

Introduction to the special issue on: Advances in Soundscape: Emerging Trends and Challenges in Research and Practice

Editorial for the Special Issue

ABSTRACT

This editorial introduces the special issue “Advances in Soundscape: Emerging Trends and Challenges in Research and Practice” published jointly by *The Journal of the Acoustical Society of America* and *JASA Express Letters*. Marking over a decade since JASA's last dedicated issue on soundscape research, this collection highlights the field's rapid evolution and diversification. It features 28 peer-reviewed articles from international research teams, showcasing advances in methodology, technological applications, theoretical developments, and real-world implementations across various acoustic environments. We categorize the contributions thematically, identify emerging trends and ongoing challenges, and offer perspectives for future research and practice.

I. SOUNDSCAPE STUDIES: EMERGING RESEARCH THEMES

Soundscape has undergone a remarkable transformation over the past two decades, evolving from a niche perspective within acoustics into a vibrant, interdisciplinary research field with far-reaching implications. Formally anchored (or not?) in the ISO 12913 series, soundscape studies have fundamentally shifted how we understand sonic environments by emphasizing the perceptual, experiential, and contextual dimensions of auditory phenomena. This human-centred approach stands in thoughtful complementarity to traditional acoustics, enriching the field by integrating experience alongside physical measurements and parameters, thereby creating a more holistic framework for understanding our relationship to our acoustic surroundings.

Over the past decade, we have witnessed an extraordinary flourishing of the field, characterized by increasingly sophisticated theoretical models, innovative experimental approaches, and nuanced policy discussions. These developments emerge from the collective aim to integrate human perception and experience into acoustic assessment, design, and management practices across diverse environments—from bustling urban centres to tranquil natural landscapes, and from public spaces to intimate indoor settings.

The emergence of soundscape as a distinct paradigm reflects a broader societal recognition that sound profoundly shapes human experience, well-being, and quality of life. As communities worldwide face escalating challenges related to noise pollution, habitat degradation, and sensory disconnection, the soundscape approach offers valuable conceptual and methodological tools for creating more harmonious relationships between more harmonious relationships between communities and between societal needs and goals (e.g., economy, industry, climate change).

This special issue emerges at a pivotal moment in the field's development. A decade after JASA's previous dedicated issue on soundscape research¹, we now observe a discipline that has not only developed intellectually but has begun to significantly influence practice across multiple domains—urban planning, architectural design, environmental management, public health, and cultural

heritage preservation, among others. The articles assembled here showcase this maturation process, reflecting diverse methodological approaches, technological innovations, theoretical advancements, and real-world applications that collectively push the boundaries of what soundscape research and practice can achieve. The 28 contributions to this special issue represent diverse approaches to soundscape research and practice, reflecting the field's expansion across multiple domains and methodologies. To provide structure to this collection, we have organized the papers into four overarching themes. The first theme, “*Methodological Advances and Assessment Tools*,” encompasses papers developing new frameworks, metrics, and analytical approaches that strengthen the scientific foundation of soundscape research. The second theme, “*Not only public spaces: Indoor Soundscape Contexts*,” explores the growing application of soundscape concepts to enclosed environments, moving beyond traditional architectural acoustics to examine perceptual qualities in spaces where many people spend significant portions of their lives. The third theme, “*Cross-cultural and Contextual Dimensions*,” investigates how geographic, cultural, and situational factors shape soundscape perception and evaluation, highlighting the importance of context-sensitive approaches. Finally, “*Technological Applications and Virtual Environments*” showcases how emerging technologies are enabling novel methods for soundscape simulation, evaluation, and design. While these themes provide a useful organizational framework, they also reveal productive intersections and complementarities across different research streams, demonstrating the inherently interdisciplinary nature of soundscape studies and its capacity to integrate diverse perspectives and methodologies.

As editors, we have sought to capture both the breadth and depth of contemporary soundscape scholarship, highlighting contributions that demonstrate methodological rigor while maintaining relevance to pressing social and environmental challenges. The papers in this special issue, published jointly by JASA and JASA Express Letters, represent work from international research teams spanning several continents, underscoring the global relevance of soundscape perspectives and the richness that comes from diverse cultural and geographical contexts. Through this collection, we aim not only to document the current state of soundscape research but also to catalyse new conversations, collaborations, and initiatives that will further advance the field.

A. Methodological Advances and Assessment Tools

This theme encompasses research focusing on novel methodologies, metrics, and assessment frameworks that are advancing how we measure, analyse, and understand soundscapes. These papers collectively demonstrate the field's methodological maturation, introducing innovative approaches such as soundscape codes for underwater environments, AI-based analysis tools, perception indices, and comparative evaluations of modelling techniques. Articles in this cluster emphasize the importance of reliable, validated methods for capturing the multidimensional nature of soundscape experiences, addressing the longstanding challenge of characterizing perceptions. These methodological contributions provide essential tools that enable more rigorous and nuanced soundscape studies across various environments, ultimately strengthening the scientific foundation of the field.

The study by Wynn and Dannemann Dugick² demonstrated that urban infrasound sensor networks, like the one deployed in Las Vegas, can effectively detect signals of interest—such as explosions and tonal noise from turbines—despite the presence of anthropogenic noise sources like traffic and HVAC systems, with overall noise levels aligning with global models. Wilford et al.³ introduced the “soundscape code,” a multidimensional framework for comparing underwater

soundscapes, enabling the assessment of ecological health and anthropogenic impacts across diverse marine environments. The study by Aletta, Xiao, and Kang⁴ identified key barriers—such as limited national interest, resource constraints, and a lack of practical guidance—that hinder the adoption of the ISO 12913 soundscape standards, and proposes a strategic roadmap emphasizing stakeholder engagement, capacity building, and community development to facilitate their integration into built environment practices. Jedrusiak et al.⁵ proposed a definition-independent formalization of soundscapes to bridge interdisciplinary gaps by accommodating diverse research perspectives, demonstrated through an application involving frequency correlation matrices for land use type detection. Zhang et al.⁶ investigated the distinction between perceived and felt emotions in urban soundscape evaluations, finding that “preference” is better predicted by felt emotions like enjoyment, while “appropriateness” aligns more with perceived emotions such as comfort, highlighting the nuanced roles these emotional dimensions play in assessing urban acoustic environments. The study by Tailleur et al.⁷ presented a method for classifying urban sound sources using fast third-octave band data from acoustic sensor networks, employing a transcoder to convert these measurements into Mel spectrograms compatible with pre-trained audio neural networks (PANNs), thereby enabling accurate prediction of the perceived time of presence for various sound sources. Hornberg et al.⁸ used carried out soundwalks in two urban areas of Essen, Germany, and found that perceived dominance of traffic noise strongly worsens overall acoustic environment assessments, especially in residential areas, while natural sounds improve them and human sounds have little effect. Mitchell et al.⁹ proposed a unified framework for creating context-dependent Soundscape Perception Indices (SPIs) that condense multidimensional soundscape assessments into single-value scores, enabling comparison and optimization based on specific perceptual goals using a test-target paradigm within the soundscape circumplex. The study by Versümer et al.¹⁰ compared five modelling methods across three diverse soundscape datasets and finds that nonlinear approaches—especially random forest and gradient boosting—consistently outperform linear models in predicting Eventfulness and Pleasantness, with model performance influenced by dataset characteristics like variance, setting, and balance. Oehme et al.¹¹ developed and validated two multi-item questionnaires (15- and 21-item versions) to measure the perceptual dimensions of road traffic noise beyond annoyance, identifying five to seven key factors through factor analyses of listener responses to Ambisonics-recorded traffic scenes.

B. Not only public spaces: Indoor Soundscape Contexts

This group of papers explores the expanding frontier of indoor soundscape research, examining how perception-centred approaches can enhance our understanding of interior acoustic environments. Moving beyond traditional room acoustics, these studies investigate diverse indoor settings including classrooms, offices, intensive care units, and museums, demonstrating how soundscape concepts can be productively applied to enclosed spaces where people spend significant portions of their lives. The research in this theme highlights the unique perceptual, contextual, and functional requirements of different indoor environments, emphasizing that successful indoor soundscaping requires attention to specific user needs, activities, and expectations. These contributions collectively establish indoor soundscaping as a distinct and valuable sub-discipline with significant implications for architectural design, public health, and occupant well-being.

The pilot study by Visentin and colleagues¹² investigated primary school children's perception of indoor classroom soundscapes, revealing that they are mostly exposed to unpleasant sounds—

mainly peer-generated noise and traffic—while preferring music and natural sounds, highlighting the need for soundscape-informed design in educational environments. Louwers et al.¹³ proposed a need-driven approach to designing soundscape interventions for ICU patients by identifying four types of sonic ambiances linked to fundamental human needs, demonstrating through listening experiments that tailored sound compositions can enhance perceived pleasantness and emotional well-being. West et al.¹⁴ developed a model of soundscape perception in open-plan offices, identifying Pleasantness, Eventfulness, and Emptiness as key perceptual dimensions and showing that experiences are influenced more by human sounds, psychological well-being, and contextual factors than by traditional noise level metrics. Al-Bayyar et al.¹⁵ showed that participation in a structured indoor soundscape workshop significantly enhanced interior architecture students' awareness, sensitivity, and understanding of sound as a critical design element in their professional practice. Bem et al.¹⁶ found that museum visitors significantly preferred soundscapes congruent with exhibition content, as these enhanced immersion, reduced distraction, and improved overall experience during audiovisual experiments in an immersive environment. Puay and colleagues¹⁷ examined the soundscape of contemporary worship music in a Malaysian church, finding that high sound levels impacted congregants' worship experiences—both positively and negatively—depending on factors like perceived loudness, ability to participate, and cultural values, with implications for auditory health and inclusive sound design.

C. Cross-cultural and Contextual Dimensions

Papers in this theme examine how cultural, geographic, and contextual factors shape soundscape perception and evaluation. Through comparative studies across different world regions, cultural settings, and environmental contexts, these articles reveal the complex interplay between universal aspects of auditory perception and culturally mediated interpretations of sound. The research highlights significant variations in how different communities experience, categorize, and respond to similar acoustic stimuli, emphasizing the importance of contextually sensitive approaches to soundscape assessment and design. These cross-cultural investigations not only enrich our theoretical understanding of soundscape perception but also carry important practical implications for developing culturally appropriate acoustic environments and avoiding one-size-fits-all solutions in increasingly diverse urban settings.

In a large-scale study comparing over 2000 soundscape surveys from Europe and China, Aletta et al.¹⁸ found significant cultural differences in how public space soundscapes are perceived, with Europeans associating pleasantness more with natural sounds and Chinese participants linking vibrant soundscapes to nature, highlighting the need for culturally sensitive urban soundscape design. Zhu et al.¹⁹ identified four key perceptual dimensions—Relaxation, Communication, Quietness, and Spatiality—in the soundscapes of outdoor public spaces in urban high-rise residential communities, revealing that enclosed layouts with less traffic and more human sounds tend to enhance relaxation and overall soundscape satisfaction. Ooi et al.²⁰ developed a perceptually balanced dataset of one-minute audio-visual soundscape excerpts from 62 Singaporean locations using a modified partitioning around medoids algorithm guided by ISO-based Pleasantness and Eventfulness metrics, enabling efficient and representative future soundscape research. Ramírez-Esparza and colleagues²¹ found that cultural heritage and socioeconomic status influence everyday acoustic environments, with Latinx students experiencing higher nearfield noise levels due to collectivist social behaviours, highlighting the role of cultural dynamics in shaping auditory experiences and implications for health equity. Manohare et al.²²

observed significant cross-country differences in psychophysiological responses to traffic noise, with British participants showing greater cardiovascular and stress reactions than Indian participants, highlighting the influence of cultural and environmental factors on noise perception and its health impacts. In their study in London, Fang et al.²³ found that perceived soundscape appropriateness is most strongly influenced by dominant sound source type—especially natural sounds—while personal and contextual factors also play a role, validating its relationship with the pleasantness-eventfulness circumplex of ISO/TS 12913-2.

D. Technological Applications and Virtual Environments

This cluster focuses on the intersection of soundscape research with emerging technologies, particularly virtual and augmented reality, advanced spatial audio techniques, and sensor networks. These papers explore how technological innovations are enabling new approaches to soundscape simulation, evaluation, and design, creating opportunities for controlled experimental studies and immersive experiences that would be difficult or impossible to achieve in physical environments. The research demonstrates both the potential and limitations of virtual environments for soundscape assessment, highlighting considerations for ecological validity while showcasing how these technologies can facilitate public engagement, design iteration, and educational applications. As these technologies continue to evolve, they promise to further transform soundscape research practices and create new possibilities for experiential design across various domains.

The study by Hou et al.²⁴ presented a dual-branch AI model (DCNN-CaF) that successfully performs both sound source classification and annoyance prediction from environmental audio, showing strong alignment with human perception and outperforming traditional models in soundscape analysis tasks. Yang et al.²⁵ found that virtual environments with higher audio-visual authenticity—especially those based on field recordings and augmented reality—yield soundscape evaluations most comparable to real-world experiences, supporting their value in future soundscape research and design. Fraisse and colleagues²⁶ used soundscape simulation to evaluate different composition strategies for a public sound installation in Paris, finding that abstract sound compositions significantly enhanced perceptions of familiarity and variety, offering a valuable approach to soundscape-informed design in urban spaces. Jorgensen et al.²⁷ found that while acoustic environment demand and diversity measured by body-worn dosimeters remain consistent across seasons and weeks, they vary notably by day and time of day, suggesting that a single well-distributed one-week sampling period is sufficient for assessing individual sound exposure. Rehman et al.²⁸ noted that web-based audiovisual listening experiments offer a viable alternative to immersive VR setups for evaluating noise perception in complex auralized environments, with comparable results in sound quality and participant engagement despite slightly lower visual presence in consumer setups. Zargarneshad et al.²⁹ showed that ninth-order ambisonics can achieve spatial resolution matching or exceeding human auditory acuity for horizontal sound localization, though spectral distortions at high frequencies may introduce unintended elevation cues in perception.

II. CONCLUDING REMARKS

A few key trends can be identified across the contributions in this special issue, reflecting the increasingly rich and diverse landscape of soundscape research. One of the most evident developments is the broadened scope of application. Soundscape research, once primarily

concerned with public urban spaces, now encompasses a wider variety of settings, including healthcare environments, educational spaces, religious contexts, and cultural venues such as museums. This expansion reflects a growing recognition that soundscapes are a critical component of human experience in all types of spaces, not only in traditionally studied urban areas.

Another important trend is the continued emphasis on perception-driven methodologies. Human experience and emotion are central to many of the studies presented, aligning with the ISO 12913 framework's focus on contextual and perceptual dimensions. Researchers are increasingly developing tools and indices that reflect the complexity of these human responses, acknowledging the nuanced ways in which individuals interpret their acoustic environments. The integration of psychological, physiological, and cultural factors into soundscape evaluation points toward a more holistic understanding of auditory quality.

Technological innovation also stands out prominently in this special issue. From AI-driven sound classification and predictive modelling to the use of virtual reality and ambisonics, the field is rapidly embracing tools that enhance both data collection and experiential simulation. These methods enable researchers to analyse soundscapes with greater precision and to create experimental settings that reflect real-world complexity. Wearable devices and web-based platforms, in particular, are making soundscape research more accessible, scalable, and relevant to everyday life. At the theoretical level, several contributions reflect ongoing efforts to refine, standardize, or nuance the conceptual foundations of soundscape studies. Papers discussing ISO 12913 implementations, interdisciplinary formalizations, and creative applications underscore the need for shared frameworks that can guide both academic inquiry and practical interventions. The challenge remains to balance theoretical robustness with the flexibility needed to adapt to different cultural and environmental contexts.

The special issue also points to a growing awareness of cultural and ecological dimensions of soundscapes. Whether exploring underwater acoustic environments, modelling infrasound in natural areas, or examining the role of sound in religious and community identity, the papers demonstrate a commitment to understanding the full spectrum of auditory experience. This expansion not only enriches the research field but also opens avenues for applying soundscape thinking in ecological conservation, cultural heritage, and participatory urban planning.

Despite these exciting advances, several challenges persist. Chief among them is the need for more integrated policies that incorporate perceptual soundscape metrics into environmental and urban governance. Bridging disciplinary boundaries also remains a complex task, as effective collaboration between engineers, psychologists, designers, and policymakers requires mutual understanding and shared goals. Moreover, ensuring inclusivity and representativeness in soundscape assessments is critical, particularly as the field engages with diverse, and some, vulnerable, populations and environments. Addressing these challenges will be key to realizing the full potential of soundscape research in both theory and practice.

As the soundscape field continues to evolve, there are several promising avenues for future research and practice. One major opportunity lies in refining context-sensitive frameworks for assessing soundscapes, which can capture the nuances of diverse spatial, social, and cultural settings. These frameworks should go beyond universal typologies to accommodate differences in expectations, uses, and cultural norms that shape the perception of acoustic environments. Expanding international collaboration around standardization is another key priority. While the ISO 12913 series has provided a valuable foundation, its adoption and adaptation across various regions and professional sectors is still inconsistent (and sometimes challenged). Further work is

needed to harmonize methodologies, ensure comparability of results, and translate guidelines into actionable tools for practitioners, planners, and policymakers.

Ethical considerations will also be central to soundscape research. As more studies engage with vulnerable populations, aurally diverse groups, sensitive environments, and complex social contexts, there is a pressing need to embed inclusivity, equity, and participant agency into both research design and soundscape interventions. This includes acknowledging whose voices are heard in soundscape governance and who benefits from proposed changes. Greater engagement with policy and decision-making processes will help bridge the gap between academic research and real-world impact. Soundscape researchers can contribute to urban and environmental policy by providing perceptually grounded evidence and tools that align with broader sustainability, well-being, and environmental justice goals. The integration of soundscape concepts into environmental impact assessments, urban master plans, and public health strategies represents a concrete pathway forward. Finally, the field stands to benefit from embracing multisensory and immersive approaches. Advances in virtual reality, spatial audio, and interactive installations provide not only research opportunities but also new modes of communication and participation. These tools can be used to co-create environments with communities, communicate around auditory futures, and make research more accessible to the public.

The future of soundscape research is interdisciplinary, inclusive, and impact-driven. The work featured in this special issue lays a strong foundation for these next steps, offering both theoretical insights and practical innovations that can shape how we experience, evaluate, and design the auditory dimensions of our environments.

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REFERENCES

- ¹ B. Schulte-Fortkamp, and J. Kang, “Introduction to the special issue on soundscapes,” J. Acoust. Soc. Am. **134**(1), 765–766 (2013).
- ² N.R. Wynn, and F.K. Dannemann Dugick, “Modeling and characterizing urban infrasonic and low-frequency noise in the Las Vegas, NV region,” J. Acoust. Soc. Am. **154**(3), 1439–1447 (2023).
- ³ D.C. Wilford, J.L. Miksis-Olds, and S.B. Martin, “Multidimensional comparison of underwater soundscapes using the soundscape code,” J. Acoust. Soc. Am. **154**(5), 3438–3453 (2023).
- ⁴ F. Aletta, J. Xiao, and J. Kang, “Identifying barriers to engage with soundscape standards: Insights from national standards bodies and experts,” JASA Express Lett. **4**(4), 047401 (2024).
- ⁵ M.D. Jedrusiak, T. Harweg, T. Haselhoff, B.T. Lawrence, S. Moebus, and F. Weichert, “Towards an interdisciplinary formalization of soundscapes,” J. Acoust. Soc. Am. **155**(4), 2549–2560 (2024).
- ⁶ Y. Zhang, J. Kang, and B. Yang, “Comparison between perceived and felt emotions in the soundscape evaluation of urban open spaces,” J. Acoust. Soc. Am. **155**(4), 2756–2768 (2024).
- ⁷ M. Tailleur, P. Aumond, M. Lagrange, and V. Turre, “Sound source classification for soundscape analysis using fast third-octave bands data from an urban acoustic sensor network,” J. Acoust. Soc. Am. **156**(1), 416–427 (2024).

- ⁸ J. Hornberg, F. Hemker, K. Schröer, M. Hinse, S. Moebus, and J. Schröder, “Association between perceived sound type dominance and overall assessment of the acoustic environment using ISO 12913 soundwalks,” *J. Acoust. Soc. Am.* **156**(4), 2827–2837 (2024).
- ⁹ A. Mitchell, F. Aletta, T. Oberman, and J. Kang, “Soundscape perception indices (SPIs): Developing context-dependent single value scores of multidimensional soundscape perceptual quality,” *J. Acoust. Soc. Am.* **156**(6), 3694–3706 (2024).
- ¹⁰ S. Versümer, P. Blättermann, F. Rosenthal, and S. Weinzierl, “A comparison of methods for modeling soundscape dimensions based on different datasets,” *J. Acoust. Soc. Am.* **157**(1), 234–255 (2025).
- ¹¹ A. Oehme, P. Schweidler, M. Schuck, A. Fiebig, S. Lepa, and S. Weinzierl, “A measuring instrument for the perceptual dimensions of road traffic noise,” *J. Acoust. Soc. Am.* **157**(3), 1587–1597 (2025).
- ¹² C. Visentin, S. Torresin, M. Pellegatti, and N. Prodi, “Indoor soundscape in primary school classrooms,” *J. Acoust. Soc. Am.* **154**(3), 1813–1826 (2023).
- ¹³ G. Louwers, S. Pont, D. Gommers, E. van der Heide, and E. Özcan, “Sonic ambiances through fundamental needs: An approach on soundscape interventions for intensive care patients,” *J. Acoust. Soc. Am.* **156**(4), 2376–2394 (2024).
- ¹⁴ B. West, A. Deuchars, and I. Ali-MacLachlan, “Office soundscape assessment: A model of acoustic environment perception in open-plan offices,” *J. Acoust. Soc. Am.* **156**(5), 2949–2959 (2024).
- ¹⁵ Z. Al-Bayyar, P.N. Dökmeci Yörükoglu, K. Kitapci, and Ö. Türker Bayrak, “Impact of indoor soundscape workshop on sound awareness of interior architecture students,” *J. Acoust. Soc. Am.* **157**(2), 1202–1214 (2025).

- ¹⁶ M. J. Bem, S.R. Chabot, V. Brooks, and J. Braasch, “Enhancing museum experiences: Using immersive environments to evaluate soundscape preferences,” *J. Acoust. Soc. Am.* **157**(2), 1097–1108 (2025).
- ¹⁷ R.S. Puay, B. Lam, A. Mitchell, and J. Chieng, “Soundscape and Worship Experience of Contemporary Worship Music: A Case Study in Malaysia,” *J. Acoust. Soc. Am.* *in press* (2025).
- ¹⁸ F. Aletta, T. Oberman, A. Mitchell, M. Erfanian, and J. Kang, “Soundscape experience of public spaces in different world regions: A comparison between the European and Chinese contexts via a large-scale on-site survey,” *J. Acoust. Soc. Am.* **154**(3), 1710–1734 (2023).
- ¹⁹ G. Zhu, J. Kang, H. Ma, and C. Wang, “Characterization of soundscape assessment in outdoor public spaces of urban high-rise residential communities,” *J. Acoust. Soc. Am.* **154**(6), 3660–3671 (2023).
- ²⁰ K. Ooi, J. Goh, H.W. Lin, Z.T. Ong, T. Wong, K.N. Watcharasupat, ... and W.S. Gan, “Lion city soundscapes: Modified partitioning around medoids for a perceptually diverse dataset of Singaporean soundscapes,” *JASA Express Lett.* **4**(4), 047402 (2024).
- ²¹ N. Ramírez-Esparza, S. Jiang, A. García-Sierra, E. Skoe, and C.R. Benítez-Barrera, “Effects of cultural dynamics on everyday acoustic environments,” *J. Acoust. Soc. Am.* **156**(3), 1942–1951 (2024).
- ²² M. Manohare, F. Aletta, T. Oberman, R. Elangovan, M. Parida, and J. Kang, “Cross-country variation in psychophysiological responses to traffic noise exposure: Laboratory experiments in India and the UK,” *J. Acoust. Soc. Am.* **156**(5), 3067–3079 (2024).
- ²³ X. Fang, F. Aletta, A. Mitchell, T. Oberman, and J. Kang, “Determining factors for the appropriateness of soundscapes: A cross-sectional large-sample study in London (UK),” *J. Acoust. Soc. Am.* **156**(5), 3588–3607 (2024).

- ²⁴ Y. Hou, Q. Ren, H. Zhang, A. Mitchell, F. Aletta, J. Kang, and D. Botteldooren, “AI-based soundscape analysis: Jointly identifying sound sources and predicting annoyance,” *J. Acoust. Soc. Am.* **154**(5), 3145–3157 (2023).
- ²⁵ M. Yang, A. Heimes, M. Vorländer, and B. Schulte-Fortkamp, “Comparison of subjective evaluations in virtual and real environments for soundscape research,” *J. Acoust. Soc. Am.* **155**(6), 3715–3729 (2024).
- ²⁶ V. Fraisse, N. Schütz, M.M. Wanderley, C. Guastavino, and N. Misdariis, “Using soundscape simulation to evaluate compositions for a public space sound installation,” *J. Acoust. Soc. Am.* **156**(2), 1183–1201 (2024).
- ²⁷ E. Jorgensen, J.B. Tufts, and E. Skoe, “Examining sound levels across different time scales measured from body-worn dosimeters,” *J. Acoust. Soc. Am.* **157**(2), 1483–1499 (2025).
- ²⁸ R. Rehman, C. Dreier, J. Heck, J. Llorca-Bofi, and M. Vorländer, “Comparison of virtual reality and web-based listening experiments on the perception in complex auralized environments,” *J. Acoust. Soc. Am.* **157**(3), 2001–2017 (2025).
- ²⁹ N. Zargarnezhad, B. Mesquita, E.A. Macpherson, and I. Johnsrude, “Focality of sound source placement by higher (ninth) order ambisonics and perceptual effects of spectral reproduction errors,” *J. Acoust. Soc. Am.* **157**(4), 2802–2818 (2025).