DOI: 10.61782/fa.2023.0291

forum acusticum 2023

SIMPLE ASSESSMENT OF THE ACOUSTIC QUALITY OF RECREATIONAL SPACES IN URBAN AREAS

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ABSTRACT

With increasing densification, it becomes more and more important to create, protect and improve recreational spaces in urban areas. Therefore, a group of experts from Cercle Bruit Suisse which is the association of noise abatement authorities in the Swiss cantons, created a simple structured assessment of the acoustic and recreational quality of courtyards, squares and parks in urban areas.
This brief assessment is to be carried out by experienced noise experts, focusing on the acoustic aspects that are important for the general public (e.g. visitors of a park).
The 12 criteria have emerged from research and experience and will be explained in this paper.
One of the most attractive ways to enhance such a soundscape is with water sounds, which can also help to make traffic noise less perceptible.

Keywords: *soundscape quality assessment, recreational spaces, acoustic quality,*

1. INTRODUCTION

With inward settlement development, public outdoor spaces are shrinking. The remaining areas are used more intensively and must meet a wide variety of needs. It is therefore important that these courtyards, squares and parks have a good quality of stay.
The quality of stay in a place is not only determined by the visual appearance, the smell and cleanliness, the micro-climate and the feeling of safety, but also by the acoustic quality, even if we often only perceive this subconsciously.

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But the acoustic quality of a place cannot be measured because it is not a question of sound level: Other parameters such as the composition of the soundscape relevant for the usability of the place and the well-being of the visitors.
The present assessment was developed by the sound design expert group of Cercle Bruit (association of cantonal noise protection experts) with the aim of assessing the acoustic quality as the audible part of the quality of stay.
The aim is to assess the acoustical and recreational quality of courtyards, squares and parks in urban areas in a structured and uniform manner. This brief and rapid assessment is to be carried out by noise protection experts, but with a focus on the acoustic aspects that are important for visitors.
As there is a growing international interest in assessing the acoustic quality of recreation areas, other methods have been developed. ISO 12913 also distinguishes between different sound sources (e.g. natural vs. technical vs. human, ...) in Method A Part 1, while the Tranquillity Rating Prediction Tool (TRAPT) uses only L_{Aeq} and visual parameters. For example, a disturbing low frequency noise from a nearby but invisible industrial site is neglected, but this situation is realistic in urban parks and our method is designed to deal with it. Unfortunately, none of these methods has yet been applied to sites assessed with our method to allow direct comparison.

2. BACKGROUND: SOUND PERCEPTION AND SOUNDSCAPE QUALITY

2.1 We hear sources and events, not sounds

To the question "What are you hearing right now?" hardly anyone will answer "... a dark, oscillating hiss and hum, now and then a bright chirping, and then a relatively loud rising hum". The answer will be: "Distant traffic, a few birds and an unnecessarily accelerating motorbike". The sources and events behind the sounds and their meaning for the listener are more important than the sounds themselves.

Table 1. Perception of natural and "man-made" sounds (modified after [5] based on [4]).

Wind, water, waves, ...	Animals (birds) leaves, ...	Bells, alphorn	Water wheel old tools, ...	Machines, motors, ...	Transportation: cars, trains, airplanes	(Warning) signals
geophonic	biophonic	"archaic"	"historical"	technical		
"natural"		"man-made"				
pleasant / positive				**unpleasant / negative**		
children playing		human voices		people (loud) – children's screams		

This experience is confirmed by research: "It turns out that the ideal (original) soundscape was described mainly in terms of sound sources" [1]. "In particular, the meaning associated with the sound source shapes the quality of the soundscape" [2].

2.2 Positive and negative sounds

What does the public look for in a city park? Surely some nature in a built environment. Scientific studies come to the same conclusion, e.g. [3]: "The quality of a soundscape is highly correlated with natural sounds (positive) and technical sounds (negative)".
In a representative telephone survey of the Swiss resident population [4], noise from aeroplanes, machines, traffic and sirens were described as particularly unpleasant. But not only natural sounds were mentioned as particularly pleasant, but also, for example, church bells. We may therefore include among the positive sounds those from "archaic" or "historical" or "preindustrial" sources, even if they are indirectly man-made (Table 1).
In this same survey, human sounds appear all over the scale, i.e. from "pleasant" to "unpleasant", depending on the specific situation. This is confirmed in [3]: "There was (only) a weak correlation between human sounds and the quality of the soundscape".

3. ASSESSMENT OF THE ACOUSTIC QUALITY

3.1 Assessment principle

The assessment is always carried out on site. It is based on seven main criteria, three specific criteria and two bonus criteria (table 2). Four assessment levels are available: very good (++), good (+), neutral (0), poor (-), very poor (- -). A neutral rating is also set if the criterion is not applicable.
Bonus criteria can only be assessed as "neutral" (0), "good" or "very good". The specific observation that is decisive for the assessment of the criterion is noted in the last column so that the assessment is comprehensible for third parties.

3.2 Reference sites

In order to "calibrate" the assessment, at least two reference locations with a consolidated assessment published by the expert group should be visited and assessed before an independent assessment of a site is made. These reference venues are located in Basel, Bern, Lausanne and Zurich.

3.3 Assessment criteria

3.3.1 General situation, calm

Here, the quietness is meant in comparison to the immediate surroundings outside the site and not the absolute sound level.

3.3.2 Predominant noises

Natural sounds are almost always perceived positively. But according to [4], as mentioned this also applies to bells, water wheels, horse-drawn vehicles, etc., which, although not natural, are preindustrial and culturally deeply rooted and are referred to here as "archaic" or "historical".

3.3.3 Diversity of positive sounds

A variety of positive sounds is more attractive than if e.g. only one bird species produces the natural sounds.

3.3.4 Communication friendliness

Effortless intelligibility of naturally modulated speech is just as much a part of this as sufficient privacy of conversations towards bystanders (not like in a "whispering room"). However, that a conversation in the free sound field remains intelligible at a distance at a low background level is normal and should not be considered negative.

3.3.5 Acoustic compatibility of use

The issue here is whether different uses - from personal conversations to bocce, football games or skateboarding - are possible at the same time without significant mutual

Table 2. Assessment criteria

	Criterion	possible features: positive	possible features: negative
Main criteria	General situation, calm	Quiet, comparatively low noise level	Loud, rather high noise level
	Predominant noises	Natural sounds predominate	Technical noises predominate
	Diversity of sounds and (positive) noises	Multiple positive sounds "audible biodiversity"	Constant, uninteresting, monotonous soundscape
	Communication friendliness	Good comprehensibility, effortless communication with adequate privacy	Loud speaking necessary, or no privacy
	Acoustic compatibility of use	Different uses cause only discrete noise	Uses cause strong disturbances
	Sound propagation and sound reflections	Obstacles shield, no disturbing reflec-tions, absorption softens reverberation	Reflections amplify noise, cause unnatural echoes or reverberation
	Direction and distance tracking of sound sources	Sounds can be located correctly, sense of safety, distant sound sources audible	Sounds cannot be located correctly, hearing at a distance not possible
Specific criteria	Water sounds	Modulated "natural" water sound, water sound masks traffic noise	Water noise dominates, disturbs or/ and interferes with communication
	Special sound sources	Enriching the soundscape temporarily, enhances the attractiveness	Installed sound sources disturb and interfere, no choice to avoid
	Safety from disturbances on site	Blatant disruptions are unlikely or highly rare	Blatant disruptions are common and possible at any time
Bonus c.	Sound space of your choice	Soundscape varies with location, choice of different soundscapes on site	
	Uniqueness, identifiability	Sound landscape recognisable due to positive soundmarks	

interference. An absorbent floor and technical measures (e.g. rubber-damped football grids) contribute to this, as do spatial separation and a natural, but not too low background noise level. If the displacement of chairs by visitors causes widespread disturbance due to an unthought-of choice of material (metal chairs on iron chains on cobblestones), this represents a negative point, for example.

3.3.6 Sound propagation and reflections

Shielding from sound sources attenuates the noise and is advantageous. Reflections – e.g. from buildings directly behind the street – amplify the noise. On the other hand, reflections behind a positive sound source (e.g. a fountain) can enhance its sound. Flutter echoes caused by multiple reflections between unbroken parallel reflecting walls are perceived as unnatural and annoying.

3.3.7 Direction and distance tracking

Good sound quality includes reliable localisation of critical sound sources. Contradictions between the visible position of the object and the direction where the sound seems to come from has an unsettling effect. This applies to both the direction and the distance.

3.3.8 Water sounds

Water sounds are almost always appreciated. The best effect is a naturally modulated water sound without resonances, as occurs in the forest in the natural course of a stream with changing speed, direction and underground. A canalized and/or evenly flowing water, which also sounds (spectrally) "narrow", appears less attractive, but can at least mask traffic noise, i.e. make it less noticeable.

3.3.9 Special sound sources

If special sound sources – acoustic or electro-acoustic – are used at a location to enrich the soundscape, this should not lead to a sound exposure that is always and everywhere unavoidable, but should set a local and temporal accent and increase the attractiveness.

3.3.10 Safety from disturbances on site

If a site suffers from blatant disturbances – e.g. caused by traversing motor vehicles of residents or suppliers with special permits – this limits the recreational value. If the site is naturally protected against such disturbances (e.g. thanks to a narrow access), then its acoustic quality is increased.

3.3.11 Sound space of choice

If the composition of the soundscape can be influenced by a slight change of location (e.g. Münster-Terrasse in Bern: more or less noise coming from the river), this is welcome. Even more if there are several different soundscapes at one location, which makes it acoustically more interesting.

3.3.12 Uniqueness, identifiability

Because it is only rarely possible to identify a place on the basis of its soundscape, identifiability on the basis of a positive sound typical of the place, e.g. church bell, water wheel, ship horn) enhances the place and justifies a bonus.

4. WATER SOUNDS AND TRAFFIC NOISE

Water sounds can enrich and acoustically enhance places to stay in settlement areas such as squares, parks or courtyards. Fountains or watercourses are not only visually but also acoustically an important element of such places.
In addition, they can defuse or reduce the annoyance caused by traffic noise or at least by individual components of it. In this context, the murmuring and splashing of watercourses or fountains is particularly effective against rushing rolling noises, but less so against engine noise containing pure sounds. At low speeds, engine noise predominates over rolling noise, but this ratio will shift as electric mobility increases, with engine noise receding but rolling noise tending to increase due to the higher weight of e-vehicles: The chances of defusing the annoyance of traffic noise with a water noise are therefore tending to improve in the future.
The population almost always appreciates the sound of fountains, streams and rivers, especially if the omni-present traffic noise is masked at least to some extent. It is therefore worthwhile to use these sound sources for the sound design of outdoor spaces and thus to improve the quality of stay of these places.
But for successful masking of traffic noise, the position of the water sound (from a fountain or from flowing water) must be chosen carefully: it should be situated between the recreation zone and the noisy street [6].

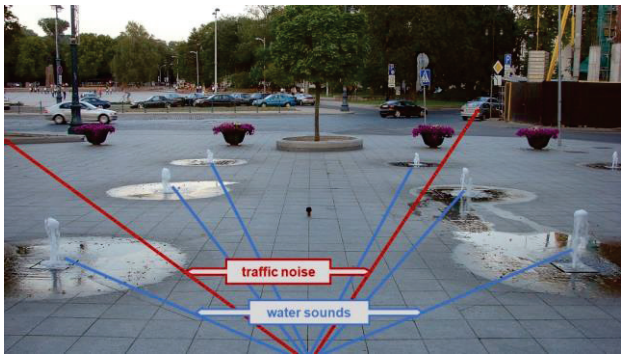

Figure 1. Odminių Skveras in Vilnius

In the best possible case, the angle of incidence of the water noise coincides both horizontally and vertically with that of the traffic noise: On Odminių Skveras in Vilnius, Lithuania (figure 1), the fountains embedded in the pedestrian zone mask the rolling noise from the passing road quite effectively.

5. ACKNOWLEDGMENTS

I would like to thank the colleagues of the expert group of Cercle Bruit for all the discussions and the testing of the assessment scheme in different cities of Switzerland.

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