Sounds Aware

Tate Carson

1. DESCRIPTION

Sounds Aware is a web application that runs on a smartphone and uses machine learning to detect human-made sound (anthrophony) and masks it with ambient music as a user walks around their environment. A study was completed to determine if this app is an effective means of shifting a user's attention away from anthrophony and to biological (biophony) and geophysical (geophony) sounds while walking and encouraging environmental awareness. Though the model is pre-trained with the author's local environmental sounds, the user can train the model further on their unique soundscape so that each user gets a personalized experience. After the training process, the user can listen to ambient music based on traits of the surrounding anthrophony. If the app senses less anthrophony and more biophony or geophony, then the music fades away, bringing the user's attention to the anthrophony.

The goal of *Sounds Aware* is to bring the user's awareness to the geophonic and biophonic soundscape, which is often so masked by noise pollution that it has fallen out of awareness for many of us. *Sounds Aware* seeks to shift the user's concept of nature to something that has no starting or ending point; it is all around us. The app brings awareness by focusing attention on the environment. Because of the predominance of eye culture [2], our reliance on seeing rather than listening as a primary means of sensing the world, it is a lot to ask of a person who might be uninterested in acoustic ecology to "just listen" to their environment. But, if you give them a tool that urges listening in the quieter places, where the natural world will be more audible, there is a better chance of them engaging with those sounds because the app focused their perception. *Sounds Aware* is a means of technologically mediated "ear cleaning," as described by R. Murray Schafer in *Ear Cleaning: Notes for an Experimental Music Course* [8].

A 2011 World Health Organization (WHO) report found that "there is overwhelming evidence that exposure to environmental noise has adverse effects on the health of the population [6]." *Sounds Aware* shifts a users attention away from noise pollution and to nature, which may help mitigate adverse health effects caused by noise pollution. Psychologist Stephen Kaplan found that stress reduction can be aided by the experience of the natural environment by providing a 'restorative environment' that reduces the fatigue caused by directed attention [4]. Kaplan did not mention sound directly, but a recent study by Eleanor Ratcliffe *et al* [7] has extended his research to show that certain bird sounds may provide restorative benefits. While a reduction in environmental noise at the source would be the best way to solve noise pollution, masking the noise is a stopgap solution. A masking solution has been implemented by several projects [5, 9] but not yet with a mobile device. *Sounds Aware* implements a similar idea but with a mobile phone.

Sounds Aware is accessed by going to https://walking.netlify.com in a web browser on a smartphone. It requires Internet access to download the default data set. After that, the app will work offline, so it is appropriate for various network conditions. Headphones are required so that the microphone on the phone does not pick up the music playback. Headphones with a microphone are preferred so that if the user wants, they can put their phone in their pocket while walking.

When a user first opens the application, they will see it guess the surrounding sounds based on a pre-trained data set. When assured that the microphone is working, the user can then start the music by clicking the toggle switch (see Figure 1a). The music now responds to what the surrounding sounds. The user can adjust the listening sensitivity of the microphone to their liking to match the acoustic environment if it is particularly quiet or noisy. After testing the success of the system in interpreting the user's environment, the user can now add their own training data (see Figure 1b). For this, the user will select a sound category such as a car. Then the user will wait for a car to drive by and then record it by clicking the record toggle. This will make the system more accurate in listening to the user's specific environment. Users are not currently able to add their own sound category tags.

The musical composition of *Sounds Aware* is influenced by ambient music. Synthesized sounds were used that would not be too jarring to jump in and out of and did not have an obvious beginning or ending. This type of synthesized sound blends in with the surrounding acoustic environment as a composition. The synthesized sounds are simple frequency

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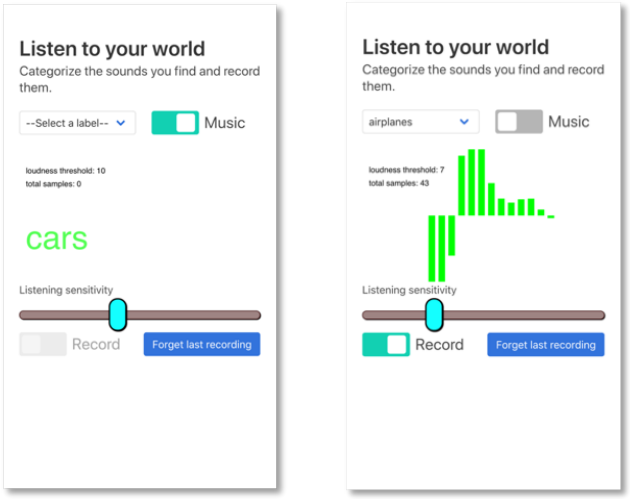

(a) Playing music (b) Recording Data

Figure 1: Two states of the application

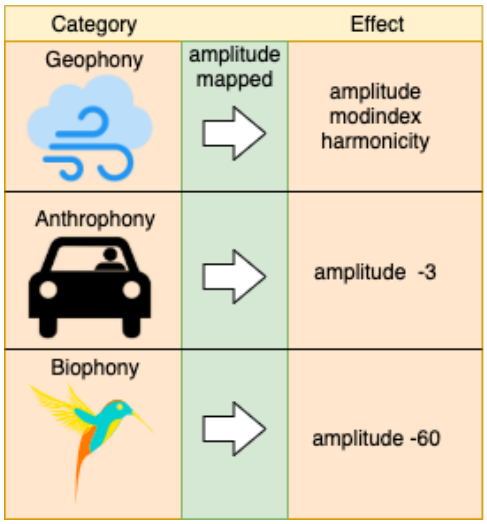

Figure 2: Mapping of tag category to music

modulation synthesis with reverb and delay effects. They are tuned to just intervals so they are more likely to coincide with tunings in nature, influenced by Aeolian practices [1] and La Monte Young [3].

The app maps the loudness[1] of the acoustic environment to the amplitude of the ambient composition (see Figure 2). The previous 200 loudness values are averaged and the amplitude ramps to a given value over one second for signal smoothing. If *Sounds Aware* hears an anthrophonic sound, the amplitude is faded up to -3 dB. If it hears a geophonic sound, the amplitude of the geophonic sound is mapped onto the synthesized sounds amplitude, creating a wind chime effect. Geophonic sounds also affect the modulation index and harmonicity of the frequency modulation synthesis, creating a variety of timbres depending on the character of the current external soundscape. If a biophonic sound is recognized, the amplitude of the ambient wash is faded down to -59 dB, which is perceptibly silent when listened to in an urban environment.

[1]A perceptual feature from https://meyda.js.org/audio-features.html

2. LINK

https://walking.netlify.com

3. AUTHOR BIO

3.1 Tate Carson

Tate Carson is a composer from New Orleans, Louisiana. He studied jazz composition and performance at both Loyola University New Orleans and the University of New Orleans. Carson was active in the New Orleans jazz improvisation scene from 2009 until 2015 when he moved to Oakland, California to attend Mills College where he earned an MFA in Electronic Music and Recording Media. He is currently pursuing a PhD in Experimental Music and Digital Media at Louisiana State University. More information about his work can be found at http://www.tatecarson.com

4. REFERENCES

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