A CD ROM on the sound effect : a new tool to understand and apply the design of spaces according to sound

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Abstract :
The sound effect, a concept defined by our laboratory some ten years ago, has become, over the years, an educational tool which we use as much in acoustics classes, as in architectural projects. Stemming from a multidisciplinary theoretical model, it remained confined to a discerning readership, familiar with scientific publications. Adapting our reference book (dating from 1995) to a new kind of medium, such as a CD Rom, has rendered it more accessible whilst developing its contents. Indeed, it is a medium which can integrate both audio and visual aids, provide information at different levels of complexity - and which could even be updated periodically. Furthermore, corresponding audio and visual examples enable us to move the different sound effects within and around urban settings and enclosed spaces.
Students or teachers of different disciplines (such as architecture, music or design) should be able to profit from using this CD ROM which could become a significant source of illustrations. Architects could also use it later as a communication aid for their projects.

Key words :
Acoustics, Sound effect, Sound environment, Multimedia, Multidisciplinary Interdisciplinary.

1 Preamble :

It is doubtless useful to first define the concept of a sound effect before describing the CD ROM which simulates it in real-life situations and permits further applications. The following text provides an introduction to the subject for the reader who has had little previous knowledge of this useful tool with which to tackle with the sound environment.

  The CRESSON-CNRS laboratory situated within the Grenoble School of Architecture has been working for about twenty years on an interdisciplinary approach to acoustics and the sound environment, this work has led us to create an interdisciplinary tool : the sound effect[1] which has since shown its potential to :
- decomparmentalise what we know about sound and sonic activity
- describe and depict complex sonic situations in "ordinary" architecture

- and finaly, to make teaching about the sonic environment easier.

The sound effect : an educational tool
A definition of the sound effect can also be found in J.F.Augoyard's text[2] from which I borrow part of my remark when I quote the "cut off effect" : this totally standard effect is well known in connection with environment, industry, music ... and consists of a sudden drop in the perceived sound impression.
First comment : the sonic intensity is not always the only dimension involved, changes in rhythm, timbre and tone ... may cause this effect.
Second comment : a change of space is often the cause of this effect (going through a reverberating hall, closing a door, going into a narrower road ...) and in general it is not in the place where one would situate this change on the visual plane that it takes place on the sonic plane.
Third comment : this effect is not reversible, that is to say, going from one side to the other of a door which opens onto a noisy street does not bring about the same "effect", and whatever the sensation perceived, it does not occur in the same place.
and finally : there can be a sonic cut off which is "subjective" (non quantifiable) and whose significance for the subject who feels it has no less value than others (those that can be quantified !).
Such an "effect" obviously brings into play complex physical and spatial variables, but also psycological, cultural, social, media related and indeed aesthetic ones.
A short definition of the "sound effect" could be as follow : it is a theoretical model crossing the fields of knowledge, half way between the universal and the specific, which whilst compatible with general sphere of ideas, takes its roots within concrete examples.
We have thus made a list of nearly a hundred sound effects (of which sixteen are very fully described) which allows architects to describe very quickly (and in an interdisciplinary way) a sonic universe.
Our experience in this field and the results already obtained, as much by students and researchers as by professionals, have led us to renew this work in the field of visual environment. More work has still to be done, however, it already enables us to work with some students on the subject[3].

2 Why a CD ROM?
Following our work on sound effects and their use within educational, practical and research frameworks, it seemed useful to create a more user-friendly medium, better attuned to educational purposes. Moreover, such an adjustment had frequently been suggested by the people we met at seminars and elsewhere in France or abroad. This new tool had to associate pictures and sounds - of which we had many extracts from our various fieldwork projects.
From our point of view, this new presentation had to associate:
-Our laboratory's significant audio stocks, available in the form of analog-digital tapes and audio CD's - all included in the « Fond Ethnologique de la France » (Ethnological Stocks of France) collection.
-Musical or iconographic samples referring to classic examples known to musicians and architects.

-Practical information ranging from acoustics regulations to institutions and associations dealing with sound and space, without forgetting various reference books, guides and documents on the subject.

-Specialised information related to traditional disciplines (such as science, technology, social sciences or musicology) and also laboratories and institutes working on the sound environment.

- And finally, information aimed at the general public incorporated in a user-friendly (and even playful) way.

Our objective was to provide an organised and interactive general body of up-to-date knowledge concerning the sound environment of everyday urban life.

The work which has been put in for this CD ROM has up until now, of course, been a team effort, uniting researchers and laboratory technicians. It was co-ordinated by H. Torgue, a musician and fellow researcher at the CNRS (the French State Research Agency). At the beginning of this project, I directed the research team and it is in this capacity title that I present it now.

3 The CD ROM

3.1 Basic structure

   As is usual for this type of tool, the user must be able to change levels or return to the general index - from wherever (and whichever level) he finds himself in the CD ROM layout. This is done through a navigation tool. It is composed of several compartments (screens) in which the user can move about and access the different levels of content.

The navigator is divided into four different levels:
- a play area and elementary initiation level.
- a general knowledge level.
- a more advanced part for specialists, organised thematically.
- a data bank and set of references (bibliography, sound recordings and iconography).

A cross section enables the user to jot down his work notes and to memorise his route around the CD ROM.

Practical educational methods are given a high profile at all times. For example, we propose a virtual mixing-table enabling the user to vary the different sound effects within the setting or the virtual rooms - which can be modified according to the sound environment thus created.

The user can also retrieve data by exporting texts or pictures (within the limits of a 27 dpi resolution to limit the number of copies).

In its final version the software will be adapted to both Apple and PC computers.

3.2 Internal Structure

The global structure of the CD ROM is divided into three modules.

3.2.1 The first module concerns the MARKING OUT of the subject and enables a first approach with simple definitions of each effect.

The objective of this module is to introduce the 82 different sound effects. Each one is tackled through its most common occurrences. Usages and everyday experience guided our choice in this first phase. We thus concentrated on three main themes : acoustics, space and perception. In concrete terms, we have represented objects, places and situations within an urban context. When the user clicks on one of them, he opens up a standard illustration of the effect and a short definition of it. Whenever possible, a connection between the audio and the visual examples is used to render the whole more explicit.

At the end of an illustration, the user is asked to choose between listening to the sample again, going back to an « urban walk » or finding out more (that is, going straight onto the third module).

3.2.2 THE NAVIGATOR, the second module, can be called up and consulted at all times.

It is a multi-functional guide, made up of a « grid » which lists all the effects and enables users to locate them within six different fields, namely architecture and townscapes, psychology and physiology, sociology, music and the media (both written and audio-visual). By activating one (or several) squares in this grid, users will be able to make up their own programme as they like. For example, they may choose to consult all the different possibilities linked to architecture, to make an inventory of priority fields of this or that effect, or again, to collect the effects according to personal criteria.
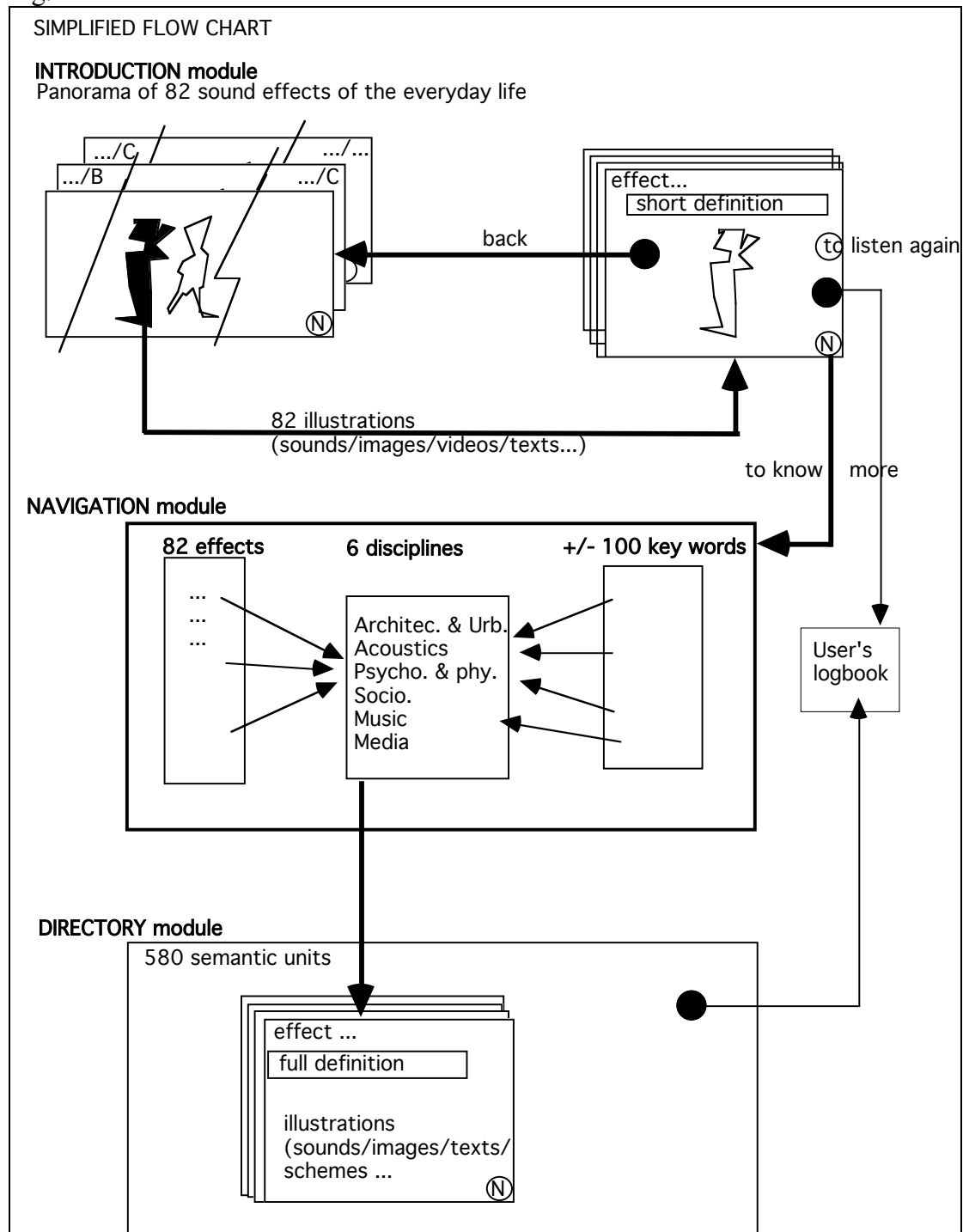
Furthermore, this module enables the user to access a network of links between the different effects : opposite effects, neighbouring effects, induced and complementary effects... as well as general headings such as the introduction or the bibliography. It's the surfer's plugboard to the CD ROM.

3.2.3 THE DIRECTORY, the third module, tackles concepts of a more scientific nature in a multidisciplinary context.

In this module, all the semantic units and the basic illustrations which make up the scientific corpus of the CD ROM are to be found. It relies for content on the reference book published in 1995, but its presentations are developed within the logic of the tool used. All the effects are presented within a multidisciplinary framework. Our objective is to make examples and illustrations our priority without neglecting the scientific counterpart to the explanation. It is therefore not a question of simply reproducing a book, but of using it to create a route presenting each effect within the logic of the disciplines encountered. Furthermore this module offers a more detailed definition of the effect than in the first module (this corresponds to the « know more » function mentioned earlier).

The diagram bellow (Fig.1) summarises the general structure of the CD ROM.

Fig.1

SIMPLIFIED FLOW CHART

INTRODUCTION module
Panorama of 82 sound effects of the everyday life

.../C
.../...
.../B
.../C

effect...
short definition

back

to listen again

N

82 illustrations
(sounds/images/videos/texts...)

to know   more

NAVIGATION module

82 effects   6 disciplines   +/- 100 key words

...
...
...

Architec. & Urb.
Acoustics
Psycho. & phy.
Socio.
Music
Media

User's
logbook

DIRECTORY module

580 semantic units

effect ...
full definition

illustrations
(sounds/images/texts/
schemes ...
N

The following diagram (Fig. 2 : third sequence) illustrates an urban sequence (the graphics here are not that of the CD ROM - they are only given here as a sketch), and the table shows its usage in the CD ROM.

Fig. 2

```
┌──────────────────────────────────────────────────────────────────────┐
│ SEQUENCE 3                                                             │
│                                                                        │
│   a pneumatic        a carpet        a fire        way into the        │
│      drill             shop          hydrant       Music room          │
│                                                                        │
```



```
│        :          (inside the shop)        :            :              │
│     CRENEL              DULL           DOPPLER          :               │
│     effect             effect          effect          :               │
│                                                   _____:_____        │
│                                                    (sequence b)        │
│                                                    (music room)        │
└──────────────────────────────────────────────────────────────────────┘
```
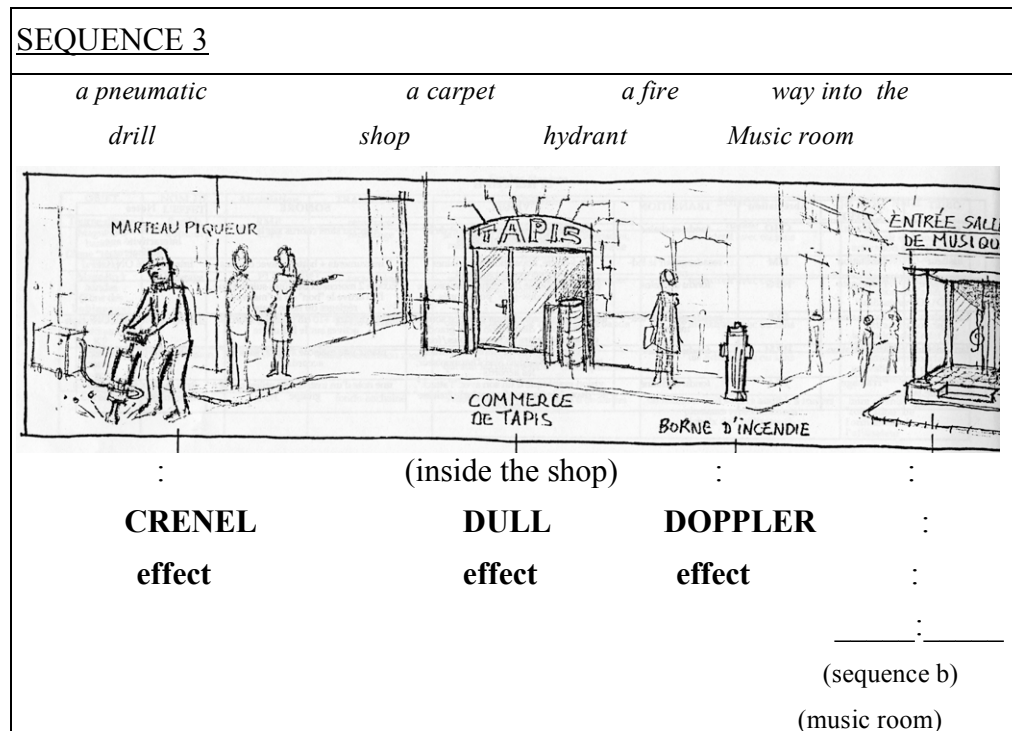
Three effects are presented here:

The Crenel effect (CRE): it consists in the emergence of a sound emitted at the moment when the context is at its most favourable. It exists in different types of intensity, height, tone and rhythm.

The Dull sound effect (DULL): contrary effect to that of reverberation, a perfect dull effect implies a total absence of reverberated sounds (as in anechoic rooms).

The Doppler effect (DOP): anamorphosis of the physical signal linked to the relative movements of the source and the hearer (a sound signal coming closer is perceived as being higher pitched than it is in reality).

The music room to the right prompts the user to discover the following sequence.

Corresponding table of the third sequence (Table 1)

objects, people and places.	Name of the effect (abreviation)	Transition	Visual information	Sound track	Notes
Pneumatic drill and two people speaking	Crenel (CRE)	focus on the people speaking	a person giving information to another on how to find their way, to one side, a pneumatic drill	« take the first on your right after the shop » « ratatap tap » Go straight on for 200m » « ratatap tap ».	
fire-hydrant	Doppler (DOP)	re-centering	hydrant	siren going by	an actual fire engine could be added

carpet shop	Dull (DULL)	fade in-fade out	in the shop, with the sales assistant, first with no carpets around, then with one, two, etc.	The sales assistant's suggestions : « How about this one, or that one, »	from reverberatin g to dull sounds.

4 Prospects and possible uses :

A very varied public ranging from the town planners to teachers or the students of architecture, musicology or sound design and the teachers at music conservatories should be able to use this concept. In its book form, this concept only seemed accessible to a limited public : a « knowledgeable public », familiar with publications of a scientific nature and capable of reading in a continuous and « learned » way. Now, in its multimedia format, using today's tools, it has become an educational and play medium, suitable for all to use at his or her particular level of understanding, enabling the user to come back to it later and opening up a field of reflection that becomes far more important than it at first seemed. The multidisciplinary contributions show how rich the sound effect concept is and will surely incite each and everyone of us to look more precisely into the disciplines to which they are the most related to (especially within the third module) as well as the applications or the links the sound effect might have to other effects.

For the lecturer, such a tool could quickly become an important source of illustration, more and more class rooms being equipped with projection systems associating videos and computers. The architect and the town planner alike could use such a medium to convince players in the world of construction of the pertinence of their choice in terms of material or shapes. The musician and the architect will find parallels between musical composition and architectural approach which modernise more formal approaches based on dimensional and perspective in particular. Finally anyone could use this medium in their own way to learn, teach or to make project design more attractive.

[1]Augoyard J.F., Torgue H. et alii 1995: *A l'écoute de l'environnement: repertoire des effets sonores* - Marseille - Parentheses

[2]in : *Sonic quality in the living environment* 1991- International symposium - Grenoble Org : Lab CRESSON

[3]J.J. Deletre. 1997. *Towards a multisensorial education for environment* Proccedings of the Gdansk's international seminar : Technical aspects in architectural education - international seminar