Sonic Place – A Sonic Augmented Reality Soundscape Experience

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ABSTRACT: This paper describes the conceptualization, technical and artistic development and the first results of the Sonic Place project.

Sonic Place is an ongoing project centered in the relationship between the cultural heritage, sonic identity and sonic memories of specific places. Presenting both artistic and scientific objectives, the project tries to promote sonic ecology awareness and explores new technological possibilities for listening and discovering soundscape compositions.

The project proposes a sonic augmented reality experience of current and past soundscapes that can be experienced by the use of a custom made mobile application.

The project was presented at the 18th Biennial of Cerveira in Vila Nova de Cerveira, Portugal, 2015 and on the 6th Semibreve Festival in Braga, Portugal, 2016. In total, more than 100 on site recordings were made, 20 musical compositions were developed and 224 users experienced the application.

KEYWORDS: sonic augmented reality, public media art, soundwalk , sound map.

1. Introduction

A place is an abstraction for the geographical and human ingredients that together establish an identity (Casey, 1997). Elements such as language, architecture, landscape and urbanism, are immediately associated with the cultural heritage of a specific place; i.e. the legacy and identity of a specific place.

Even though the visual and anthropological factors are more prominently associated with a cultural identity, the soundscape is also crucial in the construction of *place*.

The way that each individual interacts with the surroundings, and continuously perceives and affects its sonic expressions, either explicitly or implicitly, creates the ground for sonic memories to arise. These memories, which represent symbolic "soundmarks" (Schafer, 2012) of quotidian tasks or significant experiences of the past, are constantly triggered and related to what is perceived in the present.

In the work "Matter and Memory" (Bergson, Paul, & Palmer, 2004) the philosopher Henry Bergson develops a context in which memories are virtual entities and demonstrates that memories delineate the perception of past events through the awareness of the present. This relationship between past and present serves as an inspiring metaphor for the Sonic Place Project, where past and present events, respectively represented by pre-composed soundtracks from sonic memories and the real-time surrounding sonic environment, are imbricated by means of technology.

The way we explore and interact with a territory is determinant to the study of our quotidian soundscape. Therein, even unpretentious actions such as *walking* can assume meaningful conceptual aspects. *Walking* as an aesthetical practice traces back to Jean Jaques Russoe in the 18th century and Charles Darwing in the 19th century (Vermeire & Geert, 2014). Likewise, works such as "The lovers Great Wall of China" by Marina Abramovic and "Passeio branco de Vermeire" by Simona Vermeire (Vermeire & Geert, 2014), are examples of the use of *walking* as an artistic practice. In the sonic ecology context, the *soundwalk*, as introduced by Murray Schafer, represents an empirical recognition of the ambient sounds and the soundscape components (Adams , et al., 2008). Or as defined by Hildegard Westerkamp: moving with the purpose of listening to the environment (Adams, et al., 2008).

Current available technology enables "soundwalkers" to collect huge amounts of data, from high quality audio recordings to GPS coordinates. The systematization of this data allows for a comprehensive interpretation of a territory's sonic ecology that can be capitalized in activities such as urban planning and noise mapping. Projects such as the *Montreal Sound Map*, (Stein & Stein, 2008) which aims to preserve the sonic heritage of the city of Montreal by providing an interface for uploading geo-referenced audio to a website and *Stereopublic: crowdsourcing the quiet* (Sweeney, 2013), that uses mobile technology to identify

and present silent urban spaces, are good examples of soundscape projects that uses systematized data for creative and scientific purposes.

In an artistic perspective, it is possible to identify two major technological advances that enhance the potential for sonic artistic works in the context of sonic environment awareness through soundwalks and sound maps: mobile technology that offer the possibility of recording and reproducing high quality audio on the same portable device, and positioning systems. Regarding the latter, Simona Lodi refers to geo-referencing and the ubiquity of mobile devices that offer this possibility, as a tool with important relevance in the advances of public sound art. In her words: "...every single place on the Earth has coordinates that can be tracked technologically; every single space can be surveilled..." (Lodi, 2014)

The use of this kind of technology can be seen in important artistic works such as *Trace* by Teri Rueb (Rueb, 1999) and *Sound Mapping* by Iain Mott, Marc Raszewski , Jim Sosnin (Mott, Raszewski , & Sosnin, 1998).

Another important technological advance (that is particularly relevant for the Sonic Place project) that offers great potential for artistic works is *Augmented Reality* (AR) AR offers the possibility of overlaying, augmenting or substituting real world elements with virtual elements in real-time (Geroimenko, 2014). In an artistic context, this technology arises in the "AR Art Manifesto" as a subversive tool for activism, thus it can occupy both private and public spaces at the same time and also evade censorship (Torres, 2016). AR art usually relies on image recognition and geo-referencing techniques for transmitting a manifesto. This kind of technology can be seen in works such as *Outside Inside* by Tamiko Thiel and *Batling Pavilions* by Sander Veenhif (Lodi, 2014).

2. Sonic Place

With the main objective of promoting the preservation and awareness to the quotidian sonic ecology, the project proposes an "augmented soundwalk", where artistic representations of sonic memories of specific places are overlapped by the real-time soundscape of the present.

The project is presented to the audience (in this case the term *audience* is interchangeable with the term *user*) in the form of a mobile application that can be freely downloaded and used in Android devices.

The application exhibits a sonic augmented reality experience that offers the users the possibility of exploring their surrounding sonic ecology and at the same time navigate through a mixture of several soundscape compositions that represent artistic interpretations of sonic memories of that specific place.

This sonic augmented reality experience connects the audience with a soundscape composition while keeping a strong association to the very much intended sonic awareness of all the surrounding sounds.

Each soundscape composition is produced from direct or indirect references to local sonic memories of a specific place and location within the urban territory and it's surroundings. These sonic memories are obtained, identified and characterized by a threefold process: on site sound recordings, interviews with residents, research of historical multimedia archives.

In the following sections, we explain in detail the processes, case studies and results of the project.

2.1. Identification of sonic memories

In order to identify and collect multimedia data relative to the iconic and quotidian sonic memories of the cities where the Sonic Place project has been presented, the first step was to research the local historical multimedia archives such as the municipal libraries, tourism bureaus, city hall, among others, and collect multimedia content such as videos of famous speeches, concerts, interviews, etc. Additionally, for each city we promoted a social media campaign calling for the local residents to share multimedia content and (hi)stories about their city.

To update and relate the identified historical sonic memories with the current and contemporary sonic ecology of each city, local residents were interviewed and surveyed, using the scientific inquiries strategies developed by (Zhang & Kangô, 2007), where the respondents answered questions relative to their preferences in what regards sounds of their urban soundscape. Additionally, we asked for the respondent to authorize the audio recording of their interview, and also of them speaking out their family names.

Finally, in each city, a series of geo referenced field recordings of the identified sonically interesting locations within the urban space and also surrounding landmarks were made.

Figure 1. On site sound recording in Vila Nova de Cerveira.

2.2. Soundscape composition process

In order to create a collection of soundscape compositions inspired and related to the sonic memories of the places where the Sonic Place project was presented, we asked composers of different musical and artistic backgrounds to use the material gathered in the processes previously described section 2.1, as the basis for their composition.

From that, each composer chose a specific location, one that the composer could establish an interesting connection, and developed the composition using any sound design strategy. The only proposed constraint was that the compositions must relate explicitly or conceptually with the chosen location. Thus, the resulting compositions presents a strong contribute to the project, that is at the same time conceptual (relative to the sonic memories) and also artistic (artistic expression of individual composers).

2.3. Mobile Application

The "augmented soundwalk" experience was presented to the audience in the form of an application that could run in any Android device. The application was designed to be user friendly and intuitive, presenting a simple design and direct features.

The application had a single interface displaying a customized Google Maps where each composition was placed on their exact location and displayed as a marker. The user location was also displayed as a marker and constantly updated.

When experiencing the application at the locality where the compositions were developed for, the user can listen to all compositions at the same time, however, each with a different intensity (sound volume) that is proportional to his/her distance to the geographical location of each composition. Furthermore, each composition has a pre-defined actuating range, meaning that if the user was too far from a composition location, it's volume would zero or too small to be heard.

This user position based dynamic volume control, implies that by taking distinct navigation paths through the urban and surroundings territory, the user would listen to a different mix of the compositions, and thus, creating a new and unique overall composition. This strategy presents a very close relationship and is inspired by the artistic metaphor proposed by Murray Schafer, where each individual affect, voluntarily or not, an ongoing global musical composition (Schafer, 2012).

If using the application with headphones, the user would also experience the sonic augmented reality layer, which consisted of the amplified sound of the device's microphone.

The application also presented a feature that enable users to explore the soundscape compositions from anywhere in the world. By clicking on the compositions markers, it is possible to solo, mute, or play all compositions, bypassing the geo referenced dynamic volume control.

Finally, the application offers the possibility of recording samples of 10 seconds of the audio using the device's microphone, which is automatically uploaded to a web server and made available for playback and download on an interactive map. The uploaded samples are anonymous, time-stamped and geo-referenced.

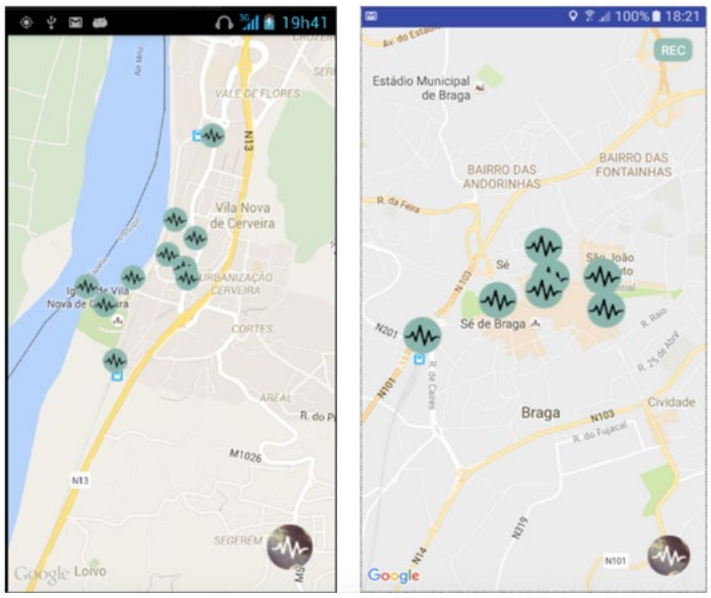

Figure 2. Screenshots from the graphic interface of the sonic place augmented *soundwalk* application.

2.4. Technical development

From a technical perspective, the Sonic Place Project consists of two distinct applications: the mobile application and the website with the interactive map. The mobile application was developed for the Android Operating System[1] and implemented using the Android Studio and SDK[2] the interactive map website was implemented using usual web programming tools such as HTML5 and JavaScript.

The Android app consists of 4 main subroutines: GPS coordinates acquisition and representation on a Google Maps interface, reproduction of the pre-recorded soundscape compositions, simultaneous capture and reproduction of the mobile microphone audio, audio file recording and automatic upload to a web server.

The Android App interface displays a Google Maps customized view of the user's current location. The map contains markers for user position and also customized markers for each of the soundscape compositions, correctly positioned in their respective localities. Using the Google Maps API[3] the GPS coordinates of the user is updated every second and then used to calculate the volume of all soundscape compositions. The volume of each composition

1. www.android.com
2. https://developer.android.com/studio/index.html
3. https://developers.google.com/maps/

is calculated to be inversely proportional to the user's distance to the locality of the composition. Hence, the farther to the composition, the softer that sound is, and inversely, the closer the user gets to a composition, the louder it sounds.

The reproduction of the soundscape compositions is implemented using the Android SDK native audio reproduction functionalities. In order to achieve simultaneous multitrack playback, the audio files had to undergo compression and conversion to 16Bit 44.1kHz Ogg Vorbis format[4] Additionally, each audio file is referenced in a configurations jSon file, where it's location coordinates and actuating range can be setup. The actuating range dictates the maximum distance in which the audio file playback volumes decays to zero.

The simultaneous capture and playback of the microphone audio is implemented using a standard ring buffer strategy obeying the following logical flow: a short amount of audio is recorded to a buffer, the buffer is reproduced (sent to the audio headphones output), the buffer is overwritten by the next audio samples coming from the microphone. The choice of a buffer size of 2048 samples was made by taking into consideration the balance between latency and audio quality. Due to the fact that the app is intended to run in several different mobile phones, of different models, manufacturers and Android OS versions, we had to compromise with a small latency (about 50ms), thus smaller buffer sizes turned out to generate clicking and distortion in some experimented devices.

The audio file recording and automatic upload functionality was also implemented using the Android SDK default audio manipulation tools, and the upload to the internet server is achieved using the FTP protocol.

2.5. Public presentations and results

The project was presented at the 18th Biennial of Cerveira in Vila Nova de Cerveira, Portugal, 2015 and on the 6th Semibreve Festival in Braga, Portugal, 2016.

For Vila Nova de Cerveira, 11 soundscape compositions were developed using the data gathered from 29 interviews, videos of concerts performed in the 80's and 90's and more than 10 gigabytes of field recordings.

The application developed for Vila Nova de Cerveira has been downloaded 185 and is still active in at least 5 devices. Additionally, the compositions are also available at the www.soundcloud.com platform and have been downloaded 187 times.

For the public exhibition at the Semibreve Festival in Braga – 2016, 9 compositions were developed by 5 distinct composers, using the data collected from 16 interviews and more than 8 gigabytes of field recordings. This version of the application has been downloaded 39 times and is still active in at least 10 devices.

The interactive map accessible at www.sonicplaceproject.net has received contributes from 11 countries and aggregates more than 200 audio recordings.

4. http://www.vorbis.com/

3. Conclusion and future work

The use of contemporary technologies and augmented reality for developing and delivering an artistic project in the context of soundscape composition and sonic ecology demonstrated to be successful in what regards the conceptual objectives and also artistic versatility. Meaning that the original objectives were able to be achieved.

On the other hand, the use of technology demonstrated to be difficult to be delivered to a general audience, thus it required a lot of promotion effort to bring people to participate and experience the application.

The implementation of the automatic audio recording feature, enables the developed "artistic" application to function also as a monitoring tool and data collector. The recorded audio files can be latter used as source not only for new musical compositions but also for scientific monitoring of the ecological soundscape and ultimately as an ongoing dynamic archive of the local sonic memory.

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