

The Sound of the Landscape: through downtown plazas of the city of Vitória, ES.

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ABSTRACT: Soundscape is the acoustic environment of a place and over time, it is observed how the sonority of cities are changing along with its development. This research aims to characterize the Soundscape of open spaces with public use of the foundational areas (Downtown and Moscoso Park neighborhoods) of the city of Vitória, Espírito Santo. Selected six major plazas, we question the sound condition of these places, which sounds its users hear and the representativeness of each sound in the local context. The relevance of this research is to present the first systematic records on the Soundscape of Vitória, and the hypothesis is that the sound of a place is part of its identity and significance. The technique used was Content Analysis and the procedures were Bibliographical Research and Case Study. The research objectives directed the delimitation of the subject, such as the spatial selection, time frame and method of measurement. The measurement was taken in three days in December 2013, during four time ranges from 7 am to 22 pm, and through dynamic collections, soundwalks, with drifting paths. The data were summarized, analyzed and diagrammed on a sound map and on graphics containing the representativeness of each sound category. It was concluded that this research has brought awareness of the sound environment of the plazas, presenting the qualitative and quantitative characterization of the Sound Events and Sound Marks, besides of generating data for the creation of a bank of sound memory of the city of Vitória.

Keywords *Architectural Acoustics, Music - Acoustics and Physics, Sound, Landscapes, Maps.*

1. INTRODUCTION

In the history of humanity, the presence of sound is contemplated through science and through the narratives of divine and mythological characters. Auditory memories begin in the intrauterine environment and from the moment which is formed, the sense of hearing begins to function uninterruptedly. The body's protection is done through a psychological mechanism. Sound is an acoustic phenomenon, propagating mechanical energy in a material medium in the form of wave motions, irradiated three-dimensionally in all directions. While sounds have a defined frequency, noise is a physical phenomenon with indefinite pressure and frequency characteristics (Abraham cited by Grandjean; Kroemer, 2005). Between sounds and noises, there is silence. However, for Cage (1961), silence, as the absence of sound does not exist. A concept that can be presented is quietness, defined through the level of sound pressure applied to an area. In Brazil, the Technical Standard NBR 10151 (ABNT, 2000) sets the evaluation criteria for populated areas. In Europe it is defined in the Directive 2002/49/EC of the European Parliament and Council of the European Union (2002).

Sounds are organized in the dimension of time, and the ears discriminate the information in time and space. The audible spectrum of the human ear ranges between 20 Hz and 20,000 Hz, but the ability to listen is also related to the frequency (Lent, 2010). When the body is exposed to high-intensity sounds, the sensitivity to frequency ranges can be affected, causing hearing loss and non-hearing disorders such as physical, physiological and psychological damage.

Hearing and listening are different actions that involves hearing, but may include other senses. For Pierre Schaeffer (1966), a form of pure listening is the acousmatic where other senses does not interfere. According to the composer, acousmatic listening assists the refinement of the sense of hearing. Schaeffer (2007) identifies a particular way of listening, described as Reduced Listening, consisting of a practice of Listening and Understanding mode.

Environments are filled with sounds and soundscape is a neologism to describe the sound ambience or any portion of the sonic environment when seen as a field of study (Shafer, 1997). For Truax (2001), soundscapes also relates to the way that individuals and culture perceives and responds to the sonic ambience. Senses allow humans to have feelings for the space and sounds "dramatizes the sensory experience", widening the perception of what the eyes do not see (Tuan, 1983, p.18). Sound helps to create a sense of place.

The soundscape is composed of different elements and one of the subprojects of the World Soundscape Project, discussed systems to catalog it (Shafer, 1997). Sounds can be classified according to physical characteristics, aesthetic qualities, or as referential aspects, its function and meaning (Shafer, 1997). In one approach to categorizing sounds, Krause (2008) proposed the term Biofonia due to the need of researchers to express sounds of biological origin in a particular habitat, without human interference. Krause also brings the term Geofonia for non-organic nature sounds (like sounds of the wind, water, climate and geophysical origin) and Antropofonia, sounds produced by humans and their creations.

These studies of the acoustic environment enables the observation of patterns and changes that occur over time in places and it is presented in maps with several objectives: Music Soundmaps, Audio Guides Soundmaps, Oral History Soundmaps, Noise Maps and Soundmaps of Soundscapes. The last type has emphasis on the study of soundscapes, aiming to archive, analyze and share the sounds of different environments. Field recordings are the first step for the production of information in this type of map. The second step is to identify the Sound Events and classify them. The third step is the cartography of the map, make it available online, may or not being collaborative, with public contribution data and open license.

Soundscapes can go beyond listening and characterize the environment, also rearranging and composing music with them. The practice of soundwalk was a method developed to identify the soundscapes. Soundwalk is a meditative walk, a tour which main purpose is to listen to the environment and educate the ears (Westerkamp, 1974). The action can be performed individually or in groups, in a large or small geographical area, with or without recording (Westerkamp, 1974).

2. MATERIALS AND METHODS

This article presents the characterization of the soundscape of public use areas of the foundational site of the city of Vitória, Espírito Santo, in Downtown and Moscoso Park. As developments of this central objective, the current bibliographic production and soundmaps were discussed; a methodology for the systematization and analysis of soundscapes was developed; data of each environment at different times and days were articulated; and a document that allows to start a database of the study of the soundscape and the sound memory of the city of Vitoria was created.

The approach was made through a qualitative and quantitative research, describing the phenomena occurring in the natural environment, using the researcher as the key instrument, turning the information into numbers, in order to analyze them and classify them (Silva; Menezes, 2005). In this work, the sound of urban public environment is the object of study, being translated through a semantic interpretation, the quality of the sound signal, and quantified counting the frequency of occurrence. The technique used was Content Analysis defined by Bardin (2009). Minayo (2002, p.74), addresses the quantitative aspect of this technique, done by "frequency count of appearance features in to the messages content." From the definition of Schaeffer (2007), the aim of this study identifies the sound through the concept of listening, with a semantic analysis.

The objectives directed the delimitations, such as the spatial area, the time frame and measurement method. Other limiting factors influenced, as the period available for the research, equipments, financial and human resources. One researcher made the data collection and one volunteer complemented with photographic records.

The occupation process began in 1536-37 in the central and foundational area of the city of Vitória, Espírito Santo, later expanding through the island from the village founded in 1551-52. The areas of Downtown and Moscoso Park have historical character, containing the most significant buildings, public spaces, monuments, plazas and parks: Moscoso Park and the Plazas João Clímaco, Oito de Setembro, Presidente Getúlio Vargas, Costa Pereira and Ubaldo Ramalhete Maia (Figure 1).

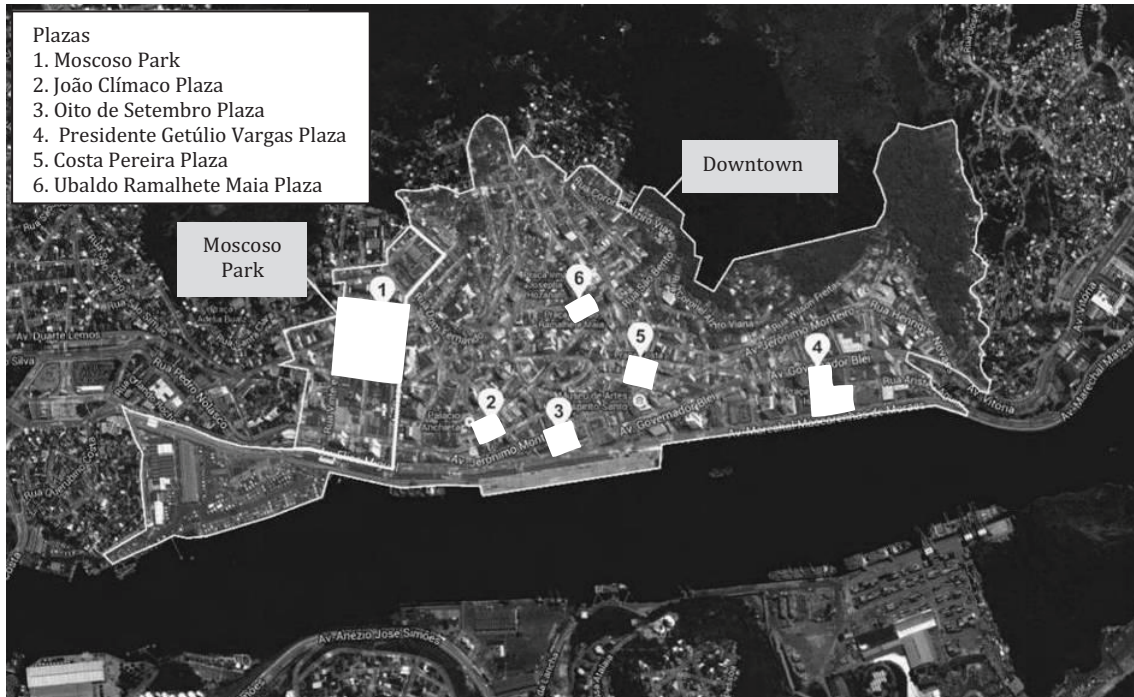


Figure 1 - Location of the neighborhoods and plazas. Source: Google Maps (2014).

The measurement was carried during three days of December 2013, in four periods throughout the day, covering the acoustic peculiarities relating to each time: H1 (from 7 to 10 am), H2 (from 11 to 14h), H3 (15 to 18h) and H4 (from 19 to 22h). The recording time was determined in 10 minutes, through drifting soundwalks, inspired by the "Theory of the Dérive" (Debord, 1954 cited by Jacques, 2003).

Audio recordings and photographs were made, and also sketches of the paths, notes, and relevant informations. A Digital Audio Recorder was used, with wind protection foam, Q3 model, Zoom, generating stereo files in MP3 format. A headphone MDR-ZX100, Sony, allowed to monitor the recordings. Pictures and videos were taken with a digital camera (model D3100, Nikon), generating files in JPG and MOV format.

The systematization of the records proceeded. Audio files were made available on the internet through the platform Soundcloud (Soundcloud, 2014). To cartograph the data collected, the platform "The Sound of the Landscape" was created using Google Maps Engine Lite (Google Maps, 2014), and the paths were georeferenced and identified with links to the audio files. To share the content, the page SoundwalkVix was created on the website <<http://soundwalkvix.blogspot.com.br>>.


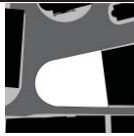
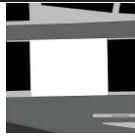
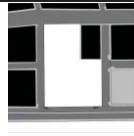


The analysis of the sound recordings were made with the software Sonic Visualiser (2013). The characterization of the Sound Events proceeded with the counting the number of events in each frame of one second of recording. At the end the composition of the events was obtained, with the categories and amounts. After analyzing the Sound Events, a spreadsheet with the number of occurrences was generated, with values in percentage related to the total duration of the recording. The taxonomy used was developed based on proposals of Schafer (1997) and Krause (2008), plus local references, resulting in four main groups, Antropofonia, Biofonia, Geofonia, Stillness and Silence.

The data were organized into individual frames containing the identification of the place, day, time, weather conditions at the time of measurement, the traveled path, the oscillogram, audio spectrogram, images, sound path description and the result containing the set of sounds present in the recording and its representation in percentage. The results were discussed, characterizing the particularities of each one, demonstrated with a chart.

3. RESULTS AND DISCUSSIONS

The physical characteristics of each square are shown in Table 1.

Table 1 - Summary of the characteristics of the plazas.

	P1	P2	P3	P4	P5	P6
Morphology						
Flooring	Sand, Concrete Block, Gravel, Cement floor	Stone Mosaic	Stone Mosaic	Stone Mosaic, Concrete Block	Stone Mosaic	Stone Mosaic
Function	Contemplation Sports, Leisure	Contemplation	Contemplatio Civic	Contemplation Commerce	Contemplation Commerce	Contemplation Sports, Leisure
Landscape	Bush, Tree, Grass, Herbaceous, Palm tree	Bush, Tree, Grass, Herbaceous	Tree, Herbaceous	Bush, Tree, Grass, Herbaceous, Palm tree	Bush, Tree, Grass, Herbaceous, Palm tree	Bush, Tree, Grass
Equipments	Academy, Arch Bench, Bridge Fountain, Lake Cabin, Sports Court, Garden Light Fixtures, Game Table, Playground Monuments	Garden, Grotto Light Fixtures Monuments	Garden, Bench, Light Fixtures, Clock Tower	Bench, Vending Tent, Newsstand, Light Fixtures, Garden, Monuments	Garden, Newsstand, Vending Tent, Bench, Light Fixtures, Monuments	Academy, Garden, Bench, Newsstand Monuments Light Fixtures Game Table Playground Sports Court
Buildings	Administration, Acoustic Shell, Chapel, Snack Bar, Substation	Bandstand, Stairway		Public Bathroom		Pergola
Sound sources	Fountain Academy		Clock Tower, Telephone	Vending Tents, Telephone	Vending Tents, Telephone	Academy
Area	24.000m ²	1.500m ²	2.100m ²	7.500m ²	2.900m ²	1.300m ²

Moscoso Park (P1) can be characterized as an urban soundscape, predominantly with leisure, contemplation and sports ambience. The differentiation of Sound Events occurred along the days and times was mainly due to the variation of uses and users of the park.

Plaza João Clímaco (P2) presents an urban-maritime soundscape, due to the proximity to the port and its characteristic sounds as continuous engines, as well as urban sound. In general, it can be understood as a space dedicated to contemplation and with the presence of many birds.

Plaza Oito de Setembro (P3) contains an urban-maritime soundscape, with the presence of continuous sounds of the harbor, sometimes masked by the sounds of traffic. This soundscape can be described with the predominance of traffic sounds.

Plaza Presidente Getúlio Vargas (P4) is also an urban-maritime soundscape due to its inclusion of important avenues, surrounded by commercial buildings and its proximity to the port and its characteristic sounds, such as engines and ships.

Plaza Costa Pereira (P5) has an urban soundscape basically with a social, commercial and contemplation ambience. The square is often used as a break in the commercial route of the city, with the use of seat benches under the shadows of trees.

Plaza Ubaldo Ramalheite Maia (P6) is inserted in a community ambience. It is an urban atmosphere where spatial appropriation is made by people of different age groups, interacting with the equipment offered. Quiet moments, without the existence of traffic, were also perceived.

The categories of sounds were listed and identified as shown in Table 2. The data collected on different days and times, were organized into individual worksheets comparing the variations of the soundscape. In this article we show the data Plaza Ubaldo Ramalheite Maia with the highest diversity of sounds, as seen in Table 3. The general characterization of the soundscape throughout the day and measurement times are shown in Figure 2. In this figure, the horizontal axis values (1 to 44) represents the categories of sounds and the vertical axis shows the percentages of each category.

Table 2 - Sound categories and their numerical references to the graphics in Figure 2.

Categories			No.	
Anthropophony	Human Sounds	Sounds of the body	Footsteps	1
			Hands clapping	2
		Sounds of the voice	Speaking	3
	Sounds as indicators		Bells	4
			Whistles	5
			Telephones	6
			Alarms	7
		Sounds and Society	Trades, Professions and Livelihoods	Street sweeper
	Vending tents			9
	Factories and offices		Shipyards	10
			Entertainments	Sports events
			Radio	12
			Tv	13
	Music		Live music	14
			Electronic music	15
			Advertisements	16
	Festivals		Fireworks	17
			Religious event	18
	Parks and gardens		Fountains	19
			Academies	20
		Playground	21	
	Mechanical Sounds	Aircraft	Airplane	22
			Helicopter	23
		Transportation machines	Internal Combustion Engines	24
			Hoots	25
			Sounders	26

Categories		No.	
Anthropophony	Alarms	27	
	Bikes	28	
	Manhole cover	29	
	Construction and demolition equipment	Drills	30
		Hammers	31
		Saws	32
		Compressors	33
		Other machines	34
	Ventilators and air conditioners	35	
	Biophony	Birds	36
Insects		37	
Dogs		38	
Bats		39	
Geophony	Air	Wind	40
		Thunder	41
	Water	Rains	42
		Earth	Trees
Quiet and Silence		44	

Table 3 - Soundscape of Plaza Ubaldo Ramalhete Maia in the 3 days and 4 hours of measurement.

	Day 1				Day 2				Day 3			
	D1H1	D1H2	D1H3	D1H4	D2H1	D2H2	D2H3	D2H4	D3H1	D3H2	D3H3	D3H4
1	1,0	1,2	5,0	0,3	37,8	6,7	0,5	35,3	6,3	13,2	9,6	7,2
2	2,8			1,2			1,3	0,7	0,5		0,7	1,0
3	95,2	100,0	100,0	100,0	84,4	100,0	100,0	100,0	100,0	100,0	100,0	100,0
6		0,2	0,5									
9											13,1	
8			4,2						3,0			
11			29,8						23,2		14,3	10,7
12											2,7	
13				3,7			20,0	22,7			81,3	48,5
14				7,5			68,7	26,3				
15	0,8	1,7	7,7	78,5	4,5	81,2	72,8	39,3			7,9	2,3
16										45,5		
20	1,7	11,8	12,5	73,1	5,5				12,7	2,5	4,4	
21												13,5
24	75,3	100,0	100,0	7,3	79,8	55,3	24,8	100,0	100,0	100,0	100,0	45,0
25	2,8	1,0	0,8		0,2	0,2		0,5		0,3	2,7	0,5
28	1,0		4,2			0,2	0,8		0,2		0,2	0,2
27			3,2									
29											0,2	
30										4,8		
34										0,2		
33	0,3		2,5	1,0	1,0	1,0		0,3	4,8	5,2	5,7	
36	97,7	97,2	89,3		100,0	70,7	6,5	0,8	70,3	78,9	75,6	1,0
37												28,8
38	0,8		1,2		4,5	6,8		1,5			1,7	
40									11,8	9,0	0,7	2,0
42									100,0			
43										2,7		7,9
44					20,2							9,5

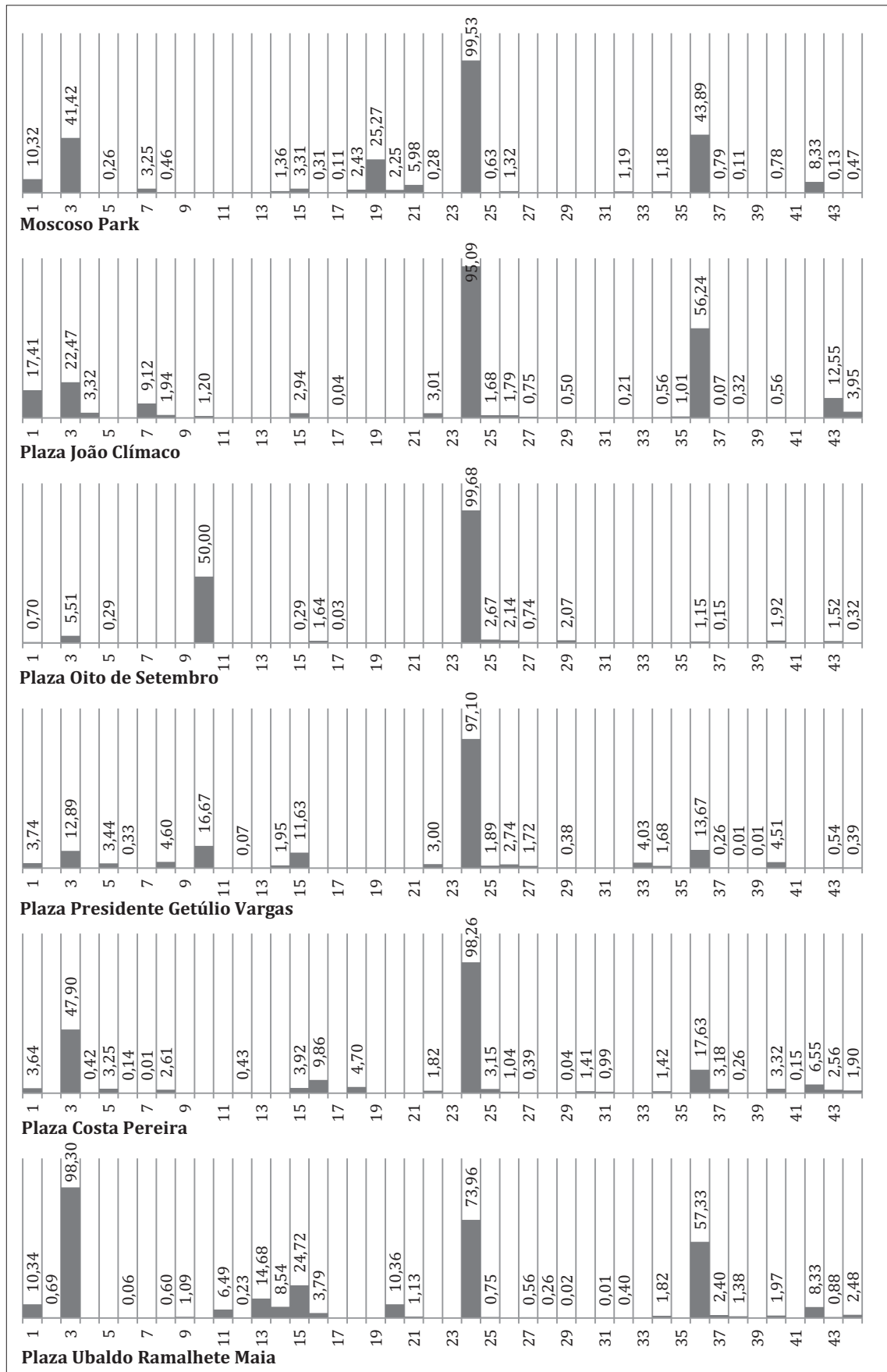


Figure 2 - Set of graphics of the total soundscape of each square.

4. CONCLUSION

In this research, some restrictions limited the spatial area, time and method of measurement. As a suggestion for future research, it is possible to extend the data collection period and the spaces under study. There was a big difference between the sounds of the streets, just as during the days and researched times. It was identified that the Plaza Oito de Setembro has the lowest diversity of sounds, while Plaza Ubaldino Ramalheira Maia has the greatest diversity. The Sound Marks characterized are the sounds of the Cathedral bells, presented in the recordings of Plaza João Clímaco, the fountains of Moscoso Park. The sound of the clock tower of Plaza Oito de Setembro could be part of this item, if it was in operation at the time.

The experience of analyzing the soundscape is distinct from the collection time and the later analysis of the data. During the collection, the body moves and is sensitive to various stimuli, in addition to listening, recognizing more precisely the spatial location and identifying the sources. In the analysis phase, the attention is completely focused on the task and the perceived complexity of soundscape increases. However, some important information is lost in the recording process, the spatial location of the sources and the translation of some sounds difficult to recognize. The location of the low-frequency sounds is more difficult, and the notes taken along the data recording are essential to complement the information.

On one hand it is fundamental to the work of an architect and urban planner to observe the acoustic impacts of their design decisions, considering also the acoustic ecology of environments before interference. On the other hand, the municipality should also monitor the quality of the sound ambience, to plan, control and legislate in accordance with population, in a participatory manner. A great tool for this assistance is the development of skills through the practices presented in this work and the development of studies like this, in partnership with acoustic mappings.

The soundwalk technique was effective for the general characterization of landscapes, learning the dynamics of different ambiences in one recording, developing auditory perception, the awareness of categories and predominance of sounds in the environment. In a second step, based on the resulting data, you can leave for a specific characterization of the Sound Events, with individual recordings.

Many other observations could be added once the collected material is a vast source of information. However, it is concluded that the observations described are sufficient for the purposes proposed in this work. The methodology developed and applied contributed to the characterization of the soundscapes. Understanding the importance of considering the soundscape features in acoustic studies, in addition to the intensity levels of studies, was verified by demonstrating the richness of sound categories composing the environments.

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