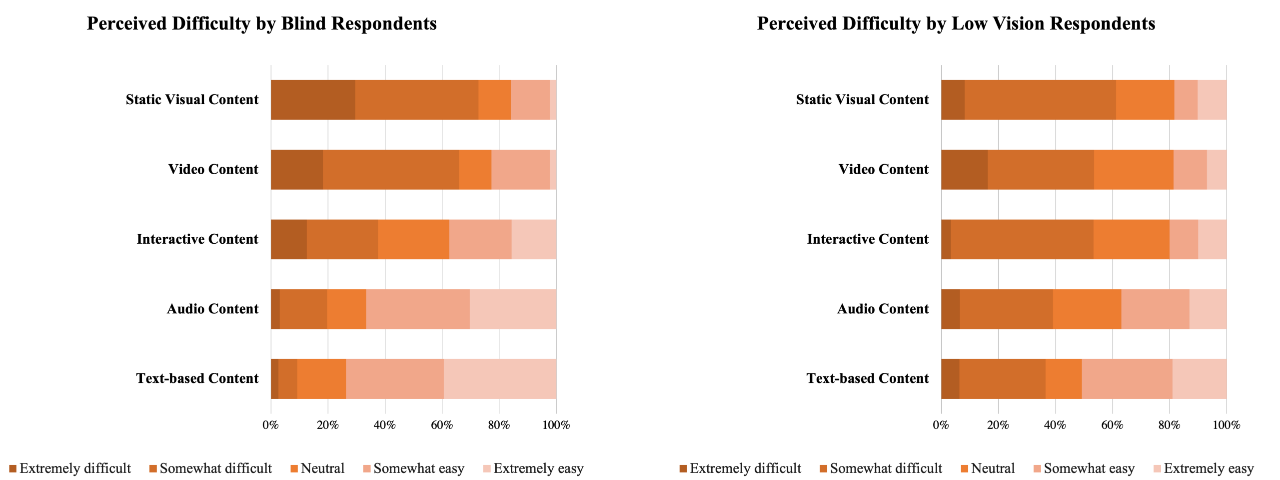

Figure 2: Perceived difficulty levels with creating the five general content types from respondents who have experience creating them, sorted in descending order. In summary, blind respondents perceive static visual and video content to be more challenging and text-based and audio content to be less challenging, with interactive content somewhere in between. Low vision respondents share the same profile, but not as extreme.

sub-category of the five digital content types, such as *"utility softwares"* (P5, LB), *"AR and VR"* (P10, SL), and *"Architectural drawing"* (P144, SL). Therefore, we present these data together with their responses associated with the general content types. Below, we dive into respondents' interests, experiences and barriers with the five types of content creation, with a focus on the ones with higher interest level and creation difficulty: *static visual, video and interactive content.* We also briefly present respondents' experience with two content types that are considered relatively accessible to create, *text-based and audio content*, and summarize issues still remaining with them.

3.2.3 *Static visual content:* The majority of respondents were motivated to create static visual content at some point. Professional activity was the primary motivator for creating static visual content for both blind (62.8%) and low vision (64.6%) respondents. For example, many respondents shared that they were often required to create static visual content at work and school, as P159 (SL) described: *"The two main reasons for me creating static visual content* *have been for school and work... During my coursework, I was frequently required to create blog posts and Power Point presentations which required me to create and edit static visual content."* Besides pressure in professional settings, family or friends and personal interest were also motivators for creating static visual content (both chosen by around 30% of blind and 40% of low vision respondents). Example scenarios where respondents felt motivated to create static visual content included: *"educating colleagues at work regarding how assistive technologies work"* (P144, SL), *"memorializing an event or day"* (P151, TB), and *"using in my son's school portfolio"* (P151, TB).

Many respondents (32.2% of blind, 19.0% of low vision) explicitly indicated that although they had interest in creating static visual content, they were prevented from doing so because of access barriers. Respondents mentioned two main barriers: (1) inaccessibility of creation tools ($N = 23$)—incompatibility with screen readers, unlabeled elements, difficulty with navigating multi-layer menus, inability to zoom-in, and (2) challenges with visual arrangement and design, including difficulties with evaluating visual appeal ($N = 34$) and details ($N = 6$) as well as understanding visual concepts ($N = 6$), as P102 (LB) shared: *"Because I do not have a good sense of what this content typically looks like and I do not have feedback on whether what I am creating looks good or not"*, which many deemed as *"unnerving and undermines confidence"* (P158, SL).

Respondents who had been able to create static visual content described their usage of both mainstream tools (e.g., presentation slide editors ($N = 43$), camera apps ($N = 16$), image editors ($N = 19$), spreadsheets ($N = 8$)) as well as assistive tools (e.g., screen readers ($N = 24$), screen magnification ($N = 8$), visual interpretation services such as *Aira* ($N = 7$)) in the creation process. Some low vision respondents also reported using their remaining vision to work on visual creative tasks, which was described as *"doable but not ideal"* by one participant (P116, LV), as seeing details and subtle changes can still be challenging. While some respondents mentioned wanting to *"get as much information as possible independently"* (P158, SL), many of them felt that sighted help is necessary ($N = 28$), as P91 explained: *"I hesitate without getting sighted assistance because I cannot guarantee that the text on each slide is not going to be out of alignment and I also need assistance obtaining graphics to make sure the presentations look good"* (P91, TB). Our respondents most often reported creating presentation slides (blind: 38.4%; low vision: 49.5%), digital photos (blind: 24.4%; low vision: 38.0%), promotional materials (blind: 17.4%; low vision: 34.2%), and informational figures (blind: 22.1%; low vision: 31.7%).

3.2.4 Video content: Our BLV respondents were commonly motivated to create videos for sharing with family and friends (blind: 60.5%; low vision: 44.3%): *"[I create] mostly videos of my pets doing something cute that I can either share with family or friends or listen to later"* (P126, TB). At the same time, many of them were also motivated to create videos for personal interest (blind: 51.2%; low vision: 41.8%) and professional purposes (blind: 47.7%; low vision: 34.2%). However, only 51.2% of blind respondents and 54.4% of low vision respondents have created videos before. Their videos were mostly raw recordings (blind: 40.0%; low vision: 29.1%), in the form of vlogs and social media shorts. Some respondents (16.28% of blind, 19.0% of low vision) also streamed online, such as for *"games"* (P43, SL), *"classes"* (P66, LB), *"religious services"* (P18, LB). As with static visual content, respondents also navigated video creation with common assistive technologies—screen readers ($N = 18$), Aira ($N = 2$), and magnifier ($N = 1$)—and sighted help ($N = 14$). For recording, they commonly used smart phones or tablets ($N = 39$), sometimes with help of a tripod ($N = 5$). Some respondents ($N = 19$) further mentioned using a video editor—most commonly Adobe Premiere, iMovie and Final Cut Pro X.

Some respondents also reported experiencing inaccessible processes with video creation (30.2% blind and 19.0% low vision respondents). Many listed camera alignment ($N = 35$) and editing ($N = 37$) as the most inaccessible steps: *"Making the video is fairly easy, but editing the video and adding effects is more difficult"* (P120, LV). The editing process of video shared two similar issues with static visual content creation: (1) inaccessible tools and (2) evaluating visual outcomes: *"all I can do with video editing on my own is crop a video. I'm not able to do any extensive editing such as adjusting colors, brightness, inserting or deleting specific frames within a video and checking for visual errors within the video"* (P59, LB). Additionally, respondents found the video editing tools *"geared towards the sighted and those who are very computer literate"* (P119, LV), and that screen feedback *"interrupts the flow of recorded video"* (P65, TB).

3.2.5 Interactive content: Among all five content types, interactive content received the least creative interest from our respondents. Still, more than half of our respondents felt the need to create such content. Their common motivation was to support professional activities (blind: 45.3%; low vision: 41.7%), while some of them also saw interactive content creation helpful for personal interests (blind: 34.9%; low vision: 27.9%) and connecting with family and friends (blind: 26.7%; low vision: 21.5%). For example, P5 (SL) mentioned creating Wordpress websites for *"university"* as well as *"organizing virtual events"*. However, only a very small portion have had experience with interactive content creation (See Figure 1). 37.2% of blind and 35.4% of low vision respondents found the creation process inaccessible and gave up trying. Again, many creation tools did not meet the basic accessibility standard ($N = 21$), and our respondents commonly faced challenges evaluating visual format ($N = 12$). However, the most prominent challenge we observed was the high bar to acquire relevant skills ($N = 22$), especially because they found *"learning to be highly time consuming, given the visual nature of websites, jargon, and slow web-browsing"* (P41, LB) as well as *"the instructions often written for people who are sighted and include directions such as pointing and clicking or locating something visual on the screen"* (P105, TB).

While we were not able to obtain a comprehensive understanding of respondents' creation experience from the small number who had experience creating interactive content, we briefly report their responses. First, these respondents mostly focused on creating questionnaires (blind: 30.2%; low vision: 21.5%) and web pages built from templates (blind: 21.0%; low vision: 24.1%). Only a very small percentage of them had experience with general programming (blind: 0.3%; low vision: 10.1%), which is more complex to learn and practice. They made use of templates from website building tools (e.g., Wordpress) ($N = 20$), survey creators (e.g., Google Forms) ($N = 23$), and general developer tools (e.g., IDE, command line) ($N = 10$) in their creation process, as well as common accessibility tools—screen readers (N = 19), magnifier (N = 3), Aira and Seeing AI (N = 3).

3.2.6 Text-based Content: The majority of respondents have been creating a wide range of text-based content and regard the process to be relatively accessible. Respondents commonly write letters and emails (blind: 87.2%; low vision: 67.8%), short online posts (blind: 80.2%; low vision: 62.0%), reports and documents (blind: 54.7%; low vision: 35.4%), blog posts (blind: 41.9%; low vision: 27.9%), creative stories (blind: 33.7%; low vision: 31.7%), and poetry and prose (blind: 30.2%; low vision: 27.9%). They felt motivated to create these types of content for personal interest (blind: 82.6%; low vision: 62.0%), relationship with family and friends (blind: 80.2%; low vision: 67.1%) and professional activities (blind: 77.9%; low vision: 67.1%). Many respondents reported use of screen readers (N = 67), screen magnifiers (N = 15), braille technologies (N = 14), dictation software (N = 11) and keyboard commands (N = 7) in creating texts. With these accessibility supports, the majority of them have developed competency, confidence, and familiarity with the creation process: *"The biggest reason it's easy is because I do it so regularly for everything. I have the keyboard shortcut commands in my head, the phone gestures in my head, and I have a lot of support from family friends and co-workers when I get stumped"* (P163, LV).

Still, a number of accessibility issues remain. First, many respondents (N = 33) pointed out challenges with formatting texts: *"Style and alignment are often difficult as well as finding and sizing images to go with the content"* (P181, TB). Many respondents thus utilized sighted help (N = 12) and visual interpretation technologies (e.g., Aira, Seeing AI) (N = 3) to check visual formatting and appeal of their text documents. Six respondents also mentioned that some online text editor fields (e.g., social media, email editors) posed accessibility barriers, while four low vision respondents specifically pointed out issues with color contrast and interface element size.

3.2.7 Audio Content: A lot of respondents enjoyed creating audio content for personal interest (blind: 67.4%; low vision: 53.2%) and sharing with family and friends (blind: 62.8%; low vision: 41.8%)—*"Creating a mixture of songs to present virtual gift to friends"* (P5, SL). Some of our respondents' careers were related to audio creation (e.g., voice acting, sound engineer) and thus were also motivated by professional purposes (blind: 48.8%; low vision: 39.0%). The most commonly created audio content type among our respondents was raw audio recordings (blind: 70.9%; low vision: 55.7%), followed by podcasts (blind: 27.9%; low vision: 15.2%) and digital music compositions (blind: 16.3%; low vision: 12.7%).

Interestingly, while 76.7% of blind respondents had created audio content, only 58.2% of low vision respondents had related experience. More low vision respondents (16.5%) felt access barriers creating audio content compared to their blind counterparts (7.0%). One possible explanation may be related to difference in effort and commitment, as P73 said: *"As a blind person, audio is the best way for me to express myself, so I learned how to use Goldwave and make use of it often"* (P73, SL). Indeed, while eleven blind respondents included descriptions of the effort they took to learn relevant tools and skills as well as how their interest level kept them up, only two low vision respondents shared similar experiences, with additionally nine confessing that audio content creation is not something they have spent time learning.

Overall, both blind and low vision respondents agreed that capturing raw audio is relatively accessible and easy (N = 57). Common assistive technologies (e.g., screen readers (N = 22), screen magnifier (N = 2)) as well as simplistic recording applications (e.g., voice memo) (N = 47) and podcast applications (e.g., Anchor.com) (N = 5) were considered helpful tools. Some (N = 40) respondents also mentioned using more advanced audio editors (most commonly Audacity, Reaper, GoldWave, Garage Band), but they experienced challenges with a range of features of these tools (N = 14), such as *"trimming"* (P28, SL), *"mixing something inspirational or improvised in a timely manner"* (P74, SL), *"precise editing"* (P11, SL). P113 (TB) expressed: *"It is not difficult to create recordings, but I find it very difficult to create high quality recordings."* As with the creative tools for other content, existing audio creation tools also still had basic accessibility issues, such as incompatibility with screen readers and complicated menu layout.

Summary: Our survey results suggest that BLV respondents' creative interests do not vary greatly across the modality of content. However, their creation experience is more limited with static visual, video, and interactive content, due to challenges with evaluating visual component and operating visually oriented interfaces.

4 INTERVIEW STUDY

Given the common interests and access barriers survey respondents reported with visual-heavy creative tasks, we conducted a semi-structured interview to follow up on BLV creators' perspectives on these tasks.

4.1 Methods

4.1.1 Participants. Participants had to be at least 18 years old and identify as blind or having low vision. We sent recruitment emails to the 146 survey respondents who had agreed to be contacted for future studies and invited them to spread the recruitment ad in their networks. In total, we recruited 15 BLV creators. Two of these participants had not completed the survey study, so we asked them to complete a revised version of the survey that included only demographic information (e.g., age, gender, disability status) and experiences with creating the five general types of content. Participants' self-reported age, gender, vision conditions, computer access methods, and experience with creating the five digital content types are shown in Table 1. In summary, participants ranged from 20 to 65 years old ($Median$ = 43, M = 40.33), with seven self-identifying as female, six male, one nonbinary, and one preferring not to answer. Five participants self-reported as totally blind, five with low vision, four with some light perception, and one legally blind. Eight indicated memory of previously seeing things, whereas the rest never had visual memory. Despite these varied visual conditions, all participants reported using a screen reader as the primary method for accessing technology. All participants had experience creating at least two types of content, most commonly text-based (N = 15) and audio (N = 13) content, followed by static visual (N = 10), video (N = 7) and interactive (N = 6) content. Participants were compensated with a $45 Amazon gift card for their time and effort. The recruitment and study procedure were approved by an Institutional Review Board.

PID	Gender	Age	Vision Condition	BLV Onset	Visual Memory?	Computer Access	Digital Content Created
P1	Female	44	Low vision	Birth	Yes	Screen Reader	Text, audio, and video content
P2	Male	44	Total blindness	Birth	Yes	Screen Reader	Text, static visual, and interactive content
P3	Female	20	Some light perception	Birth	No	Screen Reader	Text, audio, and interactive content
P4	Nonbinary	50	Total blindness	Birth	No	Screen Reader	Text, audio, and static visual
P5	Male	25	Low vision	Birth	Yes	Screen Reader	Text, audio, and static visual content
P6	Female	38	Total blindness	Birth	Yes	Screen Reader	Text, audio, and static visual content
P7	Male	60	Legally blind	Birth	Yes	Screen Reader	Text, audio, static visual, and video content
P8	Male	21	Some light perception	Birth	No	Screen Reader	Text and audio content
P9	Female	43	Total blindness	Birth	No	Screen Reader	Text, audio, static visual, video, and interactive content
P10	Prefer not to answer	30	Some light perception	Birth	No	Screen Reader	Text, audio, static visual, video, and interactive content
P11	Female	46	Low vision	Birth	Yes	Screen Reader	Text, video, and interactive content
P12	Male	65	Low vision	Birth	Yes	Screen Reader	Text, audio, static visual, and interactive content
P13	Male	49	Low vision	25	Yes	Screen Reader	Text, audio, static visual, video, and interactive content
P14	Female	28	Some light perception	6 months	No	Screen Reader	Text, audio, and static visual content
P15	Female	60	Total blindness	2	No	Screen Reader	Text and audio conetnt

Table 1: Participants' demographic information and digital creative experience.

4.1.2 Procedure. These semi-structured interviews were designed to take up to 90 minutes and were conducted remotely via video conferencing software. Following the study introduction and verbal consent, participants were asked short questions to confirm their survey responses, including their creation experiences and visual conditions. Then, for each of the five types of digital content the participant had experience in creating, the interviewer guided them to reflect: *"I'd like to know more about your experience with creating [the given type of] content. What content do you usually create? What challenges did you encounter when you were creating (the given type of content), if there are any?"* While participants conveyed their experience with the given type of content, the interviewer probed for perspectives on the visual-heavy aspects of the experience, including (a) evaluating and manipulating content that is visual in nature (e.g., presentation slides, photos, illustrations) or visual components in text-based, interactive or video content, and (b) operating visually oriented creation tools (e.g., audio editors, video editors). Specifically, participants were asked about their experience with these aspects, perceived importance of them under different situations, challenges experienced, corresponding coping strategies, and related future support that they desire.

After discussing the types of content with which the participant had experience, the interviewer briefly inquired about any remaining content types (e.g., *"What stopped you from creating this content?"*). The interviews then concluded with high-level questions around overall creativity needs and how they envision these needs could be better supported.

4.1.3 Analysis. To analyze participants' perspectives toward visual creative tasks and advanced editing tasks, we adopted an exploratory thematic analysis approach (as outlined by Braun and Clark [18]). In the first phase of analysis, the first author, who conducted all interviews, read and re-read the interview transcripts to identify an initial set of codes, with inputs from the rest of the research team. The research team then collaboratively developed an initial codebook to guide the coding activity. The first author individually coded all of the transcripts, with the second author selecting (based on a random number generator) half of the coded transcripts to review. Through multiple iterations, the final codebook focused on participants' attitudes toward visually heavy creative tasks, under-supported creation pursuits, and desired improvements. With inputs from the team, the first author then extracted salient themes from the coded excerpts and organized them into the findings.

4.2 Findings

We detail interview participants' experiences with and attitudes toward visual-heavy aspects of their existing digital creation process, highlighting both technical and societal barriers involved in these tasks that influence participants' creation pursuits and related creativity support tool designs they desire.

4.2.1 Creation Needs Impeded by Visually Heavy Digital Creation Processes. Everyone in our interview study mentioned at least one way that existing visually heavy creation processes and tools under-support their pursuits of personal creative goals. In particular, societal barriers were often brought up as an important issue that contributed to the visual-focused creation process ($N = 14$). These societal barriers primarily manifested in expectations on BLV individuals' relation and interaction with different creative tasks—six participants described feeling that the world they live in is *"sighted"* (P5, P6, P10, P15), *"visual"* (P11) and *"prejudiced"* (P4), and that the expectation to engage in visually heavy creative tasks is inevitable in everyday life. At the same time, participants commonly perceived such visual creation tasks to be deeply inaccessible, with insufficient ($N = 13$) or unhelpful ($N = 10$) feedback for manipulating visual content, limited guidance on visual aesthetic standards ($N = 6$), vision-reliant editing interfaces ($N = 6$) and time consuming work processes ($N = 9$).

Below, we detail how BLV participants perceive and navigate these intertwined barriers of structural inaccessibility and social oppression, focusing on three goals that our participants commonly desired to pursue through digital content creation but felt that existing tools and processes do not support.

Professional Success: First, 13 out of 15 participants felt challenges in achieving desired professional success with existing visual-heavy digital creation processes and expectations. Six participants shared their frustrations and struggles with educational and workplace requirements that focus on visual formatting and presentation. In particular, P3, P8 and P14 experienced difficulties with following academic writing standards (e.g., citation style), while P5 commented on the visual nature of a resume: *"a resume has to look physically balanced, and it's usually one page... it's just one of those cultural things that ends up being a visual thing"* (P5). Meanwhile, P2, P7, and P8 were pressured to create presentation slides and videos; for example, P2 said of his plans to go back to school: *"I'll have to do all sorts of PowerPoint presentations. It sounds like a nightmare"* that he would need to *"power through"* (P2) to pursue his educational goals.

Some participants voiced the hope for more inclusive educational and professional evaluation standards that are less visually focused, as P8 shared: *"I would much rather prefer assignments that focus on screen-reader appealing"* (P8). However, as with P2, the majority of participants (N = 13) felt the need to conform to existing visual-heavy practices to achieve professional goals. For example, P12 felt that the visual appearance of his website is *"where I can project the fact that I am a competent web developer. I know what I'm doing, and you know that my blindness is not gonna keep me from doing this"* (P12). P15 instead focused more on how the visual appearance of work documents influences the success of her organization: *"We really wanted it [the presentation slide deck] to look good... It was professional content that was going to be saved that would be like the base of our organization"*. P7 also felt the need to consider visual design when sharing information broadly: *"producing professional quality documents and presentation slides in order to reach a wider audience reasonably quickly"* (P7). While labor intensive, these participants had developed strategies to non-visually evaluate and manipulate visual content, such as through screen reader functionality (e.g., JAWS' formatting functions, mobile phone camera accessibility features), sighted peers' verbal feedback (N = 14), templates (N = 6), and familiarization with visual standards (N = 7). Some participants expressed confidence to *"do all the formatting independently"* but still feel the need to have *"a final check (from a sighted person) to make sure it looks okay"*(P11). At the same time, some participants chose to avoid visual tasks by engaging in other non-visual compensating strategies, such as using a *"minimal"* (P6, P10) and *"basic"* (P9) styling approach, *"using my memory for bringing up facts or information that I need for presenting something"*(P1).

While participants often struggle to meet visual creation requirements that they do not necessarily want, societal biases can also restrict desired opportunities to pursue creative professions—with some sighted people considering these activities to be too visual for a blind or low vision creator. For example, P10 described: *"When I'm in a job interview, for example, they'd say how are you gonna do this task. Once they realize that I'm blind, there's the perception out there that using the computer is specifically visual...we have to kind of overcome a society in general"* (P10). Similarly, P12, who is a blind software developer, found it difficult to find clients who *"want to commit to working with me as a blind developer"* (P12). Participants hoped for more inclusive expectations from society about BLV creators' interest levels and capabilities: *"Ever since I started college, I said - it has to be visually appealing. It has to be the way instructors require... I always tell my instructors: treat me as you would have treated other students. Don't let me off the hook, unless I say: I need help with this"* (P8).

Self-expression and interest: Turning to a more personal rather than professional context, most participants (11 out of 15) felt that their personal interests and opportunities for self-expression were limited by existing creativity tools and processes. In particular, eight participants wished for more access to creating personal visual expressions, such as artistic photos and videos, personally styled visual formatting, drawing, and video editing. While some with previous sighted experience expressed their natural inclination to care about visual components of their creation—*"my caring comes from the fact that I did have sight, and I appreciate art. I was good at art honestly, and so, knowing that there's an artistic aspect to a photo, it is important to me"* (P6), some of our congenitally blind participants also indicated interest in visual tasks. For example, P4 wanted a way to express her visual imaginations: *"I do have dreams where I have a kind of vision in the dream, and I've never had vision...I've often said that I wish I could have some good artists jacked into my brain so that...he'll jot it down for me"* (P4). However, as presented in the previous section, participants perceive that these creative interests and capabilities were often neglected by society in skillful and visual-heavy content creation: *"I think probably the myth is that blind people don't care how things look, and I think we really do"* (P15). There have been longstanding biases related to what BLV people want to, could, or should create that our participants often experience. Such social bias can diminish BLV people's motivation for creation, exclude them as target users for creative tool development, and limit opportunities for them to learn and get feedback on their creative skills for visual tasks: *"The honest truth is that they (videos and photos) are more visual things, so when companies create editing software and apps, they're not thinking of maybe someone who can't see would actually have a hobby or something to do with this, so they don't make their software or app accessible for someone who does use a screen reader to operate...just because we can't see the product, it doesn't mean we don't want to be participating"* (P2). Some participants eventually developed less interest in certain inaccessible tasks—e.g., *"just don't really have the interest of going into photo editing"* (P5)—and focused on a content format that is more accessible—e.g., live streaming instead of edited videos (N = 4).

Compared to visual expression, participants in general practice audio expression more frequently and with more ease. The majority of our participants (12 out of 15) mentioned accessibility workarounds with audio editing tools—for example, the BLV creator community has continuously been developing plug-ins (e.g., *"Osara"* [P5]) and tutorial resources that our participants commonly use. Still, seven participants voiced the hope for more audio expression possibilities: *"I want to do more sound editing, like adding and mixing sounds for movies...as far as producing, I like to do instrumental pieces, whether it's classical or lofi beats... I would like to write my own songs"*(P14). Participants pointed out three main barriers towards achieve these expressive goals. The first barrier is a lack of audio editing choices and features: *"I just wish there were more and easier choices...A lot of companies like Apple and Google are doing pretty well with their (accessible creative) products, but most of their stuff is concentrating on phones and Ipads...and we really would like some of more professional programs to get accessible [...] even if they're professional, they're kind of outdated"* (P15). Second is a lack of efficient and intuitive non-visual interfaces: *"someone with vision can sit and watch an audio file... we have to sit and re-listen to the audio completion... probably doubling that by the time we'd listen!"*

(P6). Third is the learning curve and exposure—many participants were not aware of existing accessible audio production tools or perceived the tools to require high technical literacy ($N = 12$).

Social participation and responsibility: Last, some participants felt that visually oriented digital content creation practices negatively impacted their opportunities for social participation and their ability to share accessible content with others. In regards to the former, seven participants mentioned concern around social exclusion or embarrassment caused by inappropriate creation of visual content. For example, P9 considered visual formatting important in forming social impressions and was especially concerned about refining it for the first emails she sends to others. Some participants also found that the focus on vision in popular social media introduces barriers to their online participation: *"Honestly even things like filters I don't get. I have Instagram, but I don't get to fully participate as much as I'd like to, because it's not fully accessible"* (P2), echoing past work on BLV social media creators (e.g., [10, 77]). This desire to create visual content in forming bonds with others also came up in caring for sighted family members, such as P9, who shared: *"Because my son is sighted, he has to see it in order to learn this, so I should include things like pictures. Even though they wouldn't matter to me, I see they matter for him"* (P9). Finally, six participants described difficulty with ensuring their own content is fully accessible to other disabled audiences. For example, P11 shared the challenge of inserting audio/video descriptions to make her videos accessible to BLV people: *"With videos, if you're gonna make it accessible, the other challenges you have to figure out are where to insert the audio description"* (P11). As another example, P7 experienced problems configuring the accessibility options when creating a survey.

Summary: Overall, our participants shared a rich set of attitudes and reactions toward the visual focus of digital creation practices, ranging from asking for more alternative non-visual approaches, to accepting existing situations and adjusting to them through accessibility workarounds, to not engaging with inaccessible visual tasks ($N = 10$ for manipulating visual content; $N = 8$ for operating visually oriented editing tools). Still, participants felt their creation needs were often not met and expressed hope for a more inclusive digital creation environment in the future.

4.2.2 Desired Areas of Improvement. In this section, we summarize our participants' perspectives around how their digital content creation experiences could be improved.

Accessibility awareness within digital creation realm: Firstly, participants collectively believed that accessibility awareness is still lacking in today's digital creative industry. They argued for more inclusive expectations from society about BLV creators' interests and capabilities as well as more opportunities for learning and working on different creative tasks, such as training for *"the preparation of visually attractive documents or presentation slides"* (P7) and BLV-inclusive photography workshops (P6). Participants (N=6) also commonly expressed the hope of *"accessibility being actually talked about right in the forefront"* (P6) of all creative tools and these tools be accessible *"out of the box and have accessibility be a key point"* (P6) instead of BLV creators having to retrofit tools with accessibility workarounds, which greatly increases the onboarding curve. When accessibility workarounds are necessary, our participants ($N = 8$) desired more related resources and a *"roadmap"* (P6) for them to navigate these resources, such as *"a stamp on a plugin to say: yes, this works with JAWS"* (P13) and *"a collection of accessible editors that would be easy to find"* (P2). Five participants further shared the desire to have a standardized, universal interface for creating specific types of content across platforms, *"so I wouldn't have to figure out each individual website"* (P1). P7 proposed that the authoring tools should make the created content comply with accessibility guidelines by default, so that *"you'd have to go out of your way to make non-compliant code"* (P7), whereas P12 further argued that the creative tool companies should *"get some of us on their development teams"* (P12).

Visual content evaluation and manipulation support: From the interview, we also learned that visual content evaluation and manipulation are critical to many BLV participants' creation goals. Correspondingly, they proposed a number of ways to improve the accessibility of these tasks. First, the majority of them ($N = 11$) considered improvement on accuracy and usefulness of non-visual feedback for visual components a priority through *"on-demand"* (P13), *"real time"* (P7, P10), and tactile feedback ($N = 4$), echoing findings from past work [37, 43, 81, 96]. Adding to existing guidelines for image descriptions, we learned that besides objective descriptions to visual components (e.g., *"colors"* (N = 8), *"font"* (N = 7), *"alignment"* (N = 9)), a high-level feedback about the overall visual formatting aesthetics and appropriateness could be helpful to BLV creators' evaluation of visual content as well: *"point out whether the formatting had a have a professional appearance, and, of course, whether things were correct in terms of of layout—not having too many spaces between words or any unexpected line breaks between paragraphs"* (P7). Accordingly, seven participants proposed to have a visual layout checker that is *"the conceptually equivalent of a grammar checker"* (P7), potentially through artificial intelligence. Four participants additionally proposed to have tools that automatically make visual adjustments: *"do some of those things automatically...helping with lighting or centering an object"* (P7), potentially based on information the BLV creator provides: *"figure out where each picture would go and then put it in there, so it looks visually appealing"*(P9). However, auto-generation of visual content might not work for everyone. For example, P15 would prefer to *"personalize the video"* herself instead of *"having the computer generate it"* (P15).

Advanced creative features: As presented in the previous sections, many participants ($N = 7$) experienced challenges with and hoped for enhanced accessibility for advanced creative features, especially around audio and video editing control. For example, P2 would like to be able to non-visually configure the *"contrast"*, *"lighting"*, *"blurriness"*, and *"filter"* of videos he creates. P8 and P15 both hoped for more professional audio creation tools to be compatible with screen readers they make use of. Besides wanting simply an accessible version of these features, participants also wanted to improve the operation of these features, such as: *"would be nice if there's a way you could be more precise "* (P12). In turn, participants (7 out of 15) suggested incorporating physical control support, for example, to replace repeated key commands: *"being able to physically manipulate it and go up or down in volume however fast I want to go, it doesn't sound like much, but that would save time"*(P5). Similarly, P2 proposed to use a *"track bar"* (P2) to precisely control and crop video clips: *"...put your finger on the track bar and slide your finger up, and that increases your spot in the video by like a few seconds or minutes... I feel like they should have something on the cropping part where you're able to do that same thing"* (P2).

5 DISCUSSION

Through a mixed-method study that centers BLV creators' lived experiences, we identified factors critical to the fulfillment of our participants' creative pursuits. We noted technical inaccessibility in their experiences with visually heavy creative tasks, which are reinforced by ableist practices and expectations around BLV people's creative capabilities and interests. Although some of these challenges have been surfaced by prior work (e.g., [35, 69, 70, 77, 80, 81]), our study contributes new insights around BLV people's creative pursuits, related social considerations, and perspectives toward future accessibility support, while quantifying existing insights through a large scale survey. Based on these findings, we discuss research and design implications to guide future research that shares the goal to support BLV creators.

5.1 Digital Creative Support Foci for BLV People

One goal of our paper was to inform digital creative accessibility research to better align with the needs of the BLV creator community. While we observed wide creative interests across diverse digital content types, our findings specifically call for accessibility research attention on more *diverse* supports for *visual* content creation—accessible visual content authoring beyond straightforward accessibility fixes and obligatory creation scenarios.

As we learned in the study and as past work pointed out [27, 35, 81], the evaluation of visual content and operation of visually oriented tools are two major barriers faced by BLV creators. With the heavy involvement of these two tasks, visual content, especially static visual and video content, are the most challenging types of digital content to create for BLV creators. Despite these inherent challenges, our study revealed a complex set of motivations from BLV people to engage with these visual creative tasks—a fact that, according to participants, often contradicts sighted people's assumptions. Participants shared how such biases lead to ableist practices and tool design that excluded them from fulfilling their creative pursuits. For example, they often feel pressured to meet professional and educational requirements with visual content creation, while not getting enough accessible directions and resources—a phenomena also noted in prior disability studies and accessibility literature [36, 52, 84]. Comparatively, although text-based and audio content creation are also commonly of interest to our participants, existing tooling for these tasks is largely already accessible, leaving a set of less urgent but still important accessibility issues.

Reflecting on existing accessibility research, visual creative task support for BLV people has recently gained momentum. So far, the visual content that has received the most attention is photography, often in the context of seeking visual interpretation services [2, 27, 31, 37, 89]. Several studies have also explored professional and social visual content creation, mostly around presentation slides [70, 81, 95] and social media videos [38, 77, 83]. While bringing constructive impacts, these studies still focus largely on providing accessibility support with the goal of producing content that meets sighted practices. We argue that accessibility research should consider not only support for the mere completion of these visual creative tasks but also social considerations involved in different creation scenarios. Researchers have to date explored social aspects of accessible creative support in (1) mixed-ability collaboration [20, 21, 44, 54, 70, 74] and (2) social media content creation [10, 38, 82]. Adding to these considerations, our participants shared difficulties around societal bias, visual-focused practices, and impression management. Future work should take into account these social factors to lead the digital creative environment toward a more inclusive and less sighted culture.

Another area that existing accessibility research has paid less attention to is BLV people's creation of visual content for artistic purposes and personal interest. Current visual creative support has an emphasis on scenarios where creation of visual content is a necessity, which has left out BLV people who have recreational interests in visual media authoring. Indeed, many participants shared the feeling of exclusion from more expressive personal visual content creation. Learning from our participants' perspectives, we call for future accessibility research to take these creative interests into account and address BLV creators' varied reasons for engaging in visual content creation.

5.2 Role of Technology Design in Digital Creation Accessibility

In this section, we detail potential technological ideas to achieve the creative support goals introduced in section 5.1.

Support control over visual content: In hope of gaining more control over visual content they author, BLV participants proposed a range of potential tool improvements. Firstly, they desired improvements on **visual content feedback**, aligning with past research effort on image descriptions and multimodal support (e.g., [85, 96]). Despite numerous explorations, there has not yet been a well-established guideline for presenting visual information in a creative context through verbal image descriptions or multimodal presentations. For example, there could be more examinations of non-visual ways to convey common visual digital components (e.g., font, color, filter) to support BLV people's understanding of these components without superposing a high cognitive load. How to design non-visual interaction techniques for intuitive and efficient operation and navigation of editing interfaces is another open design question. Secondly, participants envisioned applying **artificial intelligence** to automate parts of their visual content creation (e.g., automated description of visual formatting information, *"grammar checker"* for visual appeal, automatic visual content adjustments). Echoing past AI-based creative support research (e.g., [6, 13, 28, 51]), we emphasize the importance of user control, especially given that the modality these tools produce in is inherently inaccessible to BLV creators. Designers should consider how to meaningfully convey accuracy of the algorithm and generated visual content to support BLV creators' sense of control [63]. Last, there could be more technology-mediated education opportunities for BLV and sighted people to learn from each others' creative and aesthetic standards and strategies.

Design for specific creation scenarios: BLV people's requirements for creative supports will also likely vary by context. For example, creators would likely desire different feedback when creating for artistic and personal expressions versus educational or professional requirements. In the former case, detailed explanation of aesthetic properties and visual meaning may be useful, though the same information may be deemed irrelevant in the latter case. As another example, participants in our study were particularly concerned about impression management in certain social scenarios, such as when preparing grant application materials and writing emails to someone important for the first time. Consequently, they desired feedback on the visual appearance of their content (e.g., alignment, font, camera angle) that otherwise may not be as important to them. In these scenarios, more detailed non-visual feedback or high-level confirmation related to the appropriateness of visual styling would help participants' management of their content presentation and thus also self-image. Automated adjustments to visual formatting should also consider these social factors, such as by catering the formatting style based on how formal the scenario is. Future research should continue exploring diverse creation scenarios that involve other social and self-expression considerations to support BLV people's personal thriving.

Social change and limitations of technology: Technology alone will not and should not be expected to solve all access issues in the creative process. As mentioned in Section 5.1, social bias is a persistent barrier faced by BLV creators. Deriving new technologies that better help BLV people meet sighted norms without questioning or advocating for more inclusive expectations around creative output could inadvertently reinforce those norms. Given the varied user needs seen in our study, accessibility researchers should not only address straightforward accessibility problems but also how technology can help enact social change. In particular, rather than focusing purely on making visually heavy content creation more accessible, providing easy to use and widespread means for sighted people to learn about and consume non-visual content could help ease a transition to more inclusive content expectations in workplaces and educational settings. For example, if a blind screen reader user creates a document that can be shared in text but is also carefully designed to be consumed through audio, we can ease the process for a sighted person to consume this content through audio without burdening the creator or having to use an expert accessibility tool such as a screen reader.

Lead of BLV creators: Potential technological advancement should center the leadership of BLV creators, as they are the domain experts and the most impacted by these changes. Future research should explore ways to facilitate BLV people's configuration and customization of mainstream creative tools for them to be more accessible. For example, there should be more infrastructure (e.g., customization options, forums) to connect BLV creators' ideas with creative tool developers, without requiring them to go through burdensome accessibility workarounds. We also encourage future studies to adopt community-based participatory research methods in innovating related technologies [32].

5.3 Reflection on Research Process and Limitations

Here, we reflect on a number of limitations of our study approach and execution. First, although we attempted to diversify our recruitment approach, most of our participants were from the NFB mailing list, which is a powerful tool to connect with a large number of BLV people but also poses the risk of biasing toward members' experiences. Most of our participants (85% of survey respondents and all of interview participants) were also screen reader users, and therefore, their experience and perspectives may not fully apply to those who interact with digital creative tasks through remaining vision. In particular, while BLV creators who use other access technologies may share some of the societal and access barriers with our participants, they would likely adopt a different set of strategies in navigating those barriers and may desire different technological support. We recommend future studies to also explore this broader set of experiences and perspectives. Second, given the diversity of creative backgrounds within the BLV community and varied interests from person to person, our study insights cannot cover perspectives from everyone in the BLV community. In particular, due to the exploratory nature of this study, we encouraged BLV people with all different backgrounds to take the survey, which meant that factors such as creation experiences and goals were not controlled and thus not suitable for statistical examination. We encourage future research to continue surveying the needs and perspectives of BLV individuals based on insights from our study, such as more systematically assessing the interaction between background factors and needs for creation support. Third, all researchers on this project are sighted, and due to COVID-19 restrictions at the time the research was conducted, there was a lack of in-field, direct observation of BLV creators' everyday creation experience. We therefore focus our analysis on BLV creators' perspectives and attitudes. Future studies should consider engaging in-person studies with more opportunities for prolonged observations and participant interactions (e.g., course program, workshops) to gain more situated insights. Last, despite various measures taken to improve the validity of the survey responses, the self-reported nature of online surveys could bring inaccuracy, which should be taken into consideration when interpreting findings from our paper.

6 CONCLUSION

We conducted a mixed-method study to understand BLV people's content creation needs and perspectives on how the digital creative process would benefit from accessibility research. Our findings highlight the importance of research and design efforts to support more diverse creative tasks, including the evaluation and manipulation of different visual content and the operation of complex tools. More importantly, there is societal bias experienced by participants that reinforced ableist creative practices and the lack of accessibility in creative tools. Based on ideas proposed by participants and prior accessibility research, we recommend the field to consider technological design opportunities to support BLV creators' self-expression, impression management and creation identity, as well as social inclusiveness of the broad digital creative environment.

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