Audionce: A Multimodal Music Making Environment for Deaf and Hearing People

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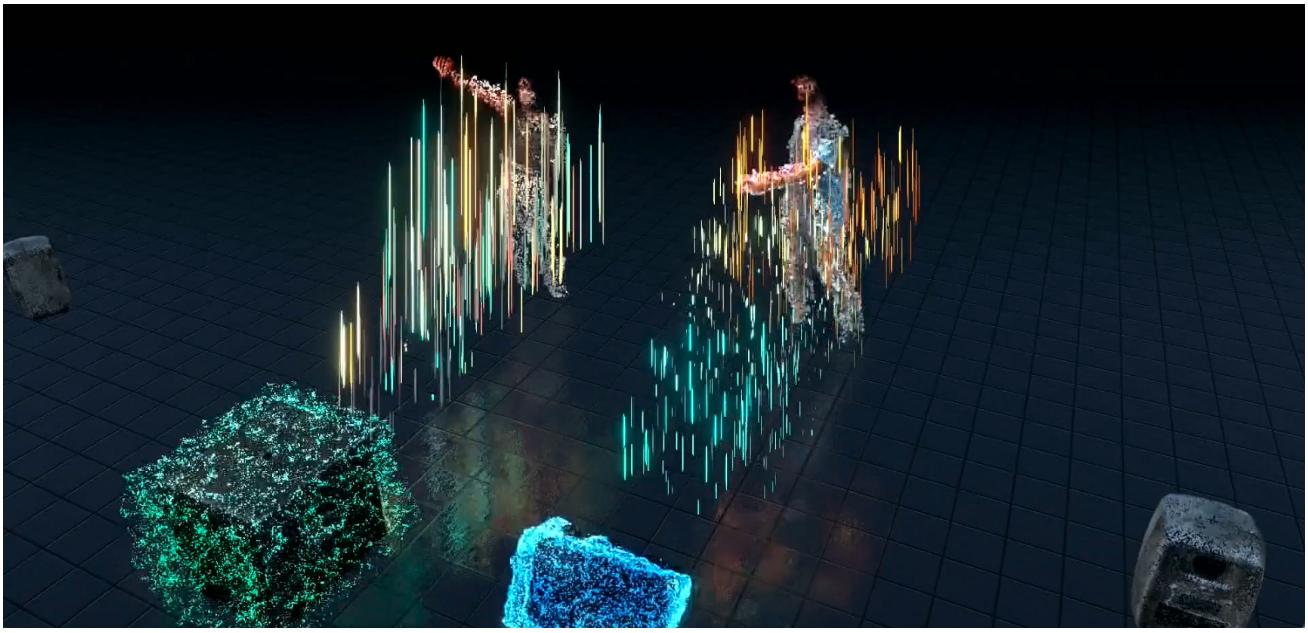

Figure 1: Screenshot from *Audionce*.

Abstract

Audionce is an audiovisual installation designed to support Deaf and hearing musicians and non-musicians to experience collaborative musical improvisation through multimodal interaction. The installation challenges the assumption that improvisation is primarily an auditory practice by reframing musical agency through gesture, vibration, touch, and visual feedback. The system combines a physical array of loudspeakers and a subwoofer with a virtual 'mirror' environment constructed from point-cloud scans of the same speakers. Using depth-camera tracking, animated lines connect participants to the speakers as their presence creates audiovisual content. As participants move through the space, additional audiovisual layers emerge, including drones, spatially responsive ostinati, and tactile kick-drum manipulation activated through direct contact with speaker surfaces. This paper presents the design motivations, system architecture, interaction mappings, artistic reflections. *Audionce* proposes a model for inclusive musical interaction that treats improvisation as a shared, embodied, and multi-sensory experience rather than one constrained by hearing ability.

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Keywords

Accessible musical interfaces, audiovisual installation, Deaf, multisensory interaction, improvisation, gesture-based music

1 Introduction

Musical improvisation is predominantly framed as an auditory-motor practice, in which listening and auditory-motor feedback form the main mode of interaction and collaboration [28]. Improvisation extends beyond purely auditory practice through embodied interaction involving gesture, timing, physical co-presence, and social responsiveness [15, 22]. In addition, improvisation can increase self-confidence, improve social cohesion, and help us better understand how different people experience the world [3, 15]. However, traditional musical improvisation centres hearing people and can exclude Deaf and Hard of Hearing people from many forms of musical improvisation. Improvisation should be accessible to everyone and *aural diversity* — the acknowledgement that people engage with sound and music through multiple perceptual pathways and that these differences constitute a valuable diversity of musical experience rather than a deviation from a normative mode of hearing [10] — should be celebrated in building cultural diversity through music making [29].

This paper introduces *Audionce*, an audiovisual installation designed to support shared improvisational experiences among Deaf and hearing participants, including both musicians and non-musicians. Rather than treating accessibility as a supplementary concern, *Audionce* foregrounds multisensory engagement as the core musical material.

The work builds on the authors' prior audiovisual performance practice using IMU (Inertia Measurement Units) sensor-based instruments and depth-camera systems [17–20], extending performer-centric gestural interaction into participatory installation contexts.

Central to the most recent development of *Audionce* is the collaboration with a Deaf researcher and co-author, Yuka Maruyama, whose lived experience, and particularly her tactile relationship to music, significantly influenced the system design. She identifies as Deaf and cannot perceive music through her ears. Accordingly, this paper focuses on Deaf individuals who have profound hearing loss, rather than Hard of Hearing individuals who have partial hearing [47] or Deaf individuals who do not sign [34]. Maruyama's observations that hearing people rarely touch speakers, despite their capacity to transmit musical vibration, prompted a rethinking of speaker interaction as an expressive musical act which completely shifted the compositional and conceptual framework for *Audionce*. Working closely with Maruyama, a self-identified 'non-musician,' from early in the design process shaped our design and interaction approach. This differentiates the work from NIME projects developed primarily with and for d/Deaf and Hard of Hearing musicians [5], aligning it more closely with projects focused on music-making experiences for non-musicians [31]. *Audionce* reframes musical improvisation as an experience shaped equally by vision, vibration, touch, and movement. This paper details the design process, interaction architecture and artistic reflections, contributing to research in accessible audiovisual musical interfaces and multisensory improvisation.

The contributions of this paper are:

- a multisensory improvisation model for Deaf and hearing co-play that treats vibration, touch, and vision as musical materials;
- an installation design pattern combining physical speakers with a point-cloud 'virtual mirror' to support shared embodied interaction; and
- reflections from Deaf-led co-design.

2 Background and Related Work

2.1 Musical Experience for Deaf Individuals

Deaf individuals engage with music through multisensory experiences, such as vibration, spatial perception, visual rhythm, and embodied experience [7, 8, 16].

Vibration particularly plays a vital role [45], supporting the perception of music as a "full-body experience" that extends beyond the ear [49]. Low-frequency sound and shared bodily experience play significant roles in Deaf musical practices [6, 33]. Research further suggests that vibrotactile feedback technologies can facilitate emotional engagement, enabling Deaf individuals to perceive and differentiate emotions, such as anger or happiness, through variations in beat, rhythm and tempo [38]. These insights informed the prioritisation of vibrotactile and visual modalities in *Audionce*.

However, one challenge for many Deaf individuals is understanding melodic and pitch differences included in the audio differences of musical instruments [50]. Fletcher [11] stated that raw vibration is insufficient for melody perception because the tactile system has poor frequency resolution compared to hearing. Hence, Søderberg et al. [40] found that collaborative music-making between Deaf and hearing participants is possible through non-dialogic cues such as gesture, timing, and line of sight. However, this environment often led hearing participants to assume leadership roles, as many Deaf participants struggled with identifying melodic differences; one of the challenges for Deaf individuals.

In less prescriptive forms of music making such as free improvisation, less emphasis is placed on playing particular melodies or rhythms, and more value is placed on communicating and interacting with other musicians through feel and energy. Lewis [27] frames free improvisation as a social system rather than a style; a "real-time negotiation of difference" rather than mastery. Through this improvisatory lens, music making between Deaf and hearing musicians and non-musicians can focus more on situated, embodied, and responsive interaction, rather than fixed pitch systems, notated score hierarchies, and auditory 'correctness.' Improvisation scholars such as Oliveros [37] explicitly reject 'listening = hearing,' stating that bodily sensation, vision, memory and attention make up the listening experience as perceived by the whole body.

Furthermore, combining this improvisatory approach with body-motion sensors in an audiovisual tactile environment allows designers some control over the aesthetic of the music and graphics themselves, doing some of the heavy lifting in terms of the 'quality' of the audiovisual output. For example, common scales can be chosen and synchronised rhythms and visual pulses can allow participants to focus more on interacting with others instead of finding the 'correctly' pitched notes or moving perfectly in time.

2.2 Accessible Musical Interfaces for Deaf Individuals

Research into Accessible Digital Musical Instruments (ADMIs) has expanded the possibilities for inclusive music-making through adaptive sensors, gestural control, and alternative mappings [12].

Facilitating collaboration between Deaf and hearing artists requires approaches that extend beyond audition to embrace multisensory engagement [43]. Research shows that profoundly Deaf performers spend more time watching and interacting with their co-performers, using deeper and more collaborative communication to coordinate timing and interpretation [13]. While this strengthens the connection between performers, it can also cause challenges, such as timing issues when visual contact is lost, or power imbalances where hearing musicians dominate decisions due to traditional musical knowledge.

To address these challenges, recent technologies use haptic and multimodal feedback to support embodied listening, feeling music through the body instead of just hearing it. For example, systems like the *Emoti-Chair* [4, 23] convert sound into vibrations across different parts of the body, allowing users to physically experience different frequencies.

New wearable and gesture-based systems further expand this idea. Cavdir et al. [6] developed tools such as Felt Sound and Bodyharp, which connect the performer's body directly to the instrument. These systems let users feel sound through their skin while expressing music through movement, making performance both physical and visual. Similarly, Lee et al. [25] showed that combining web platforms with tactile devices can help Deaf non-musicians understand musical concepts like tempo through experience rather than theory. These approaches can also shift roles in mixed-hearing groups, allowing Deaf participants to move from passive roles (e.g., writing lyrics) to more active roles like creating and shaping music.

Cavdir et al. [5] introduced three technologies to support sonic agency, enabling DHH musicians to control and engage with music without relying on hearing. Their work involved collaboration between Deaf and hearing musicians. The technologies included LED-based visualisation systems, wearable audio-reactive masks that provide haptic feedback, and gesture-based interfaces for controlling sound parameters. Wu and Jain [46] developed *SoundNarratives*, a real-time AI system that helps DHH individuals understand environmental sounds. The study found that participants preferred this system, especially when it was used together with visual information.

While these innovations support individual agency and specific collaborative settings, they often depend on personal wearable devices, and many installations are not designed for Deaf non-musicians engaging in real-time music-making. As a result, there is still a need for shared environments that enable embodied listening [1] without requiring complex individual hardware setups. Furthermore, relatively few systems support collective improvisation in installation-based contexts or explicitly integrate Deaf perspectives into the creative process.

Figure 2: Walsh Performs *Blue Space* on Oboe and Bluff's audiovisual interactive system.

2.3 Audiovisual and Gesture-Based Installations

Audionce draws from a lineage of audiovisual installations that use motion tracking and gesture to generate or manipulate sound and graphics simultaneously. Here, our focus will be on point-cloud technologies, audiovisual gestural works and multisensory experiences that foreground vibration and visual response.

Point clouds can be used as an aesthetic and interactive visual medium — for instance, Datum Explorer [42] transformed LiDAR scans of a woodland into an immersive projected landscape where raw point data became part of the viewer's experience. Recent interactive installations by Steve Zafeiriou [48] generate real-time point-cloud visuals from participant motion and imaging, foregrounding embodied presence in 3D data modes. Such works signal an emergent point-cloud aesthetic in media art, where spatial data itself becomes part of an installation's sensory language.

The merging of 2D and 3D spatial data with sound has also been explored by several artists. Classic interactive works such as Golan Levin's *Messa di Voce* (2003) [26] show the expressive potential of synchronised motion, visuals, and sound — offering a lineage for installations that grow out of performer interaction. Works such as Walsh et al.'s *Blue Space* (2017) [44] (see Figure 2) integrate motion capture and gestural visualisation with sound synthesis to create immersive performer-driven audiovisual environments. Computational research such as Points2Sound [14] shows how 3D point-cloud data can act as a generative basis for binaural audio synthesis, revealing a technical foundation for audiovisual coherence in volumetric spaces. Aniyath et al. [2]'s research integrates visual (point cloud), haptic (touch), and sound rendering of 3D scanned cultural heritage objects, illustrating how spatial point-cloud data can unify visual, tactile, and auditory modalities outside in other fields of research.

However, to the authors' knowledge, no artists or researchers utilise this technology to provide an inclusive multisensory environment for collaborative play between Deaf and hearing people. Several multisensory works do prioritise accessibility for DHH people, but utilise other technologies. For example, I N F R A [32] translate acoustic/interactive data into multisensory experiences for DHH people, mostly through engaging with speakers and physical objects. More 'lo-fi' approaches to connecting Deaf and hearing communities include Dialogue in Silence [9]. They use non-verbal communication, allowing participants to discover a repertoire of expression possibilities with the help of DHH guides and trainers. AstroDance [35] incorporates multiple means of representation of scientific concepts for DHH students and provides evidence that multisensory representations support comparable engagement for Deaf and hearing participants.

Interactive work by contemporary Deaf artists points to broader shifts where access is not an add-on but embedded in the medium itself. One example being Deaf artist Anastasia Seufert's virtual reality piece which investigates the connection between sound and silence [39].

Figure 3: Original *Audionce* Installation 2025

2.4 Previous Work by the Authors

Two of the authors in this paper, who both identify as hearing artists (one a composer/percussionist - Alon Ilsar; the other a multimedia artist/designer - Matt Hughes), have collaborated on several works that led to the creation of *Audionce.* After working on several live shows performed by Ilsar that combined hand-held gestural technology and motion capture cameras with real-time audiovisual percussion performances, the pair have more recently turned to creating self-contained audiovisual installations for musicians and non-musicians where both audio and visual elements are controlled by the participants being tracked by infrared cameras. This shift has been driven by the desire to share the experience of music making with people who may have limited opportunities to develop such connections due to physical, social, or socioeconomic constraints.

The first work-in-progress version of *Audionce* was presented in mid-2025, with a focus on accessibility for participants with physical disability (see Figure 3). A carpet and four percussion instruments were set up in a room with a large 'virtual mirror' screen. Participants could approach these instruments to 'mix' in and manipulate the associated percussion parts, or move on the 'magic carpet' to activate and manipulate bass lines and melodies. Through the success of this system, we engaged Deaf researcher, Yuka Maruyama, to help redesign *Audionce* in ways that better supported Deaf participants in the installation.

We had two opportunities to mount *Audionce* for public interaction, both of which we viewed as work-in-progress showings or proofs of concept. We have avoided in this paper any detailed discussion of the interaction by participants from these public outcomes. We did not run formal interviews or surveys. Only limited observations by the authors are reflected in the discussion sections that follow.

Figure 4: Participants Enter *Audionce* Installation.

3 Design Motivation and Process

The guiding question for this new version of *Audionce* was: how can an improvisatory musical environment be designed such that hearing is not a prerequisite for meaningful participation?

The process began by showcasing the system to Maruyama, a self-identified 'non-musician,' so she could gather an understanding of the possible ways to connect movement, sound and visuals. Three prototype visual-only instruments were created for her to explore. Of interest at this stage of the process was what style of movement these instruments inspired and whether any 'imagined' sound was stimulated in the 'mind's ear.' Taking a step back from the system, we then regularly met to discuss our differing and shared experiences of sound and music, to share stories about sound and play, and to watch animated music videos that we felt conveyed similar emotions through the sound and vision.

Utilising MIDI controllers and wearable gestural technologies, Maruyama shaped the manipulation of the musical elements of pitch, dynamics and rhythm through a subwoofer, to explore the tactile differences that may be felt by changing these elements. This led us to trial different speakers, with design decisions emerging through Maruyama's reflections on which forms of manipulation felt most rewarding.

A significant creative breakthrough occurred when we realised that the speakers themselves should be the instruments in this new version of *Audionce*, replacing the percussion instruments in the original version. With Maruyama's experience of music being so intertwined with touching speakers, we wanted to invite hearing participants to also engage with the speakers physically; to share in this experience which is so common in the Deaf community, yet so rarely experienced outside of it. 'Runways' towards each speaker would visualise and sonify the participants' journey towards the speaker, with audiovisual elements connecting their bodies to the speakers through synchronised animations of body and speaker.

In summary, the following principles emerged:

- Multisensory interaction as the primary musical medium.
- Immediate and transparent causality between movement and response, and between sound and visuals.
- Encouragement of speaker touch and attention to vibration when approaching the speaker.
- Layered interaction that rewards exploration.
- Support for both individual and social improvisation.

These principles informed the spatial layout, interaction mappings, and aesthetic choices throughout the installation.

4 Interaction Design and System Overview

Audionce is structured around a series of interaction behaviours that emerge as participants move towards one of two main speakers; a subwoofer on the left, and large monitor on the right, as shown in Figure 1.

To the left and right of these main speakers stand two small speakers, forming a line of four speakers. The smaller speakers were non-interactive partly due to the width of the room, but also to more properly evaluate the interaction of just one or two participants. These smaller speakers did emit quiet sounds, and contributed to 'the call' in the installation's static state.

For a screen capture video detailing interactions of the installation, visit https://youtu.be/D6dg5HmssaY

4.1 Static State

As participants enter the room they are met with this line of four speakers facing them from left to right, and a 'virtual mirror' in the middle behind the speakers, as shown in Figure 4. The virtual mirror shows the four speakers in point-cloud form, alluding to the real speakers, though these are actually pre-rendered images of the speakers, allowing them to be manipulated in countless ways. The four speakers play a five-note 'call' - different inversions of a Cm7 chord played at different rhythms picked out from a main 12/8 rhythm inspired by Steve Reich's *Clapping Music*, as seen in the video. The call ranges across four octaves, with the size of the speaker determining the pitch; the subwoofer being the biggest/lowest.

4.2 Harp Line Interaction

As participants approach a speaker, they begin to see themselves in the mirror, and animated lines appear between their virtual body and the virtual speaker, as seen in Figure 1. Passing a hand or limb through these lines triggers harp-like tones. Five pitches are mapped across the speaker array, forming the same Cm7 chord the speakers have been 'calling,' with octave displacement controlled by vertical movement. Participants are encouraged to respond to the speaker's call.

4.3 Drone Interaction

When participants move through and dissolve the harp lines, a sustained drone emerges. Lateral movement alters harmonic content, vertical movement affects timbre, and depth controls density and filtering, each linked to a visual equivalent manipulating the virtual body seen on the screen. A whole step forward and the piece moves to a new Dm7 chord. The tempo also nudges forward as participants moves towards the speaker. If both participants move towards each other, they pulse at the same rate. This interaction encourages slow, exploratory motion.

4.4 Ostinato Interaction

Closer proximity to the speakers reveals a rhythmic ostinato based on Reich's Clapping Music (see Figure 5). The participants' virtual body pulses in time. Stepping forward pushes the tempo and the harmony to the next chord (Gdim7). The timbre and pitch of the notes can be played by moving up/down and left/right, and again, the graphics also morph with these elements, changing texture and noise. The drone fades out as the ostinato becomes dominant, preventing sensory overload.

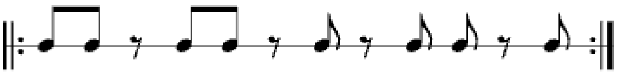

Figure 5: First inversion of rhythm from Steve Reich's Clapping Music.

4.5 Speaker Touch Interaction

Direct contact with a speaker surface enables tactile manipulation of a kick drum pattern, and a large explosion of particles from the participant's virtual body, as seen in Figure 6. Participants are invited to bend down to touch the speaker, and as they do, a kick is overlaid. The piece moves to its final chord and fastest tempo, with the rhythm getting more dense by moving up the speaker, and the decay of the kick lengthening to the right. The participant can then either go back through the runway to continue interacting, jump over to the other runway to interact with another speaker, or move out all together to complete the interaction.

4.6 Technical Implementation

Multiple *Orbbec Femto Mega* depth cameras[1] mounted high up on three sides of the room are used to create a real-time 3D representation of the installation space as a point cloud. This is accomplished using *Pointcaster*,[2] a custom engine developed by one of the authors. After ingesting camera data and reconstructing the 3D space, the resulting point cloud is analysed to determine the pose and position of multiple users. This data is then published over Open Sound Control (OSC) to the *Unity* game engine[3] and *Ableton Live*[4] Digital Audio Workstation — utilising various *Max For Live*[5] plugins for translating and mapping the data within *Ableton Live*. *Unity* then handles visual rendering and *Ableton Live* handles sound synthesis. User location and pose is mapped to musical variables using a layered state system that enables smooth transitions between interaction modes. The OSC data includes their minimum and maximum positions across all three axes with, for example, maximum Y (ie height) mapped to pitch, inviting participants to duck and weave and raise their hands, and minimum and maximum X (ie width) mapped to a notch filter to invite big stretches and reaches. Resulting audio is analysed inside *Ableton Live*, with real-time amplitude of individual instrument tracks sent into *Unity* to further integrate sound and visuals.

The visualisation is projected onto a screen in front of the play area, forming a digital mirror that reflects both active participants and the speaker array within the same point-cloud space. The point cloud representation preserves the geometry and scale of the interaction space while permitting expressive deformation and layering. Because participants are visualised inside a reconstruction of the physical play area, they can coordinate interaction through movement rather than relying on auditory feedback alone.

In contrast to the authors' earlier work utilising handheld gestural instruments, the point cloud–based system shifts interaction from personal devices to a shared spatial field, enabling more inclusive and collective improvisation.

5 Designers' Reflections

5.1 Deaf Designer's Reflections

As a Deaf designer (we move to the first person voice here of the third author), I experienced musical improvisation through visual and tangible modalities rather than audio. While I have prior experience perceiving music via visual and tangible modalities, I have also grown up with the understanding of music from conventional dictionary definitions - music is fundamentally an auditory phenomenon [36]. As a result, this improvisational experience felt new to me. I experienced it as the creation of visual and vibrational inputs by interaction with visualisations, tactile feedback, and vibrations, rather than perceiving the activity as 'music making.' Furthermore, my lack of an auditory baseline for music led me to question whether I was engaging in music making 'correctly,' despite the other authors emphasising that there is no single correct way to create music. Holmes [16] also identified treating audio as the default baseline in musical contexts as a key challenge. However, I came to recognise that I was producing what was perceived as 'conventional' music when

[1] https://www.orbbec.com/products/tof-camera/femto-mega/
[2] https://git.matth.cc/pointcaster
[3] https://unity.com/
[4] https://www.ableton.com/en/
[5] https://www.ableton.com/en/live/max-for-live/

observers noted that both the hearing artists and I were able to improvise effectively together. Some observers did not realise that I was Deaf, as this was not disclosed during the showcase. This was interpreted as a positive outcome, as it suggested that the collaborative music making did not appear unusual or disrupted. At the same time, this experience revealed an underlying reliance on validation from hearing participants to confirm the musical legitimacy of the outcome. This reliance points to a form of dependence in which hearing participants may naturally assume a leading role in the music-making process, aligning with the concerns identified by Søderberg et al. [40]. This experience highlighted how individuals' implicit definitions of 'music' can significantly shape participation, perception, and inclusion. In particular, when music is primarily framed through an auditory lens, non-auditory musical experiences may be perceived as peripheral rather than central, even within inclusive design contexts. Hence, this raises a critical question beyond accessibility alone: what constitutes musical 'worthiness,' and who has the authority to define it? Addressing this question requires looking beyond accessibility in interaction design and considering the power relationships and assumptions about what counts as music within collaborative music making.

In addition, I became aware of a gap between the system's internal complexity and the perceived richness of the experience. For example, while differences between high and low pitch were relatively easy to identify, distinguishing between pitch and volume proved challenging without prior training before the musical improvisation with hearing authors. As a result, although the system enabled successful collaborative music making, it was difficult to regard the experience as musical improvisation in the conventional sense. This aligns with the findings of Merchel and Altinsoy [30], which demonstrate that haptic feedback has limited capacity to convey fine-grained musical differences.

Moreover, relying solely on vibration introduced limitations in perceiving nuanced differences in audio. In this context, visualisation played a critical role in compensating for these perceptual constraints. Over time, visual cues supported a deeper understanding of the system's structure and interactions, suggesting that sustained engagement and learning are necessary for richer, more interpretable multimodal musical experiences. This aligns with the prior study [40], that noted that effective collaboration between Deaf and hearing participants requires more advanced visual and haptic feedback to convey melodic elements.

From another perspective, vibration is a central element through which many Deaf individuals experience and enjoy music. This project foregrounded tactile and vibrational interaction through the use of speakers and subwoofers, which constituted a key feature of *Audionce*. Many observers expressed strong interest in this interaction, noting that they had not previously considered vibration as a meaningful musical modality. This response indicates that the project functioned not only as a music-making system but also as a site of cultural exchange, as discussed by Mas and Gómez [29]. By making Deaf musical practices and values visible and tangible, the collaborative improvisation created opportunities for hearing participants to engage with Deaf musical culture. Such cultural interaction represents a significant benefit of collaborative music making, extending its value beyond accessibility toward mutual understanding and shared creative practice.

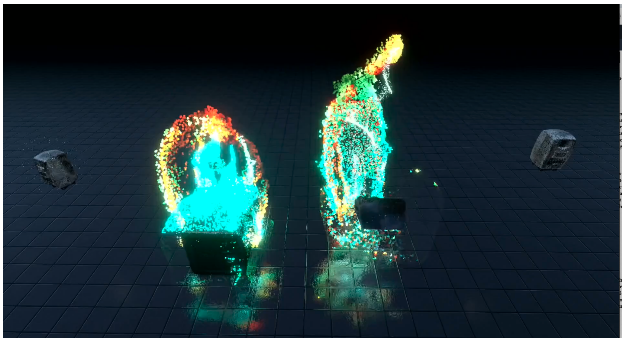

Figure 6: Participant Bodies and Speakers' Point Clouds Merge.

5.2 Hearing Designer's Reflections

As a hearing composer and interaction designer (we move to the first person voice here of the first author), I was motivated by leading the compositional process with the visual design. Having designed several audiovisual systems with Matt Hughes, I have a strong sense of how to convert movement data into both sound *and* visuals. We have published previous work about exploring this process through different lens; what we call sound-led, movement-led or visual-led design [20, 21, 41]. For *Audionce*, it was my intention to lead with the visual element, and keep the sound element in my 'mind's ear,' with early consideration to make the installation a 'visual-only audiovisual piece.' The hope was to activate both Deaf and Hearing participants' 'mind's ear;' for them to imagine what sound could be associated with the visualisation, keeping the analogies between the visual and music elements as clear as possible. For example, bass frequencies creating larger avatars, noisy synthesisers making more chaotic particle movements.

When I saw the reaction of Maruyama to manipulating musical elements while touching subwoofers and speakers, the idea of a visual-only installation was lost. What was gained was a new element; vibration. Composing for vibration was exciting as it fit nicely into my current concept for the four speaker composition. Each speaker would symbolise a 'way of hearing,' using analogies from the way animals hear and taking inspiration from Bernie Krause' *Great Animal Orchestra* exhibition [24]. The calls (a five-note pattern played on each speaker that occasionally overlap in timing) of each of the speakers were divided across several octaves, leaving room for the subwoofer to have its own moment and space.

The discovery of the runway, and the 'invitation' for participants to touch the speakers, led to a seemingly clear unspoken instruction; enter the space and move through the structure of the piece as you move towards one of the speakers. This gave the participants control over not only the pitch, timbre and pulse of any particular moment, but also the chord progression, overall tempo and structure (moving back and forth on the runway would change the order of the sections of the composition).

These elements became a focus of exploration in collaboration with Maruyama, who identified as a non-musician and brought a perspective less grounded in conventional musical frameworks. The idea of structure, intensity and mirroring are all musical elements that can be played with without making sound. Maruyama's ability to improvise with hearing participants (and for those participants to not know that she could not hear the sound), was the breakthrough we were most excited by. A secondary breakthrough was to be able to 'compose' a piece together with Maruyama, by improvising and then discussing what we could do differently, writing out clear simple instructions of how we enter, how we move through and how we end.

6 Conclusion

Audionce demonstrates how musical improvisation can be reconfigured as a shared, embodied, and multisensory practice rather than a hearing-dependent one. By foregrounding gesture, vibration, touch, and visual presence as primary musical materials, the installation challenges dominant auditory framings of improvisation and opens new spaces for collaboration between Deaf and hearing participants.

Central to this work was a co-design process with a Deaf researcher, which shifted the project away from compensatory accessibility strategies toward an integrated multisensory aesthetic. Rather than translating sound into alternative modalities, *Audionce* establishes a common field of interaction in which diverse perceptual experiences are equally valid and productive. Work-in-progress public presentations suggested that this approach can support meaningful social improvisation across differences in hearing ability, musical training, and bodily capacity.

Beyond accessibility, the project highlights the cultural and creative potential of engaging with Deaf musical practices and aural diversity, particularly through tactile interaction with sound-producing objects. By inviting hearing participants to physically engage with vibration and speaker surfaces, *Audionce* facilitates a form of mutual exchange that challenges assumptions about what constitutes music and who music is for.

Future work will explore scaling the system for larger groups, refining multimodal mappings through extended use, and deepening collaboration with Deaf artists and communities. More broadly, this research argues for improvisational environments that embrace aural diversity not as a constraint to be overcome, but as a generative foundation for new musical forms.

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7 Ethical Standards

Audionce was partially funded by the University of Technology Sydney's Disability Research Network, Monash University, the Australian Research Council and the Inner West Council in Sydney, Australia. No participants were identified in this research and all knew they were being recorded. All participants were verbally informed that they were being recorded, that any data used would be non-identifying, and that they could opt out at any time.

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