Opportunities to Support Communal Experiences of Deaf and Hard-of-Hearing People in Live Popular Music Concerts

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Deaf and hard-of-hearing (D/HH) people attend live popular music concerts. While communal experiences such as group fan-chanting and dancing are often the major reason for going to concerts, no existing tools have been designed to support such experiences of D/HH people in live popular music concerts. We interviewed five D/HH people to understand current challenges and technological demands for better communal experiences in live popular music concerts. All participants expressed eagerness to participate in communal activities during live popular music concerts. However, they mentioned that they had experienced difficulties joining sound-based communal activities such as group singing and fan chanting due to a lack of other sensory guides, while they can follow behavioral group activities that are visually recognizable such as audience movements (*e.g.,* audience waves). In order to tackle these challenges, our participants suggested utilizing visual stimuli such as AR glasses to provide some contextual information that enables D/HH people to understand and pinpoint the right moment to engage in communal experiences.

CCS Concepts: • **Human-centered computing → Empirical studies in collaborative and social computing**; *Empirical studies in accessibility*.

1 INTRODUCTION

Despite the disabilities of hearing sounds, deaf or hard-of-hearing (D/HH) people attend live popular music concerts [8]. They enjoy concerts through multi-sensory stimuli other than sounds such as the vibration of musical sounds or visual artifacts. For example, people use a wearable device that emanates sounds in the form of vibrations such as SubPac [1] and Sencity [2]. Such technological support enables D/HH audiences to perceive and feel musical experiences during live popular music concerts. However, enjoying musical experiences is not the major motivation for attending live popular music concerts. Social and communal experiences (*a.k.a.* group activities with other individuals such as dancing and singing together [7]) are often one of the primary motivations for audiences to attend live popular music concerts [6, 10]. On the other hand, to the best of our knowledge, little work has investigated how to support the communal experiences of D/HH people in live concerts. To fill this gap, in this paper, we explored the following research questions:

- **RQ1**: How are the current communal practices and the challenges for D/HH people during live music concerts?
- **RQ2**: What types of interventions or modality would be desirable/effective to improve the communal experiences for D/HH people in live concerts?

We conducted a semi-structured interview study with five D/HH people to understand their current practices and challenges of communal experiences in live popular music concerts. All participants are highly interested in joining various group activities during live popular music concerts. However, their communal activities tend to be limited

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Table 1. Background of interviewees who are concert goers and D/HH. They all have participated in fandom community activities during the past 12 months. *H.L. in the *Degree of H.L.* column denotes Hearing Loss. The degree of hearing loss was referred to the CDC description [3] (*c.f.,* mild < moderate < severe < profound). **ASL, ISL, and KSL stand for; American Sign Language, International Sign Language, and Korean Sign Language, respectively.

#	*Age*	*Nationality*	*Gender*	*Occupation*	*Degree of H.L.**	*Frequency of attending concerts*	*Type of Sign Language***
1	38	U.S.A.	Female	Not working	Mild	once a year	ASL
2	32	Korea	Female	Part-time	Moderate	4+ times a year	KSL, ISL
3	46	Korea	Female	Full-time	Profound	2+ times a year	ASL, ISL, KSL
4	34	Korea	Female	Full-time	Profound	2+ times a year	KSL
5	33	Korea	Female	Full-time	Severe	4+ times a year	KSL, ASL

to visually recognizable ones such as audience waves or group dancing. To enhance the communal experiences of D/HH people during live popular music concerts, participants suggested that technology could play a vital role in transforming auditory information such as artists' talks and group singing moments into multi-sensory stimuli.

2 METHODOLOGY

The main goal was to understand the challenges in social and communal experiences that D/HH people face in live music concerts and to consider technological solutions to support them. We recruited total of five D/HH people from social media and online communities through flyers and word-of-mouth. All participants are i) adults (18 or above), ii) deaf or hard-of-hearing, and iii) have been to live concerts during the last 12 months. We tabulated details of our participants in Table 1.

We conducted semi-structured interviews through Zoom with our interviewees. The communication was either done via typing in the Zoom chat or speech in sign language if the interviewee has requested a sign language interpreter in advance. We explained the purpose of our online interview study is to understand the challenges and technological needs to support the communal experiences of D/HH people in live popular music concerts. Each interview took about an hour (64.10 minutes, 5.97 minutes). After interviews, we first masked all confidential data within interview scripts. Then we conducted thematic analysis [5] to analyze data in accordance with research questions.

3 RESULTS AND DISCUSSION

We confirmed that all participants want to actively engage in many communal activities such as group singing/dancing and fan-chanting. They first introduced current practices and challenges (RQ1), then suggested several ideas that could improve their communal experiences during live popular music concerts (RQ2).

3.1 Current Practices: Enjoying Visually Recognizable Communal Activities (RQ1)

Our participants reported that they often enjoy non-auditory group activities during concerts. For example, they join group dancing and waving because such activities can be visually recognizable to them.

> P2: "When people shake their light sticks or do an audience wave, I can visually tell what's going on. Then I join the movements. The bond – 'I am a part of this fandom' – is a great communal experience."

Although all participants are willing to experience diverse communal experiences, they can only join a few non-auditory communal activities.

3.2 Challenges: Following Auditory Contexts during Concerts (RQ1)

We found D/HH people commonly have troubles in i) understanding artists' auditory performances/speeches, and ii) recognizing audiences' auditory activities during live popular music concerts.

3.2.1 Understanding Artists' Speeches. All participants mentioned the challenges of understanding artists' speeches between performances. For example,

> P2: "[when artists begin talking] people seemed having fun, but I couldn't understand the talk by myself, so I haven't been [to concerts] for a long time."

Artists set aside time in the middle of their concerts to interact with audience. In particular, they do not just sing, they chat about their everyday episodes or talk to the audience. This allows another great communal experience for audiences during live popular music concerts. In this regard, live events are the culmination of active interactions between performers, audience members, and the environment [9]. However, since this kind of conversation takes place through hearing, it is often very challenging for D/HH people to understand and experience it.

3.2.2 Recognizing Auditory Group Activities. Participants reported that they find it frustrating when they cannot join any auditory group activities during live popular music concerts. For example, audiences often sing some parts of songs or do fan chants together, when D/HH individuals have no idea on when to start.

> P1: "Apparently, a particular fan chant begins among audiences when a certain song begins by artists. However, it's quite frustrating that I cannot take part in those communal experiences since I cannot pick up such auditory context."

Due to lack of support for their auditory disabilities, they have a lot of troubles in getting along with the crowds especially auditory group activities.

3.3 Technological Support: Providing Contextual Information (RQ2)

Some participants maintained that technology should capture and provide contextual information about concerts to improve their communal experiences in live popular music concerts. For example, real-time translation of the performance content such as lyrics and speech of artists (Section 3.2.1) could enable D/HH audiences to pick up situational contexts. Also, it could let them know which part of fan-chanting or song they can join together.

> P2: "Since I had no idea which part of songs that audiences were singing together, I had no choice but to be waving my light stick."

For example, AR glasses (*e.g.,* Microsoft's Holo Lens 2) providing real-time subtitles or sign-language translations of music or artists' speeches could enable D/HH audiences to understand auditory communal contexts better. Also, providing contextual information of auditory group activities such as fan-chanting could be made by visually presenting i) if group singing is going on, or ii) which part of fan-chanting is going on at the moment on such AR devices.

3.4 Technological Support: Enabling them to Perceive Artists' Emotions in Music (RQ2)

One of our participants (P4) complained about the lack of tools or channels that enable her to feel artists' emotions during live popular music concerts. She acknowledged that there are devices and tools designed to support D/HH audiences in perceiving music through different modalities such as vibrations. Further, she revealed D/HH people's need for technology to make it possible to feel emotions in music.

> P4: "I once tried on a vibrating vest. It felt great to feel the rhythm. However, I wish it could convey artists' emotions infused within songs"

This response resonates with a prior study [11], which investigated that vibrotactile feedback (*e.g.*, vibrating vest) could not make D/HH individuals tell the difference of diverse musical emotions. Therefore, future research should investigate how to design technology as an effective vehicle for conveying emotions contained in songs in order to enable D/HH audiences to distinguish them.

4 LIMITATION AND FUTURE RESEARCH

Our study has some limitations. First, we mainly recruited Korean participants except P1. Accessibility support and communal experiences within live popular music concerts may differ by countries (P3). As different support may cause or resolve some problems, therefore, our findings may not be universally applicable in other countries. Future research should include participants from various countries to identify more generic challenges and design spaces. Secondly, our interviewees are limited to those in their 30-40s. The common experience and expectation may differ depending on the age group [4]. Thus, future study needs to conduct more inclusive research, including those in their 10-20s.

5 CONCLUSION

We interviewed five D/HH people who are concert goers to investigate their current practices, challenges, and technological needs for improving communal experiences at live pop music concerts. We found that activities of our participants tend to be limited to visually recognizable ones because there is a lack of technological support for auditory experiences such as fan chanting. To enhance their communal experiences during live popular music concerts, participants suggested technology should transform auditory contextual information such as artists' talks and group singing moments into multi-sensory stimuli.

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