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## **Sound quality in railstation : users' perceptions and predictability**

### **ABSTRACT**

This paper deals with sound perception in spatial transitions in railway stations. My purpose is to describe sound qualities or sound failures perceived by users in the aim to create a prediction tool for architects. This paper shows how a specific methodology can be used to develop a catalogue which connects spatial forms, sound sources and social practices. Sociological, acoustical and architectural surveys can describe what users feel for several spatial transitions in stations. Sound quality is approached through acoustical criteria measurement and evaluation of subjective listening criteria. This research led surveys in Paris - Gare du Nord, Paris Gare Montparnasse and Paris - Gare Haussman (Eole line). All these results are feeding global thought on predictability of the sound quality perceived by users in public spaces.

### **1. - INTRODUCTION**

This paper deals with sound perception in spatial transitions in railway stations. My purpose is to describe sound qualities or sound failures perceived by users in the aim to create a prediction tool for architects. This paper shows how a specific methodology can be used to develop a catalogue which connects spatial forms, sound sources and social practices. Sociological, acoustical and architectural surveys can describe what users feel for several spatial transitions in stations. Sound quality is approached through acoustical criteria measurement and evaluation of subjective listening criteria. This research led surveys in Paris - Gare du Nord, Paris Gare Montparnasse and Paris - Gare Haussman (Eole line).

### **2. - SOUND QUALITY**

This work is based on ecological theories of the perception [1] and considers that there is no perception without action. Action and perception are linked and we cannot understand what people feel inside railstation without understand what people do inside. Cultural and sociological criteria have also a great influence on our perception. It is why it is difficult to define which type of sound could be annoying or not. It is always depending on the context, your culture and what

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you are doing at the moment. In other words, we cannot reduce all the complexity and the richness of the sound world in a simple problematic which compares noise with silence.

In this way, this theoretical position implies studying acoustical criteria of sounds, but also how the sounds are perceived and how sounds interact with our behaviours. *Sound quality* deals with the interactions between sensitive phenomena (perceived sounds) and people's activities within the space. *Sound quality* indicates certain qualities of relationships between the sounds, space and social practices. *Sound quality* is not a fixed criterion of the environment. It embodies itself differently with people and time. Consequently, *sound quality* of a space involves a crossed analysis between space, acoustics and people's behaviours.

### 3. - METHODOLOGY

As it is impossible to study *in situ* the same type of architecture in different stations, we choose to study basic social practice which is common to the three stations : a walk of a person which crosses a station to use another mean of transport. Several walks in different stations have been chosen to value architectural devices crossed, sound sources and social practices which can be observed. This very simple action is studied : (1) at different time in the week (with or without public in the space) ; (2) in the 2 ways of the walk (go and back) and in 3 stations in Paris (Montparnasse, Gare du Nord and Eole-Haussmann).

For example, we studied people crossing Paris Gare-Montparnasse when they go out the subway to take domestic train : walk A, B, C, D, E, F – cf. below.

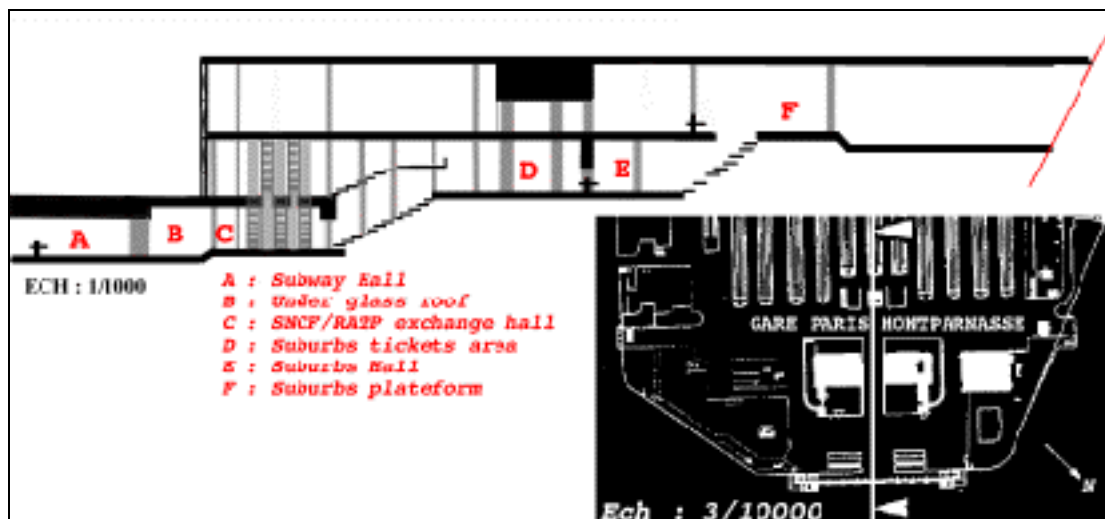


fig 1 : Cut on public spaces in Gare Paris - Montparnasse

Different type of surveys have been made in each station :

1- Acoustic criteria .[2]

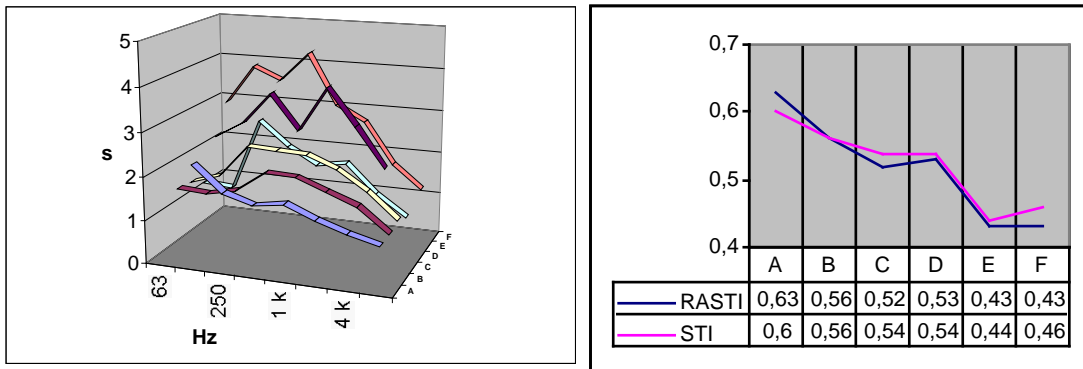
- room acoustic criteria : reverberation times (TR60, EDT), Clarity, STI, RASTI, Decreasing of the sound level with the distance...

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- environmental criteria : sound level pressure during the day, frequency analysis of the ambiances...



tab1 : TR, RASTI and STI on the walk between subway area and domestic trains area (walk A, B,C, D, E, F – cf. map above).

- sound recordings of specific walks in stations in the two ways, at different time of the day. This sound recordings are used for the sociological interviews (cf. below). Sound level pressure and frequency analysis are also led on this sound recordings.[2]

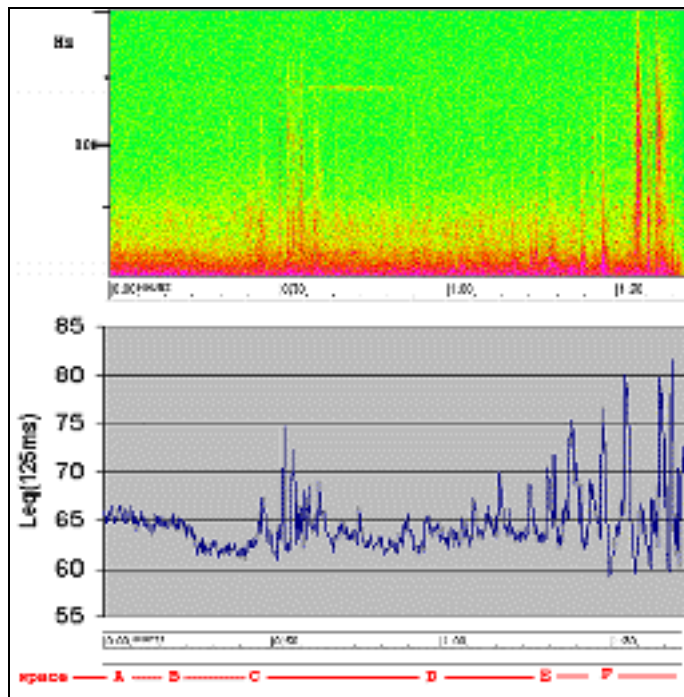


fig 2 : sound walk analysis – Montparnasse walk A, B, C, D, E, F - low occupation in the places-

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### 3 - Subjective criteria of listening:

Conducted story with users have been made based on the listening of different sound walks recorded in each station. Giving the opportunity to listen is a way to help people to describe what it is not usual to describe (reactivated listening [3]). All interviews began with very well known sound tracks. Then we played the same sound walk at different time, then the same walk but in the other way and finally the same walk in a another station. Interviews were recorded , put down in paper and analysed by a recurrent semantic observation [4].

### 4- Architectural analyse :

Each sound walk is described by all the architectural devices crossed by users. This description is focused on "sound architecture", that is to say that all devices which interact with sound and social practices (materials, volume, sound sources, but also benches where people can sit and talk, library, shops, etc...) are described.

Connections between bus (outside place), national trains, suburbs trains are also studied in this way. Same analysis have been led for each walk, each time and each place.

The aim is to understand how *sound quality* embodies itself in different architectures, at different times in the week and with several publics.

## 4. - CONCLUSION

All measurements are finished but the analysis of sociological surveys are still in process. We cannot give any definitive results right now. Nevertheless, it is interesting to see that same "acoustic parameters" can create several sound quality perceived by users. Theses tendencies can be described according to three dimensions : an acoustic one, a spatial and a social one. It could be summarised in a catalogue which can be a tool for architect to predict sound quality in new projects.

That kind of methodology allows us to understand the relationship between these dimensions and see in each context : for example, in the global perception of sound quality of a space, criteria linked to space seems to be stronger in Haussman whereas criteria linked to social practices are stronger than space criteria in Montparnasse or as one user says : "*I can say that in Montparnasse, you'd better not be agoraphobic whereas in Haussman, uou'd better not be claustrophobic !*[*Je dirais qu'à Montparnasse, on n'a pas intérêt à être agoraphobe alors qu'à Haussmann on n'a pas intérêt à être claustropobe !*]".

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- . M. Romagne, chef de secteur, Haussman, UO Eole.

#### FOOTNOTES

[1] STRAUSS E., *Du Sens des Sens – contribution à l'étude des fondements de la psychologie.*, Jérôme Million Editions, Grenoble, 1989, 649 p.

[2] software used are developed by the society 0,1dB (France) : dBFA, dBbati 32.

[3] method developed J.F. AUGOYARD. This method has been often used for researches in Cresson. Lecturer can find description of this method in reference [4].

[4] THIBAUD J.P. and GROSJEAN M., *L'espace urbain en méthode*, (to be published). cf. contribution of AMPHOUX P., CHALAS Y. et Torgue H.