Exploring sonic landscapes through the use of spatial and temporal sampling techniques

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ABSTRACT

This paper describes the process conceived to design and implement two site-specific sound installations exploring diverse acoustic and perceptual features of urban and rural sonic landscapes. The process involved in the design and implementation of both installations is explained, concentrating on sampling and montage techniques based on the exploration of spatial and temporal features of original field recordings compositional methods. Current developments of the project involve an algorithm capable of automatically record and assemble sounds collected through a period of time in various locations or simultaneously in various locations.

1. INTRODUCTION

In the last decade, field recording equipment has become more accessible and easy to handle allowing artists and researchers from diverse backgrounds to engage in projects involving the use of field recordings [1, 2, 3, 4, 5]. While more and more practitioners are using field recordings for artistic and research purposes, there is still a restricted understanding of ways of engaging with audiences from different backgrounds through the use of environmental sound [6]. The following article describes the creative process behind two site-specific installations created using two sampling techniques conceived to enhance individuals' awareness about our daily relationships with our sonic environment.

2. SPACE-BASED SAMPLING TECHNIQUE

The idea behind this sampling technique was developed during a student recording project with the sound recordist Chris Watson during one of his visits to Lancaster University in 2011 [7]. During the visit, Watson gave a lecture to students where he explained the timbral and spatial unpredictability of beach recordings carried out at varying distances from the shore. This triggered the idea of exploring the natural filtering process of landscapes as part of a sound installation exploring soundscapes of sections of the Chilean coast at the Phillipi Natural Science Museum for the Relincha Experimental Music Festival in Valdivia. As a starting point field recordings were carried out at various distances from the seabed at the Curiñanco beach, 45 kilometers south of the city of Valdivia. Twenty stereo recordings were carried out in a straight line at different distances from the seashore, using a pair of omnidirectional DPA 4060 microphones in an AB recording disposition with 20 centimeters separation and a Rycote windjammer. As expected, recordings obtained showed an increasing low pass filtering process that became more apparent as the distance from the microphone to the shore increased. Recordings carried in proximity to the shore contained a wide rich spectrum with a clear and well defined stereo field, while recordings carried out further away from the shore contained mostly low frequency components with a very poor spatial resolution. The 20 samples obtained were then edited and combined using a straightforward crossfading montage technique emulating a continuous aural journey from the shore (10 metres) to the back of the beach (150 metres). Figure 1 shows microphone positions used to capture samples on the beach (top) related to timbral variations in spectrogram of one cycle of the installation soundtrack (below).

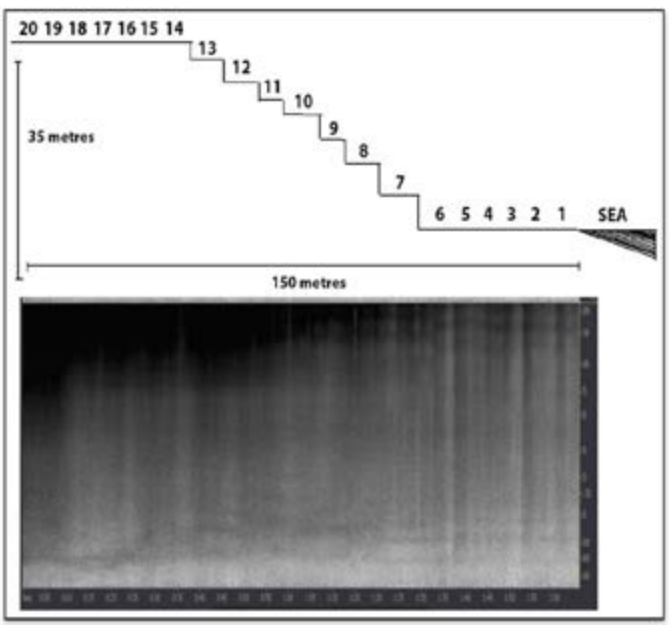

Figure 1. Microphone positions on the beach (top) in relation to a 2-minute spectrogram of one cycle of the installation sound track (below).

As distance from the shore increased, microphone variations in height had an increasing low-pass filtering effect on recordings. Different sample durations' lengths were tested aiming to convey a sense of timbral and spatial development in the soundtrack of the installation. After some informal listening tests with volunteers it was decided to use the shortest sample duration possible (8 seconds), creating an overall 2-minute soundtrack cycle using the 20 samples chronologically. This soundtrack overall duration was conceived in order to match the museum's average visitor time per room in order to allow visitors to familiarize in a short period of time with the sonic environment created by the piece.

The final installation was implemented in a 40 m² room with using a four-channel loudspeaker setup playing two synchronized stereo mixes of the soundtrack cycle mentioned above for a period of three weeks. During that time, more than two hundred visitors experienced the installation providing various kinds of feedback in the museum´s guest book. Most comments focused on the immersive character of the installation and the timbral richness of the sea field recordings.

3. TEMPORAL-BASED SAMPLING TECHNIQUE

A second installation project involving the use of environmental sound was conceived taking as a starting point studies exploring public perceptions of wetlands in the city of Valdivia [8]. Wetlands are distinctive natural feature of the city natural landscape, but unfortunately there is a considerable lack of awareness among Valdivia's citizens about some of their basic features and environmental relevance [9]. With some of these ideas in mind a project aimed to investigate public perceptions of wetlands in the city was conceived in collaboration with the architects Carolina Ihle and Roberto Burgos.

Pilot field recordings were carried out at a wetland located in the southeast part of the city, surrounded by a park with large trees, abundant bird population and a large number of newly built housing developments. An original recording setup was designed and implemented to carry out 24-hour continuous stereo recordings in a non-compressed audio format. The portable system included a Tascam DrII recorder powered by a portable mobile phone battery connected to two omnidirectional Microphone Madness BSM9 microphones fitted with Rycote mini windjammers. This simple system allowed the possibility of recording continuously stereo files in 16 bit 44.1 kHz stereo audio format up to 36 hours in various weather conditions. Figure 2 shows pictures of the setup used to carry out the 24-hour field recordings at the wetland in Valdivia.

Figure 2. Field recordings setup designed for wetland with omnidirectional microphones hanging at the sides of a closed plastic bag.

Taking into account natural temporal compression techniques developed by Soundscape composers and recent research in soundscape ecology a soundtrack for a sound installation assembling short recording samples for each hour of the day was generated [10, 11, 12, 13]. Informal listening tests were carried out in order to assess the impact of various samples' durations in the final mix, showing that shorter samples provided a more realistic sense of temporal development in a limited period of time. After various tests with different samples' durations tracks using as source material 12-second samples from different wetlands across Valdivia were used as the basis for the installation. The final soundtrack assembled 24 samples recorded chronologically during each hour of the day resulting in a track of an overall duration of approximately 240 seconds (4 minutes).

Figure 3 shows a portion of the 24-hour spectrogram of continuous wetland recording (top) compared with part of the resulting 4-minute montage created using the temporal-based montage technique conceived for the installation. The comparison of both spectrograms shows an interesting resemblance in overall temporal evolution of the main sonic events. These results show that the temporal-based montage method could be used as an effective tool to reconstruct the sonic evolution of a particular sonic landscape in a relatively short period of time.

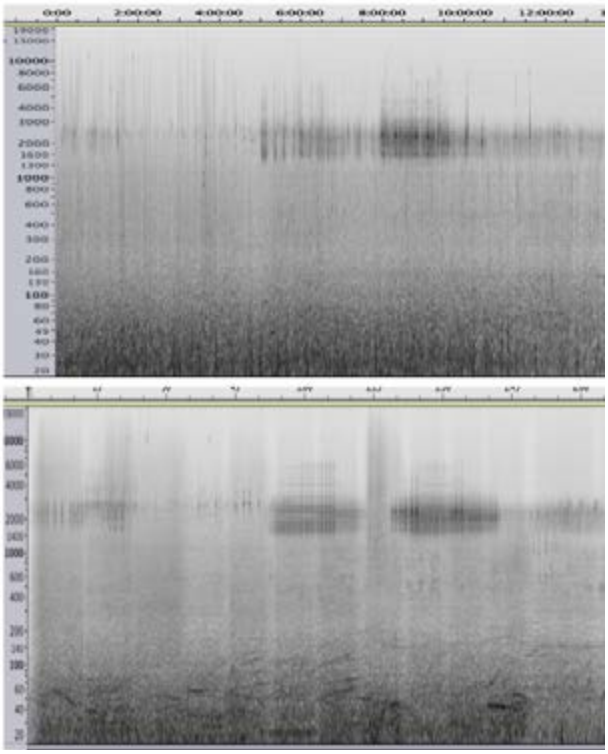

Figure 3. Part of the 24-hour wetland recordings spectrogram (top) and a portion of the 4-minute time-lapse montage created for the installation soundtrack (below).

4. DISCUSSION

Listening exercises with students were carried out in order to assess perceived sonic attributes of the two sampling and montage methods described above. 22 sound engineering students with ages between 18 and 22 listened simultaneously once to 20-second extracts of each track in an acoustically treated classroom through a pair of Yamaha HS7 studio monitors followed by a short survey about the sound materials heard in each track. Before listening to the tracks students were given some background information about the locations where each recordings were carried out and basic facts of the compared recording methods. The first question of the survey considered the spatial-based montage technique using sea recordings, the second question involved the temporal-based montage technique using for the wetland recordings and the third question a comparison of both tracks. The questionnaire contained three simple questions:

1. What are the most interesting sonic attributes of the first track?

2. What are the most interesting sonic attributes of the second track?

3. What are the similarities and differences between both tracks?

While some students answered the questionnaire in a slightly subjective fashion, most participants provided a fine and detailed analysis of the sound materials heard on both tracks. Overall results showed that respondents concentrated on intensity, space and timbre as the main attributes heard on the tracks. These three sonic attributes were then mapped to each of the two montage techniques as shown on table 1. Respondents focused mostly on sonic spatial attributes, followed by intensity and timbral features when listening to the first track created using the spatial-based montage technique with seashore sounds. Answers gathered for the temporal-based montage track showed a similar tendency but with a slightly larger gap between responses for spatial attributes and the other two features. When asked to compare both tracks, respondents tend to favor spatial features, followed by intensity and, to a lesser extent, timbral features.

Survey question	Intensity	Space	Timbre	Other
Space-based montage technique	36	68	32	18
Temporal-based montage technique	23	59	9	18
Comparison	32	41	14	32
Overall results	30	56	18	23

Table 1. Survey results of informal listening tests using the two montage techniques. Numbers show answers in percentages in attribute categories, comparisons and overall averaged results.

In line with results of a previous study exploring spatial features of electroacoustic music, results of the informal listening tests showed a tendency of respondents to favor spatial over intensity and timbral attributes [12]. This inclination could be linked to a natural tendency of listeners to relate to intuitive specific features of spatial sound encountered on their daily life sonic experience. Only minor differences were detected in the way students analyzed both installation soundtracks. Overall survey results showed that the spatial-based montage provide listeners with stronger cues for the analysis than temporal based soundtrack. In this case listeners seem to find it more difficult to identify clear variations in the temporal-based soundtrack due to the more gradual and less obvious sonic evolution of the track.

5. CONCLUSIONS AND FUTURE DEVELOPMENTS

The site-specific installations described in this pilot study have shown that by using simple sampling and montage compositional methods it is possible to provide listeners with aural cues that would allow them to identify specific sonic features of soundscapes. In line with recent acoustic ecology studies exploring temporal and spatial features of sounds captured using monitoring stations, results of this study showed that audio mixes created using simple montage methods can allow listeners to focus on very refined audible relationships linked to specific sonic features of locations [13, 14]. Results of the study also showed that the compositional methods discussed above can be conceive as simple useful tools aimed to engage listeners from diverse backgrounds with salient features of different kinds of soundscapes. A refined critical listening approach based on straightforward temporal and spatial sampling techniques could inspire new opportunities for collaborations between artists and soundscape ecology researchers.

Future developments of this study will investigate ways of developing further the compositional methods described above using two main research strategies. The first approach will involve the combination of temporal and spatial sampling algorithms using a similar approach to those used in outdoor stand-alone monitoring systems [13, 14]. The implementation of an automated stand-alone sampling device to capture uncompressed audio samples over long periods of time could be combined with an automated mixing device that could use the obtained samples to create shorter versions of recorded soundscapes. This could allow users the possibility of creating time-lapse compressed versions of soundscapes of days or weeks in just a few minutes, following a similar approach to popular time-lapse audiovisual devices like Go Pro Cameras.

A second possible development could involve the possibility of integrating listeners' aural experiences as a key feature in sonic landscape assessment. Informal listening tests based on alternative-forced-choice surveys will be carried out with trained panels aimed to identify differences in the quality of the sampling and montage methods used over a period of time in different kinds of environments.

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6. REFERENCES

[1] B. Krause, *Wild Soundscapes*. Wilderness press, 2004.

[2] B. Labelle, *Background Noise*. The continuum international publishing group, 2006.

[3] A. Licht, *Sound art*. Rizzoli International Publications, 2007.

[4] T. Crook, *The sound Handbook*. Routledge, 2011.

[5] M. Bull and L. Back (eds.), *The Auditory Culture Reader*. Berg, 2003.

[6] J. Demers, *Listening Through the Noise*. Oxford University Press, 2010

[7] Chris Watson's website. http://www.chriswatson.net/a_journey_south_9th_november_2011.html.

[8] S. Chester, *A Wildlife Guide to Chile*. Princeton University Press, 2008

[9] O. Barbosa, *Configuración Actual e Histórica de la Ciudad de Valdivia: Estudio Interdisciplinario para Comprender sus Implicancias para la Planificación Urbana y Bienestar Social.* Internal report Universidad Austral de Chile, 2014.

[10] B. Truax and G. Barrett, *Soundscape in a Context of Acoustic and Landscape Ecology*. Landscape Ecology, vol. 26, no. 9, pp.1201-7, 2011

[11] B. Truax, *Acoustic Communication*. Ablex Publishing, 2001

[12] A. Farina, *Soundscape Ecology*. Springer, 2014

[13] B. Pijanowski, L. Villanueva-Rivera, S. Dumyahn, A. Farina, B. Krause, B. Napoletano, S. Gage and N. Pieretti, *Soundscape Ecology: the Science of Sound in the Landscape*. BioScience, vol. 61, pp. 203–16, 2011.