

# BRIDGING THE GAP BETWEEN SOUND AND NON-SOUND PROFESSIONALS WITH AURALIZATION TOOLS

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## 1 Introduction

A soundscape approach to design, despite its long existence as a topic of research, is still radically novel to the public and private sector and remains an untapped resource for most urban sound planning. Current sound planning practices remains dominated by a focus on identifying and limiting sound levels and are performed near-exclusively by specialized sound engineers (e.g. acousticians), supported by relevant sound-level based tools. In contrast, the soundscape approach goes several steps beyond sound levels to focus on the entire auditory experience, in which sound levels play a contributing role. However, uptake of soundscape practices to consider the auditory experience remains a major challenge due to both a lack of tools, *and* professionals trained to consider the auditory experience within the urban planning context. This work presents a new auralization tool, City Ditty, to help bridge this gap between sound and non-sound professionals, and argues in favour of a new profession – an urban sound design facilitator, to act as an intermediary.

### 1.1 Generating meaningful feedback from stakeholders to support better sounding cities

Urban sound planning is a complex process that, for this context, involves three major groups of stakeholders. First are the acoustic experts who perform the majority of the sound planning; second are the other Professionals of the Built Environment (PBEs) who shape our cities (such as urban planners, designers, and policy makers), but are typically untrained in sound-related planning; and third, city users, who live, work, and play in the city. Currently, acousticians are responsible for the majority of the sound-planning process. Due to the complex and specialized nature of sound, this has typically excluded other PBEs and city users from sound-planning processes, resulting in small groups of people making large decisions that affect large and diverse groups of city users, without understanding how it impacts their daily lives. Furthermore, as PBEs don't typically consider sound in their own work [1], they often engage with acousticians late in the urban planning process, long after decisions have been literally built into the concrete [2], limiting potential sound-intervention possibilities.

To help overcome these issues, a more diverse set of stakeholders should be included in the sound-planning process, at a much earlier time. However, many public consultations can prove problematic, as good intentions with poor methodology for communication and feedback can result in ineffectual token efforts [3]. As current sound

planning tools and procedures are sound-level based, this may not generate any meaningful feedback from non-sound experts, and may fail to address the diverse needs of city users or support collaboration with PBEs. It is unreasonable to expect the average city user – or even PBEs – to undergo enough sound training to understand and converse with acousticians at their level. However, discussion of the auditory experience is readily accessible to all – with a little bit of help.

Stakeholders must have a strong understanding of both the situation *and* the implications of proposed designs in order to support meaningful decisions. To facilitate this, simulations are required to demonstrate different design strategies. For example, there are many strategies to reduce unwanted traffic sounds: sound barriers block sounds, but are large, expensive, and can interrupt and/or fragment the urban fabric; installing water features can introduce calming sounds of water that help mask the sounds of traffic; installing quiet pavement or lowering speed limits reduce the sounds of vehicles; or pedestrianizing the area can remove it completely and encourage public space and commercial usage.

### 1.2 Using City Ditty for rapid development of soundscapes, by non-sound experts

While one-off simulations can be made by specialized experts, simple to use auralization tools can be invaluable to help PBEs to help them engage in early-stage sound planning. City Ditty is a first of its kind auralization tool that was designed through a user-centered design process to help identify the form and functions of such a new tool, as PBEs do not currently engage in sound design [4]. Taking the form of a virtual reality simulator, City Ditty provides a virtual 3D environment of an urban city that enables the user to walk around a virtual environment, listen to the soundscape anywhere in the 3D space, and modify the soundscape both directly and indirectly through simple interactions (Figure 1). Aside from being able to add, move, or remove sound sources from anywhere in the urban space, these interactions focus on giving the user control over different contextual factors (e.g. time of day, season, weather) to help show how soundscapes are always changing, albeit often in predictable ways. City Ditty includes a self-guided sound-awareness session with 36 different tasks, leading users through how to use the software while simultaneously teaching them about foundational principles of soundscape design. A first usability evaluation received positive responses and indicated that users, regardless of their experience, could complete both the learning phase, and implement their own simple soundscape designs in under an hour.

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**Figure 1:** Users can create and listen to their own soundscapes under different contexts (e.g. time of day) with a single design. Software demos and related research can be found at <https://www.youtube.com/@MultimodalInteractionLab>.

## 2 Method

The current iteration of City Ditty has enhanced the audio capabilities to binaural output, and include better distance attenuation, sound occlusion, and reverberation, as well as switching from desktop virtual reality to head-mounted virtual reality [5]. Using this version, several usability studies are underway.

First, a usability study using head-mounted VR is underway to explore how to best encourage user engagement with PBEs and how such tools can be integrated into their workflow. This follows previous methodology [4], which invites PBEs from both private and public sector to go through the self-guided sound-awareness session to learn how to both learn to use the software in VR, as well as learn the basics of soundscape design. Questionnaire data on task difficulty, user engagement, and presence is collected, as is click data to perform task performance. These are supported by exit interviews to discuss their experiences and how they foresee potential future usage. This will be followed by an additional usability study which explores how such software can support collaborative designs with multiple users. Data collection is underway.

## 3 Discussion

Designing towards the auditory experience presents many challenges, amongst multiple stakeholders, which must all be addressed to support future adoption. For example, while City Ditty's first two iterations focus on addressing the needs of PBEs and how to motivate and support them with a soundscape approach to urban sound planning, a broader look at relevant stakeholders indicate further external challenges, outside of most of their control. Economic barriers, for one, may present uncertainty and ambiguity to decision makers who will determine whether or not such a tool as City Ditty is utilized – even if it is free to use [5]. Yanaky et al. discusses this in terms of an emerging technology framework [6] which outlines the pros of soundscape design against the uncertainty of their return on investment, in relation to current market and technology trends.

### 3.1 Urban sound design facilitators

A crucial question remains: Who will lead urban soundscape designs? A single person cannot speak for a diverse city,

although they can facilitate discussion amongst a diverse group. Similarly, while tools like City Ditty can be easy to operate, there must be a knowledgeable person to guide the stakeholders through viable solutions. To perform effectively in this role, an urban sound design facilitator will need a working knowledge of soundscape research, governance and direction by human-centered sound policies and frameworks, accessible tools (like City Ditty) to help create adequate simulations, and continual collaboration and feedback from diverse stakeholders. Research has advanced in these individual topics, but not yet to the point required for integrating them into a proactive sound-planning practice. The pieces have been laid out and await integration for urban sound design facilitators to use. Such skills and experiences would also position these facilitators to be leaders in affecting policy and regulation change.

While this research focuses mainly on the research and development of suitable tools for designing towards an auditory experience, it has also come to understand through its user-centered design process that the 'ideal' user does yet truly exist – at least in a current professional capacity. We suggest that many early career soundscape researchers would make excellent candidates for this role, although expect that many acousticians and PBEs would also make excellent choices for this role as well, with further soundscape training.

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