

## How to validate the urban soundscape?

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### Introduction

Urban planners and other town designers need information to improve the acoustic comfort of the cities. One element of acoustic comfort concerns the urban soundscape. The analysis based on the standard measurements of the Equivalent Sound Level (one spot recording with an omnidirectional microphone during a determined period from a few seconds to a week or more) doesn't allow to describe the urban soundscape correctly. This is why we propose a method of soundwalks through varied urban forms based on the recordings with a "dummy" head and a DAT recorder. We have applied this method to evaluate the soundscapes of different towns in Europe and here we present some results of surveys in Brussels.

### Principle of the method

The urban soundscape is the product of a big variety of soundsources. Only the phonographie is able to preserve its track: the soundscape, composed of sound events [1], is a concept that approaches the sound ambiances without any quality judgment. The sounds are recorded with all their acoustic characteristics (intensity, frequencies, duration).

To approach the urban sound environment we propose the sound walk as methodology. It gives an immediate representation of what we can hear on an urban site according to its occurring activities. The walk of approximately half an hour follows a route that is defined by the needs of our study and is a supplement to the standard acoustic measurements of urban noise (recording equipment is fixed at one point of the facade for at least one week).

The modus operandi is based on the use of a system of sound recording associated with photographs. The completing photos serve to keep a track of on the one hand a part of the urban forms that the walk follows and on the other hand of the type of present sound sources. For the sound equipment the GRECO of Bordeaux choose a DAT tape recorder equipped with two microphonic capsules, equivalent to a "dummy head".

This recording equipment is very manageable in use, and gives access to stereophonic recordings which are similar to the natural binaural listening of the walker. The calibration of the tapes (coupled with the locating of the position of the attenuator) allows, thanks to the Symphony card and the dBEnv software, to sift afterwards in the laboratory each of the tracks.

Thus, we have at the same moment sound signals where city-dwellers can listen to, for example in the framework of a research on their opinion on the quality of the urban sound

comfort, and the calculated data comparable to the results of the measurements.

This information is presented in the form of "acoustic images" [2] what allows us to visualize the evolution of spectres during the time of the walk. Knowing that every moment is associated to a point of the route, we indeed have thus an immediate evaluation of the soundscape of a site

## Soundscapes of Brussels

### Choice of the urban spaces

To validate our protocol we tested it in many cities in Europe, in different urban forms with varied sound sources. In a previous paper [3] we showed how it allows to distinguish the soundscape of a "car free" Sunday from the soundscape of a Sunday with cars in the town of Bordeaux.

This paper deals with a study of two places situated in the centre of Brussels, in June 2003: the "place du Grand Sablon" and the "jardin du Petit Sablon". The following map (Figure 2) shows the situation of these public spaces and the routes (black dotted) followed for the recordings

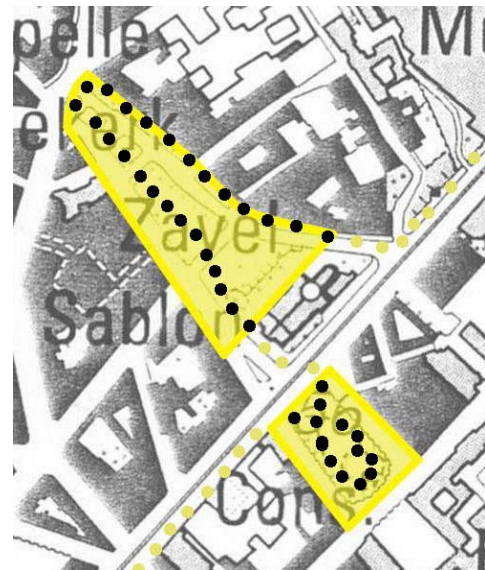


Figure 1: Situation plan of the 2 places and the routes

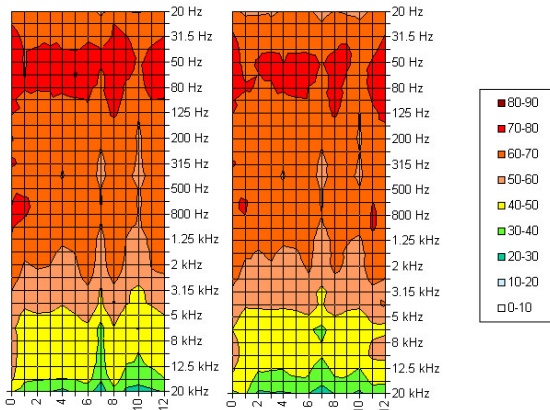
### Analysis of the recordings

#### Place du Grand Sablon

The walk starts in the "rue de la Régence" by leaving the church Notre Dame des Sablons on the left, and continues farther down the square with a stop at the level of the fountain before going back by the parking up to the "rue de la Régence" by keeping the church always on the left.



**Figure 3:** Landmarks on the plan. For the photos, the orientation of the eye indicates the direction of the view.



**Figure 4:** Acoustic images of the route: on the left one the left track, on the right one the right track.

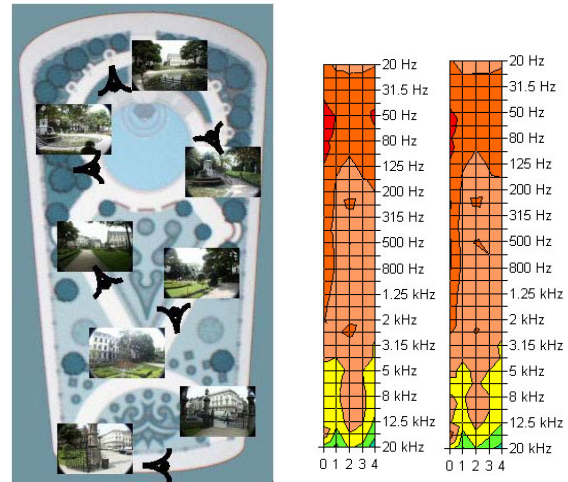
By referring to the legend, we observe that on the whole walk the sound level is loud (between 60 and 70 dB) until the range of 2 kHz, with even more important values (until 80 dB) in the bass frequencies. This really reveals that there is quite some circulation of motors vehicles in this space. This characteristic of the site is accentuated by the clearly perceptible circulation noise on the pavement surface of the road.

During the pause of 3mn (from the 6th mn) near the fountain the reading of the sound level meter IdB gives a Leq value of 62 dBA. Only the passage of vehicles, which can stand out from the background noise, is until the 9th minute more marked on the left, Marking the moment the route crossed the parking and the traffic was situated at the right side of the walker and a little more outdistanced than in the first part of the walk (confer photos on the map of the walk). The sound signal, which appears at the end of the route in the high-pitched frequencies on the right track, corresponds to the music which comes out of a car waiting for the traffic lights which allows to join the "rue de la Régence".

Globally, the sound saturation of the site is confirmed by the very big resemblance of the signals perceived by each of the ears. This, except in the case of occasional very strong noises, also translates the difficulty to track down the origin of the sounds.

## Jardin du Petit Sablon

Facing the garden, the walk begins by entering the left gate entrance. The walker goes to the fountain, goes round and leaves the garden by the right gate.



**Figure 5:** Same reading rules and same legend of colors for the dB levels as previously.

On the acoustic images we clearly see the moment (1mn) where the traffic noise coming from the "rue de la Régence" is filtered with a decrease of the sound level in the bass and the mediums. The acoustic mark of the fountain is put in evidence by the modification of the spectral answer between the 1st and the 3rd minute: the sound level increases sharply in the high-pitched ones during the tour of the pond and particularly for the left ear which is turned to the water. In the 2nd minute a sound of a horn appears (about 250 Hz and 2,5 kHz) and marks in particular the left ear which at that moment is turned towards the "rue de la Régence".

What characterizes the soundscape in the garden is not related to the fact of being in an intrinsically less noisy space, but to hear other sounds than those of cars, buses, trucks and the tram.

## Conclusion

This first analysis of the sound ambiances of two places in Brussels is based on soundwalks made during only one period. Nevertheless they allow to identify the significant character of the soundscape of each of them. The "place du Grand Sablon" is marked by traffic noise predominance, and the soundscape of the "jardin Petit Sablon" is marked by the presence of the fountain.

## References

- [1] R. Murray Schafer *The Tuning of the World* A. Knopf Editor, NY, 1976
- [2] C. Louwerse and al. "Characterisation of the urban sound environment based on psycho-acoustic criteria", 3<sup>rd</sup> Forum Acusticum, Sevilla, 16-20 Sept. 2002
- [3] C. Semidor ""In town without my car!" : a new urban soundscape", 20th PLEA, Santiago de Chile, 9-12 Nov. 2003