forum acusticum 2026
8-12 September · Graz, Austria

Translating Soundscapes into Practice using Virtual Reality: city makers' insights on Interactive Soundscape Simulation

Yanaky, Richard[1,2], Guastavino, Catherine[1,2]

[1]*School of Information Studies, McGill University, Canada*
[2]*Centre for Interdisciplinary Research in Music, Media, and Technology, Montreal, Canada*

Abstract

Despite advances in soundscape research, its uptake in practice remains limited. Professional engagement with sound remains tied to sound-level metrics, offering an evaluative lens but limited support for proactive soundscape design. This leaves many professions without accessible ways to experience, manipulate, and apply soundscape concepts. This paper reports selected early findings from a stakeholder study using City Ditty, an interactive VR soundscape simulator designed to support sound-aware city making. Fifteen participants across urban planning, architecture, urban design, acoustics, and communications used the head-mounted VR version of City Ditty in a guided sound-awareness session involving interactive soundwalks, sound-source manipulation, and contextual controls such as time of day and weather. Semi-structured interviews examined perceived value, workflow integration, and barriers to use.

Findings suggest that interactive soundscape simulation can support the translation of soundscape research into practice by helping city makers learn, communicate, prototype, and coordinate around soundscape possibilities. Participants identified value for education, early-stage design exploration, stakeholder communication, and making soundscape concerns more tangible across professional roles. However, they also emphasized the need for role-specific functionality, cognitive-load management, fit-for-purpose realism, and stronger project and institutional support. These findings position interactive soundscape simulation as a complementary, capacity-building approach for more proactive soundscape practices.

Keywords: *soundscape, virtual reality, capacity building, human-computer interaction; urban planning*

***Corresponding author**: catherine.guastavino@mcgill.ca*

1. The Research-to-Practice Gap

Despite advances in soundscape research, its application to urban planning and design practice remains limited. In many professional contexts, engagement with sound is still reduced to simplified metrics (e.g., noise limits in decibels), if considered at all, leaving city makers without the conceptual grounding to consider soundscapes as "an acoustic environment, as perceived and experienced, in context" [1]. Advancing soundscape practice is essential to support more informed consideration of urban acoustic environments by urban planners, designers, decision makers, and the communities they serve, ultimately contributing to healthier and more liveable cities.

Yet, while soundscape research continues to produce new knowledge, methods, and best practices, their adoption in professional practice remains limited. Raising sound-awareness is an important first step in encouraging city makers to consider sound within urban environments. However, awareness alone is unlikely to change practice. City makers also need opportunities to explore, experience, and apply soundscape concepts, building the understanding, intuition, and confidence required to integrate them into everyday planning and design workflows. Identifying approaches that can support this progression from awareness to practice therefore remains an important challenge for both soundscape researchers and city makers.

1.1 Interactive soundscape simulation as a bridge

Interactive soundscape simulation offers one promising approach to supporting the translation of soundscape research into practice. By allowing users to experience, manipulate, and compare alternative urban soundscapes, interactive simulators can encourage exploration, experimentation, and reflection in ways that conventional visualization or noise assessment tools cannot (e.g., sound maps or other decibel-centric methods). Rather than simply communicating sound-related information, simulators have the potential to help city makers develop the understanding, intuition, and confidence needed to incorporate soundscape thinking into everyday planning and design workflows.

Immersive auralizations, including 360-degree videos, virtual soundwalks, and project-specific VR simulations have already demonstrated value in making soundscape scenarios more experiential and accessible for assessment and evaluation [2]. However, such approaches are either immutable, as is the case of field recordings, or developed by teams with specialized expertise, tailored to specific sites or projects, and used primarily to present or compare predefined scenarios. While these approaches can be highly immersive, they may offer limited opportunities for city makers to directly manipulate soundscape conditions, test alternatives, or develop practical understanding through repeated experimentation. To support the progression from awareness to practice, the ability to interact with and modify a simulated soundscape in real time is therefore especially important.

City Ditty was developed through an iterative user-centered design process as a research artefact for exploring this more accessible and manipulable form of soundscape simulation. A central aim was to move interactive soundscape exploration beyond expert-driven, one-off demonstrations by creating a system that non-specialist users could learn quickly and manipulate directly. Rather than being designed for a predefined type of practitioner, the project adopted a broad conception of a Professional of the Built Environment (PBE), such as an urban planner, designer, or policy maker, which allowed the research to explore which professional groups might benefit from such tools, how they might use them, and what functionalities they would require. Most notably, this was designed towards those who do not necessarily have *any* type of training in sound or acoustics. Consequently, development focused on creating an intuitive interface capable of supporting users from diverse backgrounds while simultaneously investigating how interactive soundscape technologies could be adopted in practice.

Earlier work on City Ditty established the foundations required for PBE interaction, first through a usability study with its first desktop version which focused on analyzing task completion rates and user engagement with the simulator [3]. This directed further work, including incorporating an enhanced spatial audio render and identification of broader challenges of adoption through an emerging technologies framework [4], extending the system from a desktop application to a head-mounted virtual reality experience [5], and exploring emerging design considerations for interactive soundscape simulations and best use practices [6]. Collectively, these efforts resulted in both a mature prototype designed to minimize barriers to use, and an understanding of the challenges associated with adopting new technologies into practice.

1.2 Research objective

This paper uses City Ditty as a vehicle for examining how interactive soundscape simulation might support the translation of soundscape research into professional practice. By allowing PBEs to directly experience and manipulate simulated soundscape conditions, the study investigates how PBEs perceive the potential value of such tools, where they might fit within existing planning, design, communication, training, or engagement workflows, and what barriers may shape their adoption. Drawing on an initial thematic analysis of stakeholder interviews, this paper reports selected early findings that offer a preliminary, stakeholder-informed perspective on the role interactive simulation could play in supporting more sound-aware city making.

2. Stakeholder Study

2.1 Participants

Participants included 15 PBEs, recruited from the greater Montreal area to cover a wide range of expertise and professional sectors. They were required to be aged 18+ with normal or corrected-to-normal vision and hearing and at least one year of professional experience A breakdown follows for each profession type which includes range and median years of work experience, as well as division of public, private, or mixed sector experience throughout their career. Three participants reported mixed professional backgrounds and were grouped according to their primary professional role but are specified where relevant. Urban planners (n = 4, 4–25 years, M = 7.5; public: 2, mixed: 2); acousticians (n = 4, 7–20 years, M = 12.5; private: 2, mixed: 2); architects (n = 4, 1–10 years, M = 4; private: 4); designers (n = 2, 4–6 years, M = 5; private: 2); and communications professionals (n = 1, 10 years; private: 1).

2.2 Study apparatus: City Ditty

The head-mounted VR version of City Ditty was used in this study [5] (Figure 1), run on an HTC VIVE Pro VR system. Spatial audio was rendered in real time using the Wwise audio engine and presented binaurally through headphones. The study used an adapted form of the *self-guided sound awareness session,* as described in Yanaky, et al. [3], which guided users through 27 tasks that together simulate an interactive soundwalk and design exercise. These hands-on tasks both illustrate soundscape principles while also instructing participants in the core functionalities of City Ditty. For example, participants could listen to the city soundscape at different times of day, pedestrianize the city centre, modify permissible construction times, add birdfeeders to attract sounds of nature, block traffic with sound barriers, and complete other design-oriented tasks. Sound sources could be placed anywhere in the 3D space.

Figure 1. City Ditty HMD VR Version. An interface allows for manipulating sound sources and contextual factors.

The virtual space consisted of a small city centre park from which the city expands outwards for approximately six blocks on all sides. For this study, only the park (Figure 2) and a side street (Figure 3) were populated and used. These spaces utilize several different soundscape designs across the study and are constantly changing — both through loading different pre-set designs, and through the user's

actions. After user intervention, no soundscape was alike. To give a better feel for this space, figures 3 and 4 are provided from Miao, et al. [7], who used City Ditty for a comparative soundscape experiment. The soundscape designs from this study formed the base of several of the new pre-set soundscapes for this study, using the pre-built city landscape from Yanaky, et al. [3].

Figure 2. Overhead view of the city park space. Image from [7].

Figure 3. Overhead view of a side street. Image from [7].

2.3 Procedure

The study was split into two approximately one-hour parts. In the first half, participants completed City Ditty's sound-awareness session in a quiet lab space (The Multimodal Interaction Lab), using an approximately 3.5m x 2.5m VR play area. Participants navigated the virtual environment through natural movement within the physical space, supplemented by standard VR teleportation. Participants were asked to begin the experience standing but could switch to a swivel chair upon request. HTC Vive controllers were used to manipulate the environment and menu systems. Participants followed instructions across the 27 tasks to develop sound-awareness, learn several sound intervention strategies, and complete an open-ended design task in an empty lot (figure 3's empty area). In the second half, participants took part in a semi-structured interview that used their experience with City Ditty as a concrete reference point for reflecting on their professional practices, imagining possible uses of interactive soundscape tools, and identifying conditions that might support or constrain adoption. Upon completion, participants were thanked and given $25 for their time.

2.4 Data collection and analysis

The broader study collected multiple forms of data, including usability metrics, questionnaire responses, and semi-structured interviews. This preliminary paper focuses on the interview data, as these most directly addressed participants' perceptions of professional value, workflow integration, and adoption barriers. Interviews were audio-recorded, transcribed, and analyzed using thematic analysis.

The first phase used eight pre-determined thematic categories, as follows: 1) education, 2) active prototyping and design, 3) collaboration and sharing, 4) workflow integration and project processes, 5) virtual simulations, 6) user engagement, 7) existing tools, and 8) potential barriers. Relevant interview excerpts were first organized under these pre-determined themes. Each category was then examined in greater detail to identify recurring subthemes, patterns, and illustrative participant perspectives. Given the preliminary scope of this conference paper, the findings below summarize selected themes from the interview analysis; a fuller treatment of the analysis will be reported in future work.

2.4.1 Soundscape education

All participants identified education as a key opportunity for interactive soundscape simulation, in some form or another. These responses indicated that the hands-on structure of City Ditty supported this learning by allowing them to explore soundscape concepts, test alternatives, and hear the consequences of design decisions. As one participant [P10 - acoustician and designer] noted, *"if people had a better understanding of how their space could sound like, they might be much more interested in trying to improve the acoustics of their space."*

Several participants also noted that different roles require different levels of soundscape knowledge. Designers may need space to sketch, manipulate, and refine scenarios, while decision makers and clients may need enough practical understanding to recognize issues earlier, discuss trade-offs with experts, and account for broader project constraints. In this sense, interactive simulation may support both individual learning and coordination across professional roles.

2.4.2 New possibilities beyond existing tools

All participants reported that they had no comparable tools for interactively exploring and modifying soundscape conditions. This was seen as a key strength of City Ditty: it made previously abstract or overlooked soundscape considerations more tangible, giving PBEs a way to hear, test, and discuss possibilities they may not have otherwise recognized. As one participant [P04 - senior acoustician] noted, PBEs *"don't even know they need this."*

However, this flexibility also requires careful calibration to different users and tasks. The same participant [P04] described the experience as *"almost like I have too much power,"* suggesting that interactive tools should not expose every function to every user. Just as specialized acoustic software can be inaccessible to non-experts, interactive soundscape simulators may become overwhelming if their functionality is not aligned with users' roles, expertise, and immediate objectives. This need for role-specific support also points to a broader adoption challenge: introducing

new forms of soundscape interaction into practices that are still shaped by established tools, metrics, and workflows. Their value therefore depends not only on what the tools make newly possible, but on how they are introduced, constrained, and integrated into professional contexts.

2.4.3 Workflow integration and enabling conditions

Participants described the adoption of interactive soundscape simulation as depending on both everyday project workflows and the broader conditions that shape what projects *can* be. As one participant observed, substantial resources may already be spent on sound-level modelling without necessarily *improving* the experienced soundscape: [P05 - acoustician] *"I've seen a lot of money [go] to doing models… that will not change anything.... But how to change? It's like almost a society problem."* This tension highlights a central challenge: interactive simulation may help translate sound data into more accessible experiential knowledge, but existing budgets, contracts, regulations, and professional expectations often leave little room for practices that move beyond compliance.

Participants therefore saw the greatest potential before major project commitments were fixed, such as during training, early assessment, pre-design, or client engagement. Once budgets, contracts, and design decisions are established, opportunities to introduce new soundscape practices become more limited, except in unusually well-resourced projects. Without stronger project-level or regulatory support, even PBEs who value soundscape approaches may be left to incorporate them informally and inconsistently. In this context, interactive simulation may be most valuable when used early to make soundscape issues understandable across roles, allowing teams to coordinate around shared auditory goals before decisions become difficult to change.

2.4.4 Supporting communication across stakeholders

Participants envisioned interactive soundscape simulation as useful for supporting communication across groups that often struggle to align their perspectives. This is especially relevant in interdisciplinary settings where professional assumptions, priorities, and vocabularies differ. As one participant observed, [P06 urban planner and architect] *"Some studios have urban designers, landscape architects, and architects working together and sometimes the work doesn't come out too well because they become a little tribalistic… which is a testament to how different those professions think."* In this context, auralization was valued as a way to make soundscape concerns more concrete, giving PBEs a shared experiential reference for discussion.

These benefits appeared across four types of exchange which are hereby named as follows: In *horizontal exchanges*, participants saw value in helping PBEs coordinate across disciplinary knowledge silos. In *downward exchanges*, interactive simulation could support public-facing communication by helping residents experience proposed changes and articulate preferences. In *upward exchanges*, participants saw potential for communicating soundscape concerns to decision makers, managers, clients, or officials who control budgets, approvals, and priorities. Finally, *opportunity-oriented exchanges* cut across these categories but are distinguished by their strategic purpose: using experiential demonstrations to create buy-in, justify investment, or make soundscape design more compelling in business, advocacy, or policy contexts. Across these exchanges, the simulator's value lies in translating soundscape knowledge into forms that others can hear, discuss, and act upon.

2.4.5 Enabling soundscape prototyping

Participants used City Ditty not only to experience soundscape scenarios, but to actively manipulate them through design-oriented tasks. This enabled participants to move from abstract discussion to situated design reasoning, using the simulator to place interventions, adjust contextual conditions, and hear the consequences of their decisions. One participant, describing their open-ended design task, explained how they began with a social goal, [P08 – urban planner] "*I want a coffee because I want people to be there,*" before adding a café, trees for shade to the cafe, sound sources such as a fountain, bird feeders, and music, and amenities such as benches and a bus stop. Their description suggests that, when interaction is accessible, the software could fade into the background and thus allow users to focus on the design problem itself.

At the same time, participants' experiences highlighted the need to manage cognitive and sensory load. The immersive environment could become overwhelming when too many sounds, functions, or tasks were introduced in a single session. [P01 - designer] *"You're doing a lot at the same time. You're trying to figure out how to navigate...the menus...and then actually think about the space and the environment, the visuals, and the sound."* Participants therefore pointed toward strategies such as restricting functionality for specific roles, further modularizing learning activities, and using visual aids to help users locate and understand sound sources. These findings suggest that interactive soundscape tools should not simply maximize functionality but should offload complexity where possible so that users can focus on listening, experimenting, and making design decisions. By lowering the burden of technical operation, such tools may broaden who can participate in imagining and shaping urban soundscapes.

2.4.6 User engagement

Observing participants' experiences suggests that positive user engagement, understood here as a combination of aesthetic appeal, perceived usability, focused attention, and perceived reward during interaction, may be important for encouraging voluntary soundscape learning [3]. When users performed well without much difficulty, they often became absorbed in exploration and design, with many losing track of time as they tested possibilities beyond the required tasks. This was not only a matter of enjoyment, but of motivation: engaging interaction encouraged participants to keep listening, experimenting, and learning without requiring external pressure from regulations, managers, or project obligations. As one participant explained, [P13 - architect] *"Every time there was a new thing to try, I was like wow"* and *"you don't need to be an expert to understand how the noise will be impacted,"* suggesting that accessible interaction can also build confidence in working with soundscape concepts.

However, engagement was closely tied to usability and cognitive load. Participants who interacted comfortably

with the system were more likely to imagine using it for their own design work, while those who struggled were more divided: some wanted additional time to learn, while others suggested an operator-assisted approach wherein they could remain immersed in VR while verbally directing someone else to implement the changes. These findings suggest that engagement can support continued learning and experimentation, but only when the tool gives users enough support to act confidently without becoming overwhelmed.

2.4.7 Fit-for-purpose soundscape simulation

Participants' responses to the virtual simulation were shaped by their professional background and intended use. Participants without specialized sound training generally described the experience as realistic enough to support understanding, exploration, and discussion. Sound-trained participants listened more critically, attending to details such as reflections, obstruction, source localization, and the behaviour of individual sound sources. Several suggested that the simulator was suitable for early-stage auralization and intervention exploration, but not as a replacement for calibrated acoustic modelling or regulatory sound-level assessment.

This distinction produced requests for additional listening and interpretation supports, including estimated sound-level information, controlled listening positions, reduced visual dominance, and enhanced sound cues to direct attention to specific sources or interventions. The simulation also helped participants reason about contextual appropriateness of designs. Reflecting on the sound barriers, one participant [P15 – urban planner] noted that the virtual park was *"not the best environment to test the sound barriers"* given their placement, but that *"in other context it would have definitely worked."* Since these barriers had been placed by the City Ditty designer to demonstrate system functionality, rather than as part of an urban planning process, the comment highlights a broader value of interactive simulation: it can make design assumptions audible and open them to critique, helping users hear, question, and refine the relationship between design choices, acoustic effects, and urban context.

3. Discussion

Just as existing acoustic modelling tools have co-evolved with sound-level-based regulatory assessment, interactive soundscape simulation should be understood as supporting a different set of needs. Since soundscape-based practice has few-to-no established regulatory pathways, City Ditty was developed as an exploratory tool, guided by soundscape research and by the need to better understand how different PBEs might use, interpret, and apply such technologies. This suggests a fit-for-purpose understanding of simulation, where realism, functionality, and guidance are judged in relation to intended users and tasks rather than by acoustic fidelity alone. Taken together, the findings point toward three broader discussion themes: capacity building, human–soundscape interaction, and the broader conditions required for soundscape practice.

3.1 From sound-awareness to capacity building

The findings reinforce the importance of sound-awareness, as well as assumptions that awareness alone is insufficient for changing practice. Participants valued opportunities to explore soundscape designs, test alternatives, hear consequences, and understand how individual changes contribute to the broader soundscape. In this sense, interactive simulation may support capacity building, understood here as the development of the skills, resources, and confidence needed to apply soundscape concepts in practice. It does not simply tell PBEs that sound matters; it gives them opportunities to develop the practical understanding and motivation needed to work with soundscape concepts themselves.

This capacity-building role appeared across several themes. Educational value and user engagement were both supported by self-directed experimentation, as participants continued to listen, test, and learn beyond the required tasks. Design-oriented activities further showed how users could move from abstract concepts to situated design decisions when the software reduced technical and cognitive burden. Interactive soundscape tools should therefore be designed not simply to maximize functionality, but to provide different levels of control, guidance, and support for users with different roles and expertise. However, capacity building is not only a matter of individual learning; as the following sections show, it also depends on interactions that make soundscape knowledge actionable and on professional conditions that allow those actions to become part of practice.

3.2 Human-soundscape interaction

Participants' ability to use City Ditty for exploration, communication, and design suggests that soundscape knowledge had been translated into a workable form. Rather than requiring users to interpret sound through abstract metrics or expert-only software, the simulator made soundscape conditions tangible through auralization and interaction. This was especially evident when participants focused on the design problem itself, rather than on the functionalities of the software.

Thus, human–soundscape interaction builds on this translation by making soundscape elements both tangible and manipulable. By allowing users to modify the environment and hear the effects of their decisions, interactive simulation makes soundscape design more actionable within professional practice. In this way, interaction supports capacity building not only by helping PBEs understand soundscape concepts, but by giving them practical means to explore, coordinate, and apply those concepts in relation to their own work.

3.3 Creating conditions for soundscape practice

Finally, participants' reflections on potential barriers indicated a gap between everyday project work and the project governance and institutional support that determine whether soundscape considerations are budgeted for and acted upon. Soundscape approaches were seen as easiest to introduce early, when goals, responsibilities, and resources are still negotiable, such as during project assessment, pre-design, or client engagement. This is because once budgets, contracts, and

design priorities are fixed, soundscape practices become difficult to add unless they have already been built into the project. Interactive simulation may help address this gap by making soundscape value easier to demonstrate, coordinate, and justify. Accessible auralizations and scenario comparisons can help explain consequences, build support, and make soundscape-oriented design more legible to clients, managers, and decision makers. In turn, stronger awareness at decision-maker levels can help soundscape work become funded, incentivized, required, and supported through employee training.

4. Conclusions

This paper reported selected early findings from a stakeholder study using City Ditty to examine how interactive soundscape simulation might support the translation of soundscape research into professional practice. While interactive soundscape simulators remain an emerging class of tools, stakeholder responses suggest strong potential for supporting more sound-aware city making. Their value lies in helping PBEs learn, communicate, prototype, and coordinate around soundscape possibilities. More broadly, the findings point to three roles for such tools: supporting capacity building, enabling human–soundscape interaction, and creating conditions for sustained soundscape practice. These tools should therefore be understood as complements to calibrated acoustic modelling, supporting experiential, early-stage, and participatory forms of soundscape work.

This potential is also reflected in early uses of City Ditty beyond the present study. In one case, a soundscape researcher used the system to design soundscape scenarios for a controlled comparative study on the effects of music on the quality of urban public experience [7]. In another, a multidisciplinary team began using City Ditty for the biophilic redesign of a local park in Chile, including the creation of a localized digital model and recordings of local sound sources that were integrated into City Ditty [8-9]. These examples suggest that interactive simulators can enable forms of user-created scenario building and collaborative experimentation that would otherwise be difficult to conduct. Further work has also begun comparing the head-mounted VR and desktop versions of City Ditty to better understand how different interaction modalities, levels of immersion, and usability trade-offs may support different soundscape simulation tasks [10].

Despite this progress, City Ditty remains a research prototype, and broader use will require sustained resources, partnerships, and development infrastructure to adapt such tools to new places, users, and project contexts. Ultimately, interactive soundscape simulation points toward a more proactive soundscape practice where city makers are supported in considering sound earlier, more collaboratively, and with greater confidence.

5. Resources

City Ditty Project page including related works and media: https://www.sounds-in-the-city.org/en/CityDitty

6. Acknowledgments

Thank you to all participants and NSERC for support (grant RGPIN 2019-06121 to CG).

References

[1] ISO, *Acoustics—Soundscape—Part 1: Definition and Conceptual Framework*, ISO 12913-1:2014, 2014.

[2] R. Yanaky, C. Tarlao, and C. Guastavino, "An interactive soundscape simulator for professionals of the built environment," presented at the Int. Workshop Haptic Audio Interact. Design (HAID 2020), Montreal, Canada, 2020.

[3] R. Yanaky, D. Tyler, and C. Guastavino, "City Ditty: An immersive soundscape sketchpad for professionals of the built environment," *Applied Sciences*, vol. 13, no. 3, Art. no. 1611, 2023, doi: 10.3390/app13031611.

[4] R. Yanaky, G. Grazioli, Y.-Y. Zhang, and C. Guastavino, "Exploring the use of soundscape sketchpads with professionals," in *INTER-NOISE and NOISE-CON Congr. Conf. Proc.*, Chiba, Japan, Aug. 20–23, 2023, 10 pp., doi: 10.3397/IN_2023_0322.

[5] R. Yanaky and C. Guastavino, "Virtual reality for urban soundscape design: Exploring knowledge sharing, creation, and workplace integration," in *Proc. 2025 31st ACM Symp. Virtual Reality Software and Technology (VRST '25)*, New York, NY, USA: Association for Computing Machinery, 2025, Art. no. 147, pp. 1–2, doi: 10.1145/3756884.3768399.

[6] R. Yanaky and C. Guastavino, "Realistic enough? Design considerations for soundscape simulators," *Canadian Acoustics*, vol. 52, no. 1, May 2024. [Online]. Available: https://jcaa.caa-aca.ca/index.php/jcaa/article/view/4183

[7] C. Miao, R. Yanaky, and C. Guastavino, "Effect of music on the quality of urban public experience: A virtual reality experiment," presented at the 56th Annu. Conf. Environmental Design Research Assoc (EDRA), Halifax, NS, Canada, May 27–30, 2025.

[8] R. Yanaky, L. Fuentes, D. Verdugo, J. Monsalve, B. Vega, C. Villavicencio, P. Kogan, and C. Guastavino, "Application of the City Ditty soundscape tool in an interdisciplinary urban park design competition," in *INTER-NOISE and NOISE-CON Congr. Conf. Proc.*, vol. 272, no. 1, São Paulo, Brazil, Aug. 24–27, 2025, pp. 3639–3650, doi: 10.3397/IN_2025_1095787.

[9] P. Kogan *et al.*, "From soundwalks to auralisation: A participatory workflow for biophilic soundscape design in urban green spaces using City Ditty," 12th Convention of the European Acoustics Association (Forum Acusticum), Graz, Austria, Sep. 8–12, 2026.

[10] R. Yanaky, S. Toffa, and C. Guastavino, "Interacting with soundscapes in virtual reality: Desktop vs. immersive VR," 12th Convention of the European Acoustics Association (Forum Acusticum), Graz, Austria, Sep. 8–12, 2026.