

école national supérieure architecture grenoble

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## How to integrate the sonic quality to architectural design Another approach, a new teaching method

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**ABSTRACT** : The considerations and researches about "built environment" bring out a thermal approach (obviously on grounds of individual saving or global coast on a national level) and to a smaller extent they also refer to lighting approach.

For nearly 20 years the laboratory CRESSON has developed a combined research project of acoustics and sonic environment. Based on architecture, social sciences, and physics, this project gives way to research, conferences, and lately to the setting up of a master degree which is run by two laboratories that are 700 km apart.

A data processing connection, together with a sound connection allow live broadcast exchanges during courses, thus giving way to new teaching methods.

There are presently two types of research or pratice concerning the qualification of sound in a constructed space :

- a type of acoustic which is monumental in two ways, because it involves a large public auditory space and because acoustically these auditoriums employ extremly sophisticated equipment and techniques

- a diagnostic procedure and therapeutic acoustic for buildings affected by noise disturbance

At present, ordinary architecture maintains a respect for the norms and regulations concerning insulations procedures. Sonic quality is not considered as a genuine parameter ready to be programmed and conceptualized. Acoustical remedies are often introduced to correct rather than prevent a problem. The essential fonction of our research group is to propose an multidisciplinary study about sonic quality as it relates to housing and public space, a domain which we refer as ordinary or non monumental architecture.

Active speakers and participants have been sollicited, predominently among researchers in the fields of architecture and urban planning, and of course to found a multidisciplinary research group. Practitioners with experience in this domain and knowledge about the processes used for understanding "acoustic comfort" were also present. And now, our research group has more than 20 persons in the followings fields :

architecture and urban planning, applied acoustics, comparative anthropology of living space (sociology, ethnology, aesthetics), history, particulary for relations between lifestyles and living environment.

In 1991, we have organised an european symposium about "Sonic quality in the living environment" with three different themes, which are still topical :

1) For an adapted acoustic

(but on who is it adapted, and why and how is it adapted)

Present evolutions in this field allow us to pose these question in a different way. First, within an european framework : is it possible to contemplate a homogeny of measurement, norms, and rules, and how do the latter adhere to a criteria for comfort ? The other consideration is presented within a more technical framework : how does one develop simplified technical tools which respond more to desire for quality as opposed to simple easines or concern for viability ? Can we take into consideration a diversified request for acoustic comfort which evolves parallel to restrictive rules and normes ?

Over the past ten years, applied acoustics has been developping two types of innovative and hight performance techniques :

- methods for measuring and simulation for room acoustis

- measurement of intensity

Will these new techniques be able to adapt to ordinary acoustics which will be soon require, for exemple, reverberation time or types of interior insulation variables inside the same housing unit, whereas the current tendency is more forward a standard and uniform type of insulation within different housing units.

2) Acoustic comfort and sonic culture

We can hypothesize that the inhabitants construct this comfort in terms of what seems suitable for them. at this level, the psychological and sociological criteria such as members of a particular age or social group, family make-up, and reference to these different cultural groups are determinated by this personal arrangment and domestic tranquility.

The first aspect of our researchs has been to develop a study of diverse sonic cultures in which very different perceptions and practices can exist in various ways. The second, has been addressed to the intuitive practices of the production of acoustic comfort.

We think now that an overview of acoustical successful housing plans can serve the contemporary designer interested in acoustic comfort. The acoustic achievement is never solely evaluated by the occupant's conception, or experience of comfort. Instead of focusing on universal and ideal configurations, it is more interesting to refer to those procedures within a spacial framework that develop an adequation between the acoustic capabilities of constructions and the cultural caracteristics depending upon the period in wich and the place where the inhabitants dwell.

All our research allows us to relativize the notion of acoustic comfort in terms of the social groups concerned and conveys how cultural identity constitues itself in sonic terms.

## 3) Acoustic comfort in architecture

All edifices or designed space include an acoustic comfort or discomfort which can be identified in two ways : in terms of architectural conception, or in terms of criteria determined by those who use the space.

This theme will be developed within this concept of the "potential for acoustic comfort" $^{(1)}$ 

- the relationship between the organisation of space and the possibility of physical propagation and the human distribution of sound/noise emited by the building occupants

- the way that one inhabits a space, naturally creates an acoustic comfort

- the role and place of sound objects which offers a certain comfort throught utilization for the inhabitants, is also at times a source of acoustic discomfort for those on the exterior

- relationship between the interior and exterior sonic environment. It is important to understand how the exterior environment may influence the practices of comfort and the adaptation within the interior environment. This analytic axis aims to restore the practical and theorical balance between the housing unit and the environment.

Our researchs shows that sonic comfort has a much larger signifiance than what is usually considered in terms of acoustic insulation, and that the dweller is known to be an active dimension in this process. Comfort does not exist "once and for all"; it acts within a process !

CRESSON laboratory works for more than 15 years on "Sound effect" which can't be reduce to either objective or subjective data.

It allows a meeting, an interaction, a correspondance between the measurable objective Soundscape, the Soundscape of a cultural community and the one, inner to any individual.

Open to acuriate descriptions wheter from an acoustic point of view, from an architectural one or from a psycho-sociological one, the Sound Effect can first hepl unifying the fields of knowledge on sound and sound practices.

It can also be particulary useful in measuring, describing complex sound situations or as an instrument of representation, intervention as well as an aid in teaching (2).

Since then we have created a graduate degree with another laboratory.

## An original approach...

The graduate degree "Ambiances architecturales et urbaines" offers the diploma of "DEA" (Diploma of Advanced Studies : equivalent to a master's degree) in Architectural Acoustics and Sound Environment. This program was created in 1991 by the "Center for Research in Sound Space" (CRESSON : Centre de Recherche sur l'Espace Sonore et l'Environnement Urbain) of the school of Architecture in Grenoble, and the "Center for Research on Methodology about Architecture" (CERMA : Centre de Recherches Méthodologiques en Architecture et en Aménagement) of the school of architecture in Nantes (France). Those centers have developped this program to include research and course work.

This DEA is followed annually by about 25 students, in the two towns, with NUMERIS system.

The main courses

- Urban and architectural ambiances
- Computer science
- Simulation
- Comfort
- Human ecology
- Methodology

are realized on the two sites, and a digital telephon connection allows the contact between teacher and students. So, there is a double contact (in real time) by computer and by voice.

Optional courses are realized on each site

- in Nantes (Lab CERMA) : thermical

- in Grenoble (Lab CRESSON) : acoustics and lighting (for lighting we work too with Lab LASH in Lyon)

The field of acoustics has often been reserved for the engineer or technician. The architect, who works in this domaine, perceives sound as a normative problem (insulation, legal codes...) or in terms of disconfort (complaints or law suits). The gual on a long-term basis is to modify the profesional's attitude about environmental sound. He/she has generally considered it on a purely normative basis. How can environmental sound play a role from the conception/realisation of an architectural design ? Shouldn't it be a fondamental element in the creative imagination of those who construct and design ?

The originality of this program is that it offers an awareness about the use and practice of "concrete building space". This involves an anthropological approach to the study of environmental sound and course world which offers a scientific and technical perspective on architectural acoustics.

# New specialists in Environmental Sound...

- Participation on a local level (programmed operations, rehabilitation, urban planning, and renewal).

- Working with specialists (French Economy Societies) as consultant or regular-term involment.

- Fulfilling a new demand for architects who are specialists in urban acoustics and construction.

- Member of a research team in urban planning, architecture, and/or environmental design.

- and of course, researchers in laboratories

For many years, the demand for new specialists in environmental sound has substantially risen. This is evident from the number of administrative and professional correspondants who have sollicited our work. These most recent orientations in French research in the field of noise/vibrations interest to develop this interdisciplinary program. In addition, the assessment of problems in environmental sound "in situ" unstigated the immense and urgent task of improving environmental acoustics (urban facades, expressways, the treatment of housing units).

One must also consider the influential presence of the sound media in every day life which can not be treated without a strong understanding of space design and sound communication.

## Contribution to research and innovation...

From its unique profile and the pertinent work it produces, CRESSON directs the students of the DEA program into a contributive position in research and innovative methodology.

Actualy more than 30 students have succeed a DEA, and they are 8 engaged in a thesis (4 in Nantes and 4 in Grenoble)

Responsables for the training :

Grenoble

-J. F. AUGOYARD, Philosopher urban Planner, Researcher for National Center of Scientific Research with the University of Grenoble II, Director of the CRESSON at the school of Architecture in Grenoble.

-J.J. DELETRE, Engineer, Acoustician, Professor of the Schools of Architecture, the scientific director of CRESSON.

<u>Nantes</u>

- J.P. PENEAU, Architect, Professor of the Schools of Architecture, Director of the CERMA at the school of Architecture in Nantes

- P.Y.NIZOU, Professor of the University in Nantes (ISITEM)

Lyon

- M.FONTOYNONT, Enginer, Director of lighting division in LASH (ENTPE)

(1) Chelkoff G. et alii : Bien être sonore à domicile - Architectures du logement et potentiel de confort sonore - Grenoble - CRESSON (1991)
(2) Augoyard J.F., Torgue H. et alii : A l'écoute de l'environnement, répertoire des effets sonores - Marseille - Parenthèses - 1995

Les réflexions et les recherches sur les ambiances construites font la part belle à l'approche thermique (pour des raisons évidentes d'économie individuelle ou de coût global au niveau national) et dans une moindre mesure à l'éclairage.

Depuis près de 20 ans, le CRESSON a développé une approche interdisciplinaire de l'acoustique et de l'environnement sonore. Basée sur l'architecture, les sciences humaines et les sciences physiques, elle se matérialise par des recherches, des colloques, et plus récemment par la création d'un 3ème cycle (DEA) dont la particularité est d'être piloté par deux laboratoires distants de 700 km. Une liaison informatique et sonore en direct permet les échanges lors des cours, il en résulte naturellement une nouvelle pratique pédagogique.