Comparison of soundscape on the ground floor of tube-houses in Hanoi and open urban space in Bordeaux

Tuan Anh Nguyen

GRECAU Bordeaux, Ecole Nationale Supérieure d'Architecture et de Paysage de Bordeaux, Talence, France

ABSTRACT: Each urban space has its own soundscape: a specific sound level distribution according to its urban form. Urban morphology and soundscapes are the topics of many research fields. The definition of the relationship between urban morphology and its soundscape gives the clearest appreciation of urban forms through their soundscapes. This paper also approaches the dominant urban morphology features and specific soundscapes on the studied areas of Hanoi and Bordeaux. Besides, a comparison between eastern and western urbanism soundscapes is made.

Keywords: Soundscape, urban morphology, urban form, open space, tube house.

1. INTRODUCTION

The research deals with Hanoi's old town and Saint- Michel quarter in Bordeaux. Hanoi's old town started as a gathering of artisans on a traditional socio-economic basis resulting in a multi-purpose space used for living, trading and crafting. The basis structural elements are the tube-houses, which have a narrow front (from 3 to 4 meters) and a long depth (from 20 to more than 50 meters).

Because of the fact that those houses host at the same time goods production and sales, they need to have big ground floor spaces. That is why most of the houses have their main ground floor doors open. Trading goes on from the morning till ten o'clock in the evening during the week, resulting in a noisy environment throughout the day. The sound levels change clearly from indoor spaces to outdoors ones [1].

Saint-Michel quarter in Bordeaux has also an ancient history, which has given it its own character and specific features. The vehicle circulation ways set its contour, it is linked to the rest of the city through secondary roads and it is well connected to the surrounding quarters. The circulation axis converges into Saint-Michel square [2].

U-shaped streets and narrow dead-ends divide the area into blocks of small dimensions resulting in a low number of dwellings per block. The small distance between consecutive streets also results in many junctions and empty spaces.

We can also find in the studied zone, a place of vital importance for the quarter: the Meynard square, which is a big open space. The permanent soundscape is different in the open spaces and in the closed ones.

2. EQUIPMENT, RESEARCH METHOD AND REPRESENTATION DATA

2.1 Equipment

The equipment used was the following:

- Dat recorders (Tascam DA-P1, Sony TCD-D1)
- DAT tapes
- Sennheiser microphones (MKE 2002 and MKE gold) set as a dummy head called SEB (Binaural record system).
- Symphonie Card.
- Calibrator.

To transfer the recorded audio signals from the DAT machine to the computer, we used the 01dB software dBFa 32. Both the recordings done in Hanoi and in Bordeaux were carried out using this equipment. (Fig 1)

Figure 1: Sound recording and data analysis equipment.

2.2 Research method

The method proposed here is based on a new concept called "the soundwalk". This kind of measurement consists on walking along a pre-defined route on the area under study while recording the sounds taking place throughout the walk. The walker has to carry two microphones, positioned next to their ears so that a binaural recording is done. In order to achieve the best results we performed the most appropriate kind of soundwalk on each site: simple, continuous or parallel. In addition to this method, we implemented a fixed sound recording method. This

kind of measurement consists on staying on a specific spot for a certain time (not shorter than 5 minutes) while recording the sounds taking place there by means of the binaural recording technique explained before. Pictures were also taken while doing the sound recordings. (Fig 2)

Figure 2 : Soundwalker and sound recording on a fixed point.

2.3 Data representation

After transferring the recorded signals to a computer, it is possible to obtain a graphic representation of the average sound level over frequency bands (thirds of octave) for a given time period. A 3D view of that would be a classic representation. However, a 2D representation, called the acoustic image, enables an easier data interpretation by showing the time on the horizontal axis, the frequency on the vertical one and a range of colours representing the sound levels. This colour scheme is explained in a key, which shows the colours corresponding to the different sound level bands (10dB bands). [3] (Fig 3)

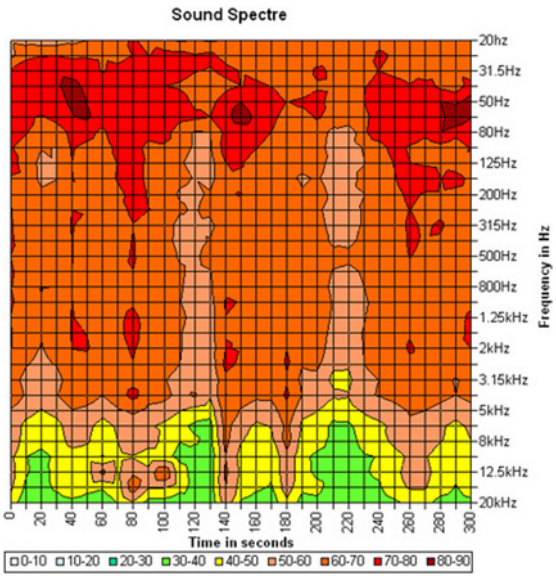

Figure 3: Acoustic image and its key

3. THE CASE OF HANOI'S OLD TOWN

3.1 Urban morphology features.

As shown below, Hanoi's old town is a particular area of the city. It has a specific urban morphology with narrow streets and small tube houses. Those factors result in a high number of dwellings per block.

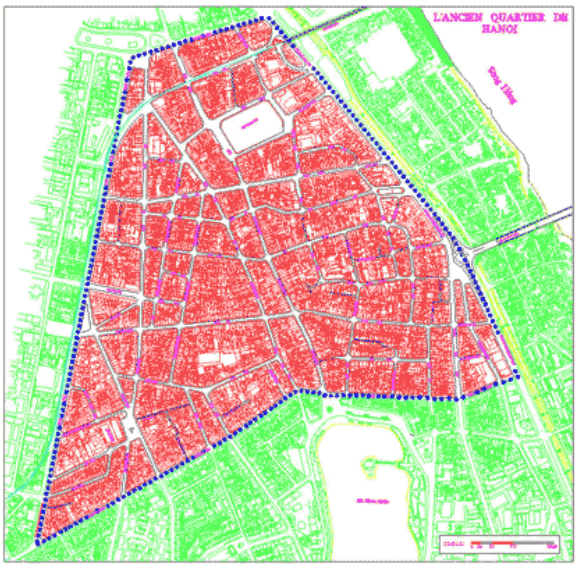

Figure 4 : Hanoi´s old town.

Nowadays, the tube-houses have become multipurpose spaces where people live and goods are produced and sold. Most of the production and trading activities take place by the houses main ground floor doors and that is the reason why those doors are usually open. Besides, production activities require large spaces and opening the main doors, helps maximize that factor. [1] (Fig 5)

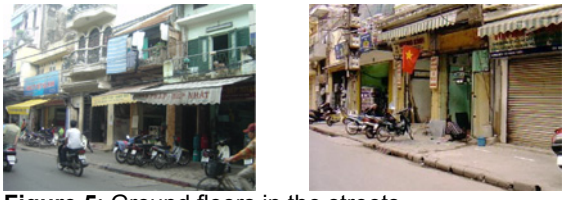

Figure 5: Ground floors in the streets.

3.2 Soundscape features

Hanoi's old town dates from the seventeenth century. It linked traditional craft villages to a direct trade basis. It emerged upon a historic base and nowadays it has become a big shopping area for the city. It has every dominant feature of a traditional commercial quarter. The high population and circulation densities generate a noisy soundscape throughout the day. The sounds associated to the production activities also contribute to make the soundscape noisy. [4] (Fig 6)

Figure 6 : High population and circulation densities in the streets.

3.3 Sound recording results.

The sound recordings were done on the ground floor of a tube house in the block under study. Two different recordings were done, one of them inside the

house and the other one outside. Both of them were done in fixed position during 5 minutes. The recording point chosen for the inside recording is in the middle of the ground floor. The one chosen for the outside recording is on the sidewalk outside the house. (Fig 7, 8)

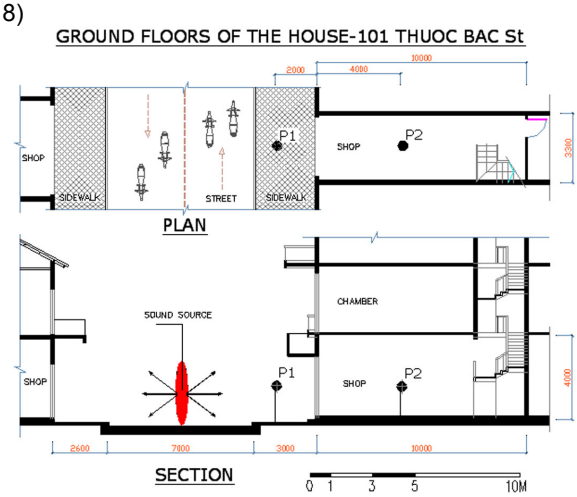

Figure 7 : Plan and section of the house where the measurements were taken (101, Thuoc Bac St)

Outside recording point Inside recording point

Figure 8 : Outside and inside recording points.

We can clearly see that the distance between the two recording points is short. The main sound source is the traffic noise in the street.

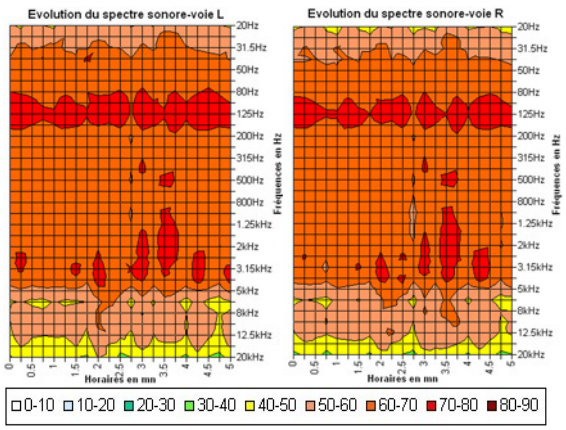

Figure 9: Acoustic images obtained from the outside recordings.

This acoustic image shows a high noise level in the street. The noise main level is 60-70dB. We can also notice that this noise spreads over a very large frequency area ranging from 31.5Hz to 5Khz. The sound perception depends directly on the outside sound sources. The sound level is the same on both ears. That shows that the traffic on the two-way road is continuous. The highest sound level (80-90dB) is due to the mopeds and cars horns. (Fig 9)

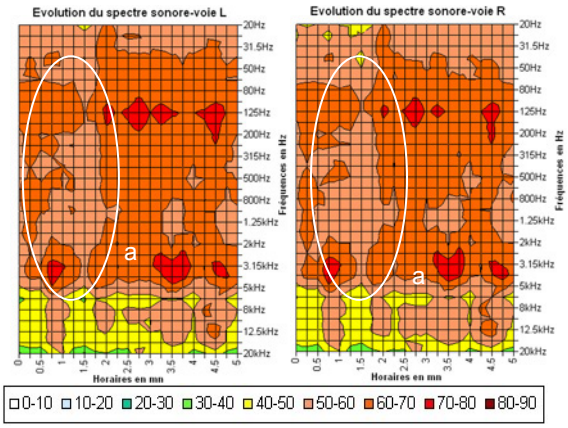

Figure 10 : Acoustic images obtained from the inside recordings.

The inside recording acoustic image shows a very different sound level spectral distribution in comparison to the outside recording one. This is specially noticeable over the “a” zone where we can clearly appreciate the tube houses attenuation effect over certain frequency bands (filtering effect). Both points´ acoustic images show high sound levels (70-80 dB) distributed over the same frequencies. The comparison between the acoustic images reveals the effect of the diffuse field due to the ground floors urban form. (Fig 10)

4. BORDEAUX SAINT-MICHEL QUARTER CASE STUDY

4.1 Urban morphology features.

Saint-Michel quarter is a Bordeaux city centre specific area. Dominant features of ancient urban morphology are concentrated there.

Figure 11 : Bordeaux centre.

A typical zone of Saint-Michel quarter was chosen for the study. The same commercial activities and trading fashions as in Hanoi´s old town can be found there. The studied area is divided into small blocks by

narrow streets and dead-ends. Those small blocks are divided into tenements. The long and narrow blocks are built one after the other. The empty spaces as the courtyards and the small square blend in with the urban structure. Meynard and Duburg squares are big open spaces next to the studied area. [5] (Fig 11)

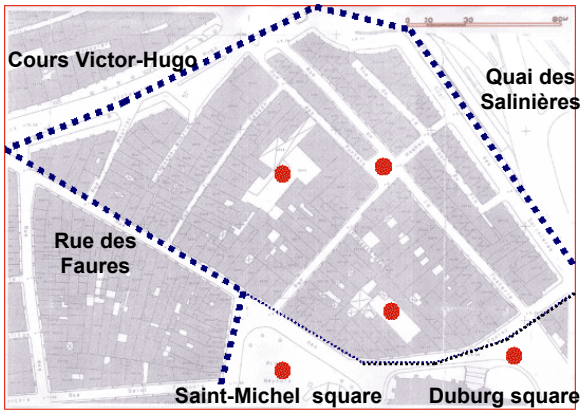

Figure 12: Big empty, open spaces.

4.2 Soundscape features:

Three important factors are to be highlighted around the area under study:

- The high traffic density along Cours Victor Hugo.
- A complex transport junction between Bir-Hakeim square and Quai des Salinières.
- The commercial and leisure activities in Rue des Faures and in Saint-Michel square.

The soundscape in Saint-Michel quarter shows the noise generated by traffic and commercial activities like in Hanoi's old town. The trading fashions in Saint-Michel are outdoors markets, greengrocers and off-licences. The commercial activity takes place every morning and it is heavier during the weekend. [5]

Figure 13 : Rue des Faures and Cours Victor-Hugo.

4.3 Sound recording results.

In order to study the distinctive factors of the open space of quarter, two sound recordings were performed: a soundwalk and a recording in fixed position. Both recordings were done in Rue des Faures.

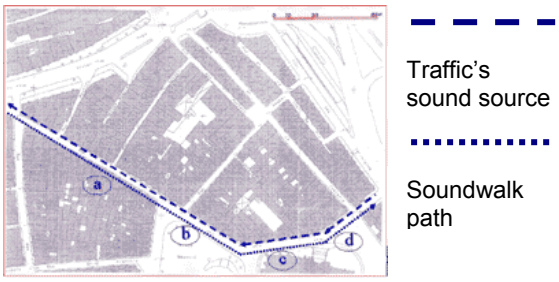

Figure 14 : Soundwalk

The soundwalk starts at the beginning of Rue des Faures. (at its junction with Cours Victor Hugo), goes across Meynard square ("b" zone), then across Duburg square ("d" zone) and finally heads towards Quai des Salinières. The main sound source is the traffic, which is facing the left ear.

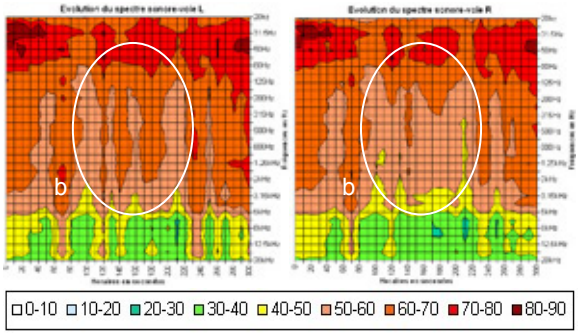

Figure 15: Acoustic images obtained from the soundwalk recording.

The acoustic image shows how the equivalent sound level spectral distribution is not uniform throughout the soundwalk. The "b" zone Meynard square is clearly, an open space where the sound field is well defined. The equivalent sound level on the left ear is higher than on the right one because the left ear is facing the sound source (traffic) whereas the right one is facing the open space and it does not get the reflected sounds. Also, the only sound sources in Meynard Sq. are the human voices. The equivalent sound level of 50-60dB is mainly caused by the wind. (Fig 15)

The soundscape features on the fixed recording points will be now analysed.

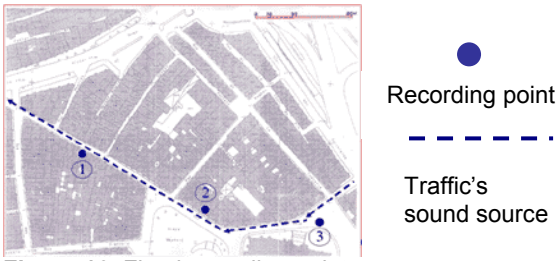

Figure 16: Fixed recording points

These sound recordings represent specific points in Rue des Faures. Recording point 1 is located on a closed space (reflected field) and recording points 2 and 3 are located on an open space (free field). We are not comparing the results between different

recording points but analysing the soundscape features around them, especially in the open space (recording point two). (Fig 16)

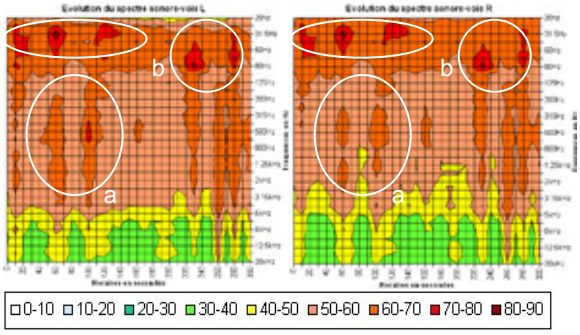

Figure 17: Acoustic image obtained from the recording done on point one.

We can see from the acoustic image obtained from the recording done on point 1, that the spectrum is quite different, due to a traffic density reduction. The equivalent sound level distribution is equivalent for both ears. However, the equivalent sound level in "a" zone is different because there is some noise coming from Cours Victor Hugo. The highest sound levels (80-90dB) are equally distributed over frequency on both ears though (''b'' zone). (Fig 17)

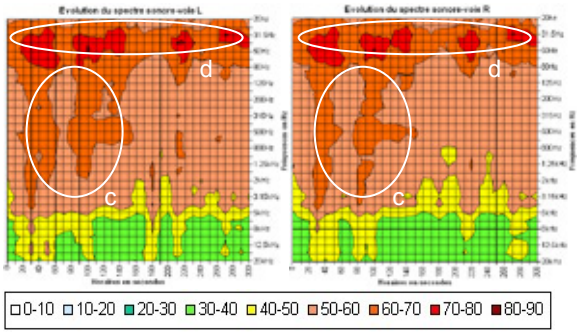

Figure 18 : Acoustic image obtained from the recording performed on point 2.

We can see this acoustic image how the equivalent sound level spectral distribution is not the same on both ears. There are noticeable differences between the left and right ear acoustic images because the microphones were exposed to different sound sources in the open space ("c" zone). The highest sound levels (80-90dB) are equally distributed over frequency on both acoustic images though (zone d). (Fig 18)

We can notice how the equivalent sound level over the low frequencies is the same on recording points 1 and 2. That means that the sound source is quite powerful.

Some general observations about the specific soundscape and urban morphology features in Hanoi´s old town and Saint-Michel quarter in Bordeaux are the following:

- The traffic noise influence on the soundscape is quite noticeable.
- The equivalent noise level is the same on both studied areas.
- The equivalent sound level spectral distribution is different on each sound field. In the "U" shaped streets in Hanoi, the sound field is clearly diffuse due to the urban form of the ground floors. However, the equivalent sound level spectral distribution is uniform in the street and not inside the houses. In Saint-Michel quarter in Bordeaux, the sound distribution is uniform in the "U" shaped streets (diffuse sound field) but it is not in the open space.

5. CONCLUSION

Our conclusion is that both sites (Hanoi´s old town and Saint-Michel quarter in Bordeaux) soundscape analysis enables a main urban morphology features definition. This analysis helps us to have an exact observation of urban morphology through soundscapes.

ACKNOWLEDGEMENT

The author wants to thank Ivan Ricoy, sound engineer, for his help during his training course at GRECAU.

REFERENCES

[1] Les Cahiers de l'Ipraus, Hanoi-Le cycle des métamorphoses, Edition Recherche/Ipraus, 2001.
[2] Etude pédagogique, Analyse des places et programme d'aménagement, École d'Architecture et de Paysage de Bordeaux, 1996-1997.
[3] C. Semidor, The soundscape as a component of urban comfort : the case of Place Paul Doumer, 22th PLEA, Beirut, Libanon, 13-16 November 2005.
[4] T.A. Nguyen, Morphologie urbaine traditionnelle et ambiances sonores dans l'ancien quartier de Hanoi, Symposium BMB, Bordeaux, 5-7 Avril 2005.
[5] T.A. Nguyen, C. Semidor, Relationship between urban activities and soundcape: commercial areas in Bordeaux and Hanoi, 23th PLEA, Geneva, Switzerland, 6-8 September 2006.