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# ACOUSTICS 2012

## Plural perception of urban soundscapes in public transportation

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This paper deals with the study of plural perceptions of the urban landscape during a public transport journey daily lived by users and non-users of electronic devices such as a Walkman, mobile phone ... To assess possible cultural appreciations of the public transport users in their representation of soundscapes, this experiment was conducted in the tramway of Bordeaux (France) and in the "tren ligero" of Guadalajara (Mexico). The followed protocol consisted of two phases: a way out with an "electronic device" and a way back without. During these two trips, we provided on the one hand recordings of the soundscapes using the methodology developed by GRECAU allowing having objective data and on the other hand interviews with the subjects from which changes in feelings and behaviors were interpreted.

## 1 Introduction

The concept of sustainable development is based on several "pillars" including environmental quality and social equity. At city level this means comfortable and appreciated sustainable public spaces, free from nuisances and pollution, low energy using, respectful towards the natural and architectural heritage and socially just. This last assertion can be represented by three following requirements of urbanity that meet general approval: diversity, mixity, proximity. Thus, any behavior, voluntary or involuntary, which tends to move away from these requirements, poses the question to the decision maker and the urban planner about the possible implementation of the overall concept.

The public space is shared by all users and includes both open and closed built areas, and the public transport (bus, train, tram ...) that cross the city. These modes of transport that are an integral part of/in keeping with the concern for sustainable development (reduced environmental impact) are daily used by users with multiple preoccupations and one wonders how they perceive the urban and social diversity, social mixity and proximity between individuals during their travel, especially when it is their cultural practice to listen for example to an mp3 player that can be described as a technological "prosthesis".

Therefore, one can ask the following questions: being cut off from the auditory world around us, how changes this the perception of the other senses? Is it necessary to have plural perceptions to stay in touch with the urban environment? What signals from others and the metropolis are significant if one of our senses (the hearing) is "occupied"?

The present paper deals with the implementation of the protocol, its validation with some subjects and the lessons learned to continue this type of interdisciplinary study.

## 2 Study Protocol

The study protocol in place should allow on the one hand describing the soundscape on public transport during the trip and on another hand to assess the appreciation scores of the users with and without "prosthesis" for the urban landscape and their immediate environment. In addition to estimate the cultural part of this practice and its impact on the experiences, we conducted experiments in two cities where the social and economic relations are different: Bordeaux, Aquitaine metropolis in France and Guadalajara, the capital of the province of Jalisco, Mexico.

The selected transport modes are the tram in Bordeaux and the "tren ligero" (electric train) in Guadalajara. To evaluate the specificities of the soundscape we used the methodology developed by GRECAU [1] based on binaural recordings made during the inward and outward public

transport trips. The analyzed data are represented as commented "acoustic images".

To obtain the opinions of the users (young mp3 users from 17 to 23 years old) interviews were conducted either during or at the end of the travel. The outward journey is done with the mp3 and the inward journey without.

In order to keep track of the user experiences, throughout the journey photographs were taken inside and outside the public transport of the situations, with or without noise, and the urban landscape through which one travels.

## 3 Analysis of different data

### 3.1 Evaluation of the soundscape

The pictures (Figures 1 and 2) taken can place the sound sources in the environment of the subject. Indeed in a confined space as a train or train the sound field is rather diffuse what we recognize in the similarity of the two acoustic images (Figure 3). It was therefore difficult to locate the sources in the environment.



Figure 1: Tram bell during opening and closing doors (tren ligero).



Figure 2: Air-conditioning event (tren ligero).

To have a trace of all noise events (sonoscenes), supposed to be perceptible by the participants during the

trip, binaural recordings were provided which can be seen on the acoustic images of Figure 3. In fact the carrier of the recording system was always near the research subject.

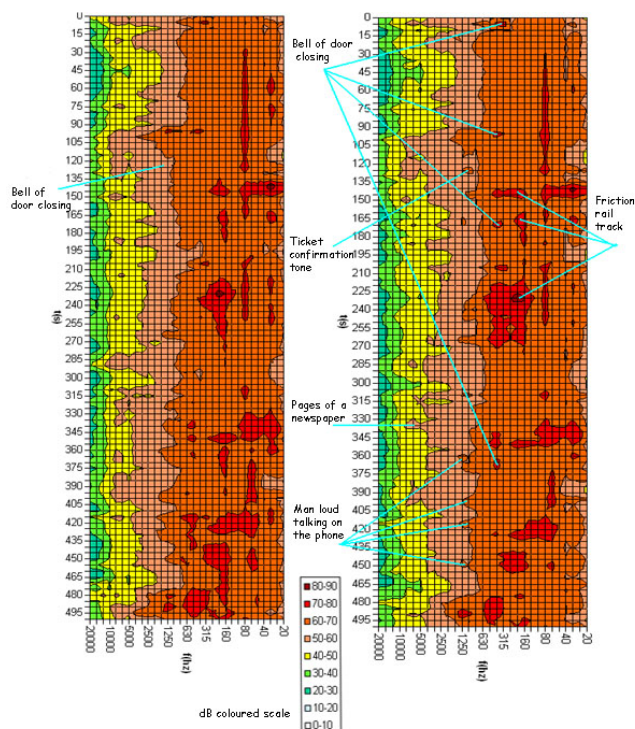


Figure 3: Recordings left channel and right channel during outward tram trip in Bordeaux (with mp3) (Subject n° 3).

Table 1: Round trip: Gambetta-Bergonie with the use of an mp3 player and high quality noise-cancelling headphones (Subject n° 3).

Sound Source	On the right Ear	On the left Ear	SPL (dB)	Perceived	
				Y or N	Annoying
Friction rail track	<input checked="" type="checkbox"/>		80 - 90	N	
Bell of door closing	<input checked="" type="checkbox"/>		70 - 80	N	
Ticket confirmation tone	<input checked="" type="checkbox"/>		60 - 70	N	
Pages of a newspaper	<input checked="" type="checkbox"/>		50 - 60	N	
Man loud talking on the phone	<input checked="" type="checkbox"/>		60 - 70	N	
Audio signal validation of the ticket		<input checked="" type="checkbox"/>	50 - 60	N	

As shown in the comparison Table 1, on the outward journey (with mp3) the subject has not perceived the sonoscenes (validation of the ticket, someone talking out loud ...) even though the noise level was high (rail track noise ...). Since the listening level of the mp3 was "reasonable", it doesn't concern a real masking of a source by another but a diversion of attention of the subject.

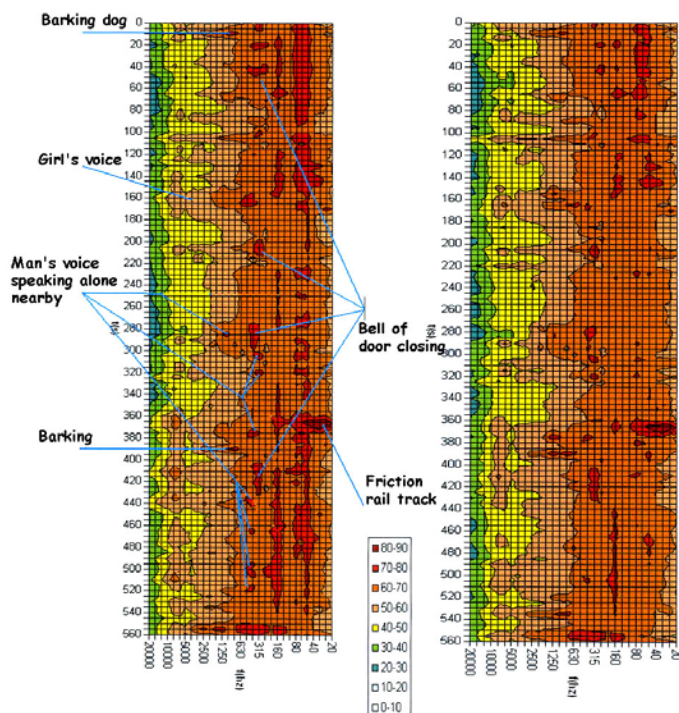


Figure 4: Recordings left channel and right channel during inward tram trip in Bordeaux (without mp3) (Subject n° 3).

Table 2: Return journey: Gambetta Bergonie-without mp3. (Subject no. 3).

Sound Source	On the right Ear	On the left Ear	SPL (dB)	Perceived	
				Y or N	Annoying
Friction rail track	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	80 - 90	Y	<input checked="" type="checkbox"/>
Bell of door closing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	70 - 80	Y	<input checked="" type="checkbox"/>
Barking dog	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	70 - 80	Y	
Girl's voice	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	50 - 60	Y	
Man's voice speaking alone nearby	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	70 - 80	Y	
Barking	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	60 - 70	Y	



Regarding the comparison, (Table 2), between existing sources and sources collected on the return journey without mp3 (acoustic images in Figure 4), on the same sonoscenes that belong to the soundscape of a tram or train ride (opening and closing doors, friction on the rails, discussion between passengers, ...), all recorded noise events have been perceived and the noisiest are described as the most annoying ones.

All trips in Bordeaux and Guadalajara have been subjected to such a "objective" comparison and were then integrated in the analysis of the interviews presented in paragraph 3-2. On the *tren ligero*, of an older technology, in addition to the sound events listed above, we note the presence of noise from air conditioners (Figure 2) in the train and the sound levels are 3 to 5 dB higher.

For the multisensory analysis, a summary table of remarks about all perceptions mentioned by all the subjects was also made (Table 3).

Table 3: Remarks about all perceptions mentioned by all the subjects in Bordeaux.

Journey	Sight	Smell	Hearing	Touch
outward (with mp3)	53	7	0	0
inward (no mp3)	40	13	13	3

It can be seen that the senses are not solicited the same way with and without a mp3. We find this tendency among both users of the tram and the *tren ligero*. It may be noted, however, that Mexican subjects are more attentive to the world around them because the imbalance between the solicited senses with and without mp3 is less important.

### 3.2 First comparisons between the tram ride with and without mp3

We first initiated this research protocol in Bordeaux, in the context of a scientific work on issues concerning large sustainable urban projects in Bordeaux, Bordeaux-Euro-Atlantic [2, 3].

We wanted to assess the conditions of the population's support for the imperatives of sustainable urban development, in their daily lives.

And we then continued and completed our research protocol in the metropolis of Guadalajara, Mexico, under similar public transport conditions.

Two preliminary observations:

- On the basis of interviews made after each trip on the tram and the electric train, we keep sound tracks, registered or not with or without mp3s, certifying that each city and each mode of transport has its own soundscape.
- We notice then, as well in Bordeaux as in Guadalajara that the remarks made by the interviewed passengers, with or without MP3, are identical with respect to the feelings, observations and perceptions. We don't talk about the characteristics of the two transport modes (the

oldest one, the electric "*tren ligero*" of Guadalajara, the other more recent, the tramway de Bordeaux) or the different districts through which the transport of the two cities moves, to focus on our protocol of experiences with and without mp3.

#### Isolation or interactions?

With the mp3, the interviewed passengers, unanimously, notice that they are interacting less with other people or surrounding world, than when they make their journey without a mp3.

Indeed, without MP3, the perceptions of the same passengers are more frequent, more noticeable and more accurate in their own eyes.

They are more alert, more present:

- Auditory sense: they feel more sensitive to the noise on the tram;
- Sense of smell, they are more sensitive to women's perfume or other passenger's breath in general;
- They are more interested in the world around them, outside the tram, they see the traffic, pedestrians go about their business, streets, square and houses along them, and they perceive the changes, movements, variations. And inside the train they are more interested in the conversations of other passengers and more open to the world around them. These last observations were more highlighted by the Mexican subjects.

#### Amplification and dynamic variations

With the mp3, the interviewed passengers find that their threshold of tolerance and attentiveness is pushed upwards in terms of decibels: the harder the sound in their ears, the more the surrounding noise requires amplification to be perceived by the mp3 users.

The more one is exposed to an amplified sound, the more one is deaf to nuances of noise, the more one listens to compressed music (constant intensity) the less one perceives the dynamic variations of other music or exterior noise.

With the mp3 one perceives less exterior elements, there is less feedback, one is more passive towards the outside world. But the noise is imposed on those around us without even realizing it.

Not only does one become deaf to the world but also blind to its presence or indifferent to its manifestations.

Without the mp3, as the same passengers notice, all senses are involved; one is more sensitive and more curious about the world around and in all its expressions, in the same way that one is more bothered by noise or nearby body movements.

### 3.3 With or without mp3, how about plural perceptions?

Busy brains, compressed ears, mobilized bodies, passengers "using" their mp3, experience flows and retranslated in terms of differentiation, confusion and congestion, while without an mp3, they are again aware of plural perceptions.

**Lack of differentiation with mp3, Diversity without mp3**

Their short-term day and night memory is less active and becomes undifferentiated by the immediacy of their amputated plural looks and perceptions.

They hear nothing else but the sound of their mp3, except a sudden and extreme amplification of a traffic accident or a very serious incident in the tram.

They see everywhere only vast passing cars, or stopped cars in traffic jams or in parking lots, and undifferentiated windows and walls flashing before their eyes so that they see nothing else. Their gaze is reduced to the smallest common denominator and their vision becomes undifferentiated.

Without the mp3, they look with all their senses and recognize the towers of 20 or 50 floors of their working-class neighborhoods or their suburb, the walls and gates of the houses in the housing estates, that their neighbors live in a family, and they are rediscovering the lavish facades of the historic center and the windows of their shops meeting all their desires, waiting for the days of sales.

#### **Confusion with mp3, Discernment of mixing without mp3**

During daytime the sun or at night the city lights, falling through the windows of the tram, form transparent visions with the reflections of the passengers in the glass and cars and pedestrians outside the tram.

When one is captured by a single sense, the real and the virtual make us get confused with appearance and reality and get us focused on the only dominant noise.

The GRECAU research [3], during the car-free days (the first Sunday of each month in central Bordeaux) and days with cars, on the same place and same time of day, confirms that the auditory perception is as much subjective as objective. In terms of decibels, the noise is of equivalent intensity, while their perception is out of proportion: the sounds of birds in the trees and children playing are as much appreciated as the noise of the cars are denigrated, although they can be as noisy in terms of noise level.

#### **Congestion Promiscuity with mp3 or Proximity with mp3**

Exposed to the management of mass flow that escapes us, to noise compression that prevents us from perceiving any dynamic change, to the rhythms that beat our bodies and drag us away from our perceptions into another reality, we constantly risk a noise congestion, because of our self-centered isolation, we are left helpless in our amputated perceptions of the polysensorial movements and interactions with our neighbors.

So we live everything in terms of risk of overcrowding and noise pollution.

While, without a mp3, it opens opportunities and possibilities of proximity, shared perceptions, or meetings, were it only through exchanged glances.

Thus, depending the use or non-use of a mp3, the same scene or incident did not pass the same way

In the tram a father reprimands his son, user of a mp3. The son moves away from his father, even goes out of his field of vision at the moment the tram stops at a station. The more the father yells to call his son to order and to find him, the more the incident spread and grew in size and the discomfort of the audience turned into a disapproval regarding the anger and dismay of the father who went out of the tram to go in search of his missing son.

Four stops later, a big brother teased her little brother who began to cry and complained to his mother. The mother looked around and enjoyed the situation. She

crossed the smiling eyes of two or three other passengers who didn't use a mp3, and who attended in silence to the provocation of the big brother. Mother, feeling supported, smiled at her younger son, put her finger on his nose as an injunction to silence him and made a sign saying "shhh" ... while addressing a few words of recommendation in an inaudible low voice to her eldest son to leave his little brother alone. So, the incident ended by an exchange of glances and smiles of shared proximity.

## **4 Conclusion**

First we recall that through the recorded sound stories, we can verify that the sources exist objectively, even when the passengers don't remember them anymore.

We also confirm the validity of our scientific approach, because through the experience of the Bordeaux tram and train in Guadalajara, we put our passenger-witnesses in conditions identical to those of a laboratory and a scientific experiment, with the advantage that it was "experienced" daily.

Finally, the consequences of this observation in terms of sustainable urban development should be measured. These feedbacks highlight the need to link our different "senses" to give urban development, not only a basis of visual relevance, but necessarily a plural one. As soon as we are cutting some senses, we lose the conditions of the global nature of the space and the polysemy of its appropriation by its inhabitants and users.

## **Acknowledgments**

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