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A phono-kinetic approach to an adaptable environment

architectural design experiment of a public shelter

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Abstract

Our hypothesis is that we have to take into account the dynamic relations which couple listening and acting in ordinary uses. These uses are based on the skills of each inhabitant, acting in different sonic environments. In other words, we have to explore the ecological conditions of perception and action. In this paper, we present our investigations and experiments which tried to highlight the relationships between sound and body movement, between sound and action. Space and sound are linked by motion. In the ordinary uses of space, we talk and hear in motion. We postulate that the potential actions are to be considered alternatives that help modulate the environment in space and time. This kind of research is concerned both with fundamental aspects and design. On the one hand, the ecological approach brings us knowledge which helps identify the sonic role during the spatial experiment and explore the different corporeal and movement modalities that emerge with hearing. On the other hand, it aims to renew the sensitive design of spatial architectural elements, taking into consideration some of the modalities of ordinary use. Specific categories, methodological aspects and some results are discussed in here.

In our visual culture, the sonic dimension remains undervalued and is too often looked at as a secondary quality of space, and therefore it has not had legitimacy in architectural and urban thinking. Several tools and concepts have been proposed – *sound object, soundscape*, *sonic effects* – (Pierre Schaffer, 1966; R. Murray Schaeffer, 1977; J.F. Augoyard, 1995) that help us understand and represent sound and reach a better awareness of the sensory qualities of the environment. But despite this positive development, the integration of sonic dimensions in ordinary architectural production remains difficult. The concept of soundscape seems too broad and blurred, while sound object seems too elementary (in terms of levels of organisation) to allow us to work comfortably both at the scale of everyday behaviour and at the scale of architectural and urban spaces. J.F. Augoyard pointed out this assertion and added, "The environment can be considered as a reservoir of sound possibilities, an *instrumentarium* used to give substance and shape to human relations and the everyday management of urban space". The lesson of this conception is that we need to find a way to link more accurately spaces, uses and sound. Thus, we have to understand the sonic experience within the spatial one and ordinary use. From this perspective, the dynamic relationships between sound and action are part of the process of perception. An ecological approach, which precisely investigates the conditions of perception and action, gives us some precious indications. Though it does not embrace the full richness of social uses, it provides some knowledge about the adaptability of the environment. Moreover, it could compensate with a receptive and passive conception of hearing and, more generally, a dominant 'contemplative' way to think aesthetics in design thinking.

issn 1904-500X

From an anthropological and sociological point of view, the investigation of sonic effects in ordinary living, as it has been described at the CRESSON laboratory, has shown us the need, and the power, of adaptability that one can feel is necessary when the environment does not agree. Some of our researchers and others – in habitations, working places or public spaces and, especially, in transportation systems – have suggested, empirically, that adaptive behaviour is sometimes necessary in order to improve the listening of others, direct vocal communication or simply remain waiting, sitting or standing. It takes many forms, including movement or emplacement choices that space users apply to adapt themselves to sonic ambiences.

The above-mentioned ideas suggest we might explore the different modalities by which the auditor can modulate and 'build' his sonic environment. Going beyond a strictly defensive conception of noise, it is important to take into account our capacity for actions. One of them is simply the faculty of moving. However, if moving uses (at least a few of them) are linked to their sonic environment, little research has been done on the subject. So, as the active and productive dimension seems essential to create comfort in ordinary life, in interpersonal relationships or during the process of adapting to a given context, these experiences could also be considered worthy of interest.

Now, the 'phono–kinetic' element we work with studies the conditions under which spaces could offer several kinds of sonic opportunities. I postulate that the *potential actions* allow us to modulate the environment in space and time. We need therefore to find the appropriate qualitative criteria and help develop innovative architectonic solutions. Designing architecture via sound involves shaping spatial features, but also their capacities and potentials in emerging sonic actions, such as sound production and hearing adjustments. In this context, certain architectural forms and situations may offer various alternatives. It leads us to think about spatial features – '*dispositif* ambiant' – as instruments that imply motion and the way we use them. In this context, we shall present experiments that have tried to answer the following questions: how can we handle the relationship between sound and movement or between sound and action? How can we identify the sonic role in constituting the experience of a spatial model and explore the different corporal and movement modalities that emerge through hearing?

Scope of work: spatial experimentation of sound – phono-kinesthesia and built space

More precisely, these questions have led us to take interest in small scale places where relevant interactions between motion and sound seem pertinent. It is mainly due to the proximity of walls that reveals relationships between kinetic aspects and

issn 1904-500X

sonic ones. So, to get a better understanding of this topic, the idea was to explore how a minimal space could afford a maximal adaptability of the sonic milieu by our body movement and our displacement.

Architectural features (appliance) – that are relatively small-scale, ordinary and recurrent, such as doors, passageways, thresholds and verandas – constitute interesting audible situations or specific sonic productions during current actions. The following two general objectives have been explored from this perspective:

1. Elaborating an annotated catalogue of sonic 'situations of reference' based on chosen categories to clarify a typology.
2. Developing an experimental methodology based on an architectural model and making an evaluation of it through a scenario of use.

Towards an annotated catalogue using three sonic spaces: articulations, limits and inclusions

The creation of an annotated catalogue of 'situations of reference' takes as a starting point three predefined modalities[1] that have been progressively consolidated and clarified through several examples. We have chosen these modalities seeing as they relate architectural aspects with daily use by the way they orient the action, maintain relations to the public, strengthen hearing capacity, find agreeable situations for staying in a given space for a period of time, etc. In the following, we shall briefly introduce the three explored modalities:

1 – The notion 'articulation', which is fundamental in this experiment, aims to take into account the different modalities of sonic transformation that emerge during the auditor displacement and enable[2] the identification of spatially distinct sonic entities. Sometimes this type of phenomenon characterises the passage from one sonic milieu to another (which in certain cases can occur within the same unity of space). This term basically highlights the adequacy and adaptation of behavioural practices and space use according to the change in sonic context. In this research, certain corporal adjustments and behavioural changes that emerge when participants are exposed to these dynamics of sonic transformation can be taken into consideration. Among the sonic effects that create articulations between milieus, we might mention the cut-out effect that acts as a disjunction or the cross-fade effect which, on the contrary, is preceded by a sort of disappearance and substitution of sound. Under the term 'articulation', *the sonic changes are systematically classified, involving auditor displacement (by walking) between two spatial configurations that are sufficiently different to be distinguishable in terms of sonic perception.* From a logical point of view, the auditor moves from A to B and vice versa, yet the experience is not necessarily the same in both directions. In brief, this research is about specifying the different

issn 1904-500X

modalities of transition between sonic entities or modulations. This criterion of transition is clearly perceived by observation, and the resulting sonic effects are multiple: cut out, filtering, crescent, mixing, resonance, etc. Each time, we have had to define the pertinent sensory scale in space and time for these articulations. In this context, duration and rhythm are important parameters, whereas sonic transformation in time is central. We have therefore identified the different modalities of sonic transformation: *glissando, progression, projection*, etc. In general, this category covers all types of access to closed and semi-open spaces as well as the majority of urban transitions. From an architectural design point of view, this category is particularly concerned with how users tackle the experiment course and the produced sequence of sensory forms that foster certain relations of repetition.

2 – The term 'limit' involves other situations where sonic environment tips rapidly, one by one, register depending on the corporal movement. This often proceeds the sonic effect of irruption or filtration. A typical example of this situation is: bending over a parapet or stepping behind it. Concerning the regulations of use at the micro-sociological level, the term limits is particularly concerned with adjusting social distances such as interpersonal communications or other situations of physical proximity, as in the case of crowds. Focusing mainly on 'situations of limits' which indicate moments when the auditor can modify his sonic medium by a simple displacement or minimal corporal orientation. In logical terms, this term means commuting from situation A to situation B with the ability to return back instantly. This character clarifies an immediate reversibility that is introduced as a potential spatial use. At first, it was difficult to identify exemplary cases in this category, despite being ordinary. This notion is as much of interest to the architectural plan as it is to the sonic one, because it reveals possible adjustments, yet is extremely delicate. It does not necessarily describe a physical limit within the space, as certain sonic situations themselves limit a sensory space (a crowd for example). As mentioned above, from a social point of view, this category questions verbal interaction, that is, relationships with others. In addition to the possibility of sonic changes that are sensible enough to change the sensory composition.

3 – Finally, 'inclusion' which evokes the idea of covering or wrapping up sonic phenomena in which the auditor, without making any movements, develops a sense of belonging to a universe contained within another. In this category, there is a relationship between the container and the contained. It signifies a possible movement towards an elsewhere that is being heard. The idea of inclusion is mainly concerned with perceiving the relationship between the whole and the parts of a sonic society, the collective and the individual feelings in public spaces, the relationships between different distances separating neighbouring

issn 1904-500X

> milieus. Through this idea of inclusion, we think about situations where the auditor, whether standing still or moving, is conscious of being plunged into a sonic volume contained in another entity, which he perceives as a container. This situation does not necessarily need any displacement, on the contrary: this is basically a static situation. In pragmatic terms, we conceive a situation of inclusion when we are able to perceive A when we are immersed in B; this is not necessarily true for the opposite situation (B in A). Simultaneously, the reciprocity can only be experienced by changing the spatial and temporal references. Each time, we notice that it is possible to perceive that we feel that A is in B whereas we exit in B, i.e. in the exteriority of A. This sensory form can be reinforced by the paradoxes resulting from the shift between vision and audition (sometimes without even hearing) or through links with the sonic dynamic (metabolism, differences in frequency, differences in propagation between two milieus). Concerning the feeling of sociability, the term 'inclusion' can be read as the opposite of exclusion: a sense of belonging to a whole sonic entity is considered one of the major concepts in this context. Moreover, sonic inclusion can also create exclusion that may be caused by excessive isolation or barriers for negating others. Diffused or 'transparent' sonic spaces may cause problems concerning the ability to construct an inclusion. Regarding the architectural design, it is a notion that may be applied in order to create local sonic entities that are not totally isolated from their context; where the conditions of sonic filtering are important.

As we see, the 'quantity' of auditor movement varies depending on his location in terms of articulation (displacements within the space), limit (from weak to very weak corporal motion) or inclusion (no motion, yet the spatial distance in this context is sensitive to sound). It is difficult to classify a remarkable situation by only one of these classes. It may instead be interpreted through two or even three classes. This depends on the type of action via which we perceive the situation. For example, a staircase in an apartment building can be conceived and experienced as an articulation (moving from one place to another), but it may also be a limit (if it overlooks what is outside and if there is a rapid change in the sonic field when traversing it) or an inclusion (if a conversation takes place between two neighbours: at this moment, the context no longer exists or rather disappears in their perception). Therefore, the action perspective seems fundamental in this context.

The table below summarises the characteristics of each of the preceding classes:[2]

issn 1904-500X

Articulation	Limit	Inclusion
Situations involving a corporal movement of crossing. These situations deal with the transitions between distinct sonic mediums.	Phonically limited situations where a slight movement (of the head or body) results in a sensation of change or a perception of a situation of limit. These situations permit a short stay.	Situations of sonic envelopment that do not implicate the auditor displacement, but rather reveal the awareness of different containers.
Basic chosen architectural elements:		
Doors Openings Passages Bridges Airlocks …	Parapets Thresholds Staircases Perforated walls Difference in level …	Court Portico Fosses Corridors Canopies Bus shelters …

A model to experiment

The previous work of creating an initial categorisation was part of the second research phase that centred on experimenting with an architectural model '*dispositif*' at a body scale in motion. This stage focuses on fabricating a spatial model at 1:1 scale. It is worth mentioning that these experiences are promoted after previous attempts to create such models.

After these primary tests, benefiting from these experiments *in situ* that were carried out in Grands Ateliers de L'Isle d'Abeau,[3] we wanted to examine their pertinence, validity and performance in a more systematic way by envisaging an adequate evaluation protocol. It should also be noted that these experiments cover all stages of the architectural project cycle (programming, design, construction and evaluation). These experiments unite both spatial and sonic design, electro-acoustic sounds and use assessment. In terms of use assessment, we had to establish a

Test 2001: ENSA Grenoble / Liveneau – Chelkoff: phonic walls and seats situated in a patio

issn 1904-500X

Test 2002: GAIA Liveneau – Chelkoff: a phonic 'extractor' situated in a grand hall

survey protocol questioning the action whose objective was not merely a collection of speeches about the model (although we also did this, as was required), but also constituted a direct proof of how the model was used. The main objective of this experiment was to capture the way that participants handle sonic situations (focusing mainly on articulation, inclusion and limit) according to the model that is being designed and built.

Designing an architectural model

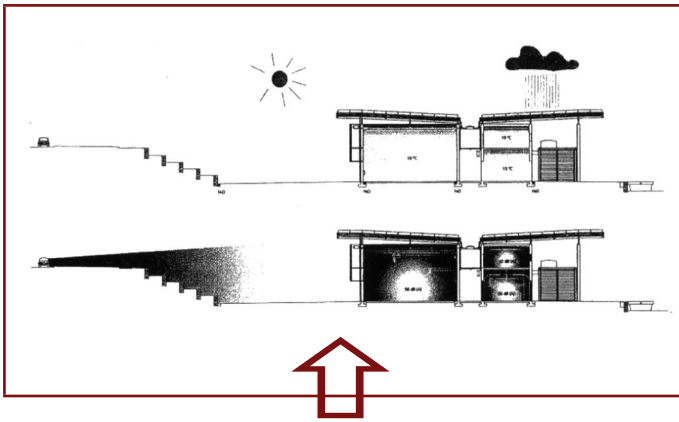
On the basis of the information gathered in the first phase, we have built the architectural model in order to test it. It is designed as an interface between outdoor and indoor spaces. It is important to say that due to certain concerns regarding the implementation of the project, this model has the same scale as a bus shelter or urban furniture such as seats or kiosks, so that it can be implanted on large sidewalks, in grand halls, on platforms or in work spaces. We thought it might be placed or transposed in public spaces (a bus shelter or another mode of transport) where different uses are possible and thus needed different qualities. This kind of model can also fit into large volumes such as train stations or underground spaces where the sonic conditions are very difficult and where 'small' spaces could afford some alternative sonic environments. This concept might also interest architectonic skins that are placed between spaces of different natures (or which need to be differentiated).

The model was implanted in an outdoor platform parallel to an existing building (the grand hall whose lower part is overlooking an outdoor space).

The existing building 'simulates' a public building. Certain links of different orders – dimensional, functional and ambient – between the building and the model are taken into account during the design process, such as the main door framework (120 cm) in the hall.

The model generated the idea of 'double face' furniture which affords the categories of the potential experiences I defined above:

issn 1904-500X



Architectural section through workshops showing the level of the platform (about at least 4 metres lower than the highway soundscape) of medium circulation and a bus stop on the opposite side. The space where we have installed the 'model' is a vast esplanade. The arrow indicates the position of the architectural model which leans over the building façade.

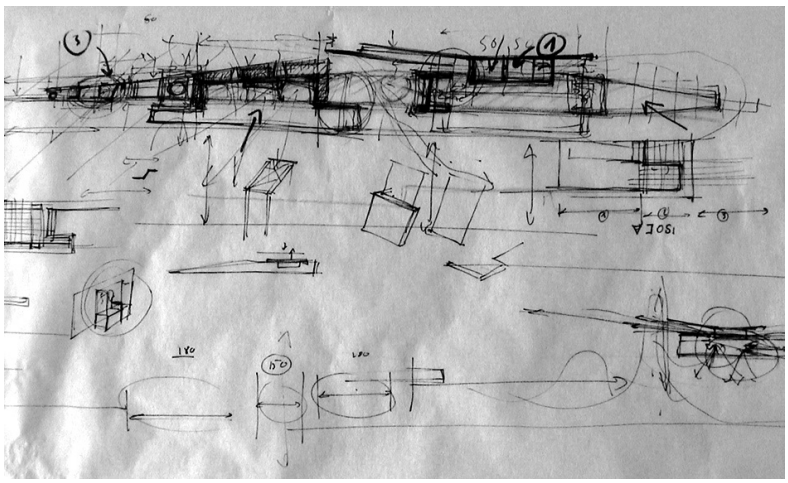
Articulation: passing from one face to another in which the sonic context changes completely.

Limit: changing the micro-settings placed on its faces.

Inclusion: the model is thickened to create an interior pocket.

Each side of the model is exposed to extremely different sonic contexts: the indoor hall from one side, and the outside surrounding landscape from the other.

The total length of the model is approximately 10 to 12 metres, but certain 'interlinks' could have been stretched along its length. Its height does not exceed three metres. Certain extensions might have been implemented by appropriate means had it not been for the limited time. The basic material used to construct this model is wood, which is chosen for economical reasons and to facilitate the elaboration of the model. It took the form of panels (multiple, of 15 mm) whose thickness was not very efficient in terms of acoustic mass.



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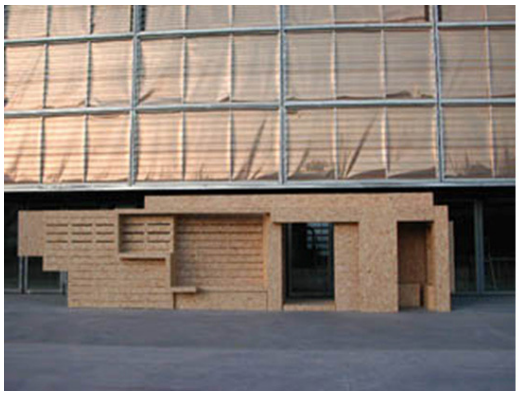
Architectural and sonic design



The morphological vocabulary is based on certain recordings of actions and gestures (Liveneau, 2004): *imprint* (the parts that have been hollowed out in the depth of the model), *split* (plans that do not really touch one another but hardly brush one another), *repetition* (reproducing certain discontinuous elements) and, finally, the *fold* (continuous transformation of the envelope). These 'morphologies' offer specific sonic qualities and uses that we can distinguish as follows:

The *split* passes sound and light as the in-between spaces allow one to look and hear, forming certain audible and visual escaping points.

The *imprint* permits sonic recess or resonance, which is also suitable for the body, and forms protected spaces for seating, shaped and incorporated into the model.

And *repetition* permits the fabrication of more or less porous walls, filtering light and sounds. Depending on the relationship between solid and void, these walls offer several potentials for seeing and hearing, whether direct or fragmented.

Finally, the *fold* which does not only facilitate the creation of sonic shelters or pockets, but also canopies and abat-sons that project sound beyond the constructed model (however, the mechanical registers of the materials used have severely limited this potential).

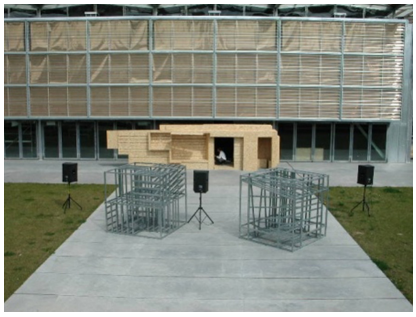
Photograph of the 'backstage' between the model and the building, taken from the side facing the space of inclusion: the advanced part of the first floor closes the space; glass walls can be opened or closed. Two spaces on either side of the model are created: one is turned towards the outdoor space, whose activity is continuous, while the other side overlooks the reverberating activity in the inner hall, whose activity is somewhat eventual. The model is aligned with the overhead ceiling of the first floor, thus creating a 'backstage' facing the building. We postulate that anyone who chooses to pass by this side will be more exposed to the building's soundscape (where certain activities take place: noise from machines, verbal interactions, etc.) than to the diffused sound from the loudspeakers.

issn 1904-500X

The real local sonic context of the model

The main purpose of this experiment is to expose the model to real sounds and examine their effects on participant behaviour. During the experiment, the existing building was in use as a workshop and that corresponded with our conditions. Certain noisy activities whether intended and unintended emerge in the main hall of GAIA. The emitted sound from the hall has pervasively invaded the "backstage" between the building and the model. Given the sonic conditions of the GAIA site (Grands Ateliers de L'Isle d'Abeau), a special sonic device have been installed in order to 'stimulate' the imagination of a sonic environment of urban transport. Soundtracks and sound diffusers were installed so as to reveal and enhance certain effects of the model and to contextualise the participants' experience. We chose a soundtrack that simulates the soundscape of a platform or station and put the pedestrians in a sonic situation that did not really exist, but was subtly mixed with the real environment *in situ*. The overall sonic intervention is composed of two parts:

- The first aims to remodel the exterior urban environment by imitating a suburban soundscape that includes different types of transport.
- The second seeks to resonate the sound in the model's interior and, in particular, the space of inclusion in order to create the effect of double envelope.



Photograph showing the HP installation placed in the outdoor space following a linear form for constituting a sonic front (the metal structures were installed prior to our experiment and they have nothing to do with our sonic experiment).

The loudspeakers diffuse a controlled soundtrack. They are located 10.7 metres from the model's street-side façade.

Putting into action a survey method

An assessment activated by use

The aim of the evaluation[4] is to clarify how participants use the model with respect to the sonic hypothesis that we have put forward and to understand the different modalities of actions that the participants apply to appropriate the model.

Moreover, the objective does not only seek to constitute descriptive discourses about the perception of sonic qualities, but rather to identify the different *potential actions* that emerge due to both the model form and the sonic situation. In addition, the experiment aims to put the participants in a specific 'sonic situation', then

issn 1904-500X

examine and observe how they react. From a methodological point of view, we are conscious of the limitations of this artificially activated evaluation, but this is true of all experiments.

Eighteen experiments were conducted. The choice of participants varied: habitual users (or not), architectural and acoustics experts (or not) in addition to the visually handicapped participated in the survey. The following protocol was established: in the first part of the experiment, each participant had 4 minutes to 'explore' the model, and they had to visit the model either individually or in pairs. The experiment always begins from the same starting point (called 'the prow', which is the thinnest part of the model, measuring about 5 cm), and the soundtrack is released as soon as the participant leaves the investigator to begin his journey.

At the beginning of the experiment, facing the prow, participants had to choose on which side they want to pass: on the right where the sound diffuses or on the left where it gets narrower and the body is more balanced.

The experience is somehow destabilising for two main reasons: on the one hand, the model interior as well as its surroundings, where participants had to walk, was completely unknown to them. The model does not look like any ordinary urban furniture. Moreover, exploring the model was a bit confusing: there was not a lot to do, except turn around or, eventually, settle here or there, either alone or in pairs.

So, we had to develop a particular protocol to provoke an active sonic appropriation. In this sense, we developed the following scenario: after 4 minutes of free exploration, which was deemed sufficient for discovering all the facets of the model, the wireless telephone placed in it rings and the participant has to answer it. Then he was asked to read a press article placed next to the handset. Meanwhile, the sonic background increases, until it becomes high enough to provoke (or not) certain adaptive behaviour. It is worth emphasising the special focus of attention that this survey creates: the reader is visually occupied by the article, so that his movement, while reading the article, is more guided by sound and touch than by vision.

At this point in the survey, we examined the different sonic modalities that the model offers, either as constraints or as resources to induce one or several ordi-

issn 1904-500X

nary uses (talking, sitting, walking or making telephone calls), especially when the participant's attention is distributed among several actions. Making a telephone call and reading out loud are both sonic activities, but, as we will see later on, participants also move, sit down or search an appropriate place; all these actions are accomplished while their eyes are occupied with reading the article.

At the end of the exploration phase, the researcher who observes the participant's attitude from a distance determines that the experiment should end when he sees that the participant no longer knows what to do). After that, an interview is held with the participant (whether alone or as a couple), following a fixed-format questionnaire.

How can we update and register the evoked attitudes? What are the different potentials that this kiosk offers to corporal adjustment with respect to this sonic environment?

Sonic behaviour in the architectural model

The results are based on three types of corpus: observation of corporal behaviour (using video-graphic recordings), interviews after the experiment and the research team's own experience. The experiments were initially filmed with a mobile camera, then with two other fixed cameras, placed at the extremities of the space (the presence of these cameras might have bothered some participants). Some photographs, showing participants' attitudes and positions, were also taken in order to identify certain invariant behaviour. These visual documents provide important material that has been analysed to see whether or not they showed particular attitudes. In the following part, we shall only refer to a few of these observations and point out the advantages as well as the limits of the experience. According to our three categories, the outputs are not similar.

For example, here the sonic 'articulation' is illustrated either by the 'door' (passing through the model) or along the wall. This experiment was conducted several times (people go through this 'door' several times when they 'try' this experience: there is a passage that distinguishes the front from the back, but in this case the spatial cut has been determined. The transition is too short to be noticed, letting other ambient elements dominate the perceptual structuring. Similarly, in the passage that is placed parallel to the model, whether in front of or behind the structure, sonic continuity is perceived even with the sonic emergence that occurs as soon as participants enter the model from one of its extremities.

Among the total number of participants, few chose to go into the 'backstage' between the building and the model. Starting from the same point, most of them chose to pass on to the right, facing the direction of travel. It seems that the broad-

issn 1904-500X

Walking along the wall:

Visitor orientation in this photograph is almost perpendicular to the sound front, a slow observing motion.

casted sonic front did not prevent the use of the frontal side where participants are more exposed to sun and light.

The backstage is therefore rarely used and appears to be extremely smooth. It only offers few opportunities for one to pass, let alone stay. The fact that it is a bit more protected from sound (less than 10 dB) does not make it appropriate. In fact, the time spent at the front, exposed to sun and light, is always more important than the time spent on the dark side where participants are exposed to the building's interior. We will probably have to move away from the building to enlarge this part that is perceived as the back.

Besides, the door that acts as a passage is used several times in both directions. Certain participants stop for a while in the sun, orienting themselves towards the road. Actually, this part facing the road functions as a sonic support with different sets of opportunities.

Regarding the notion of 'limit', our observations made it possible to notice certain limit situations. For example, some seats, due to spatial configurations like depth, by a simple corporal modification, such as bending the body, offer the possibility to be more or less exposed to the exterior or the interior soundscape. This was obvious at the telephone call test.

A series of different attitudes, occurring during the task of 'reading while making a telephone call', were observed.

In some cases, participants stayed in the same position next to the telephone, despite the sonic events. They did not exploit the model's potentials.

Some users settle at the backstage while making their telephone call or continue to move, as if walking determines the reading rhythm, helping them to continue speaking. Other users did not budge, despite the sonic effect, but turned their backs to the sound and leaning to read.

issn 1904-500X

Reading while making the telephone call, turning his back to the sonic front.

Sitting in the 'inclusion'.

In the passage, backs turned towards the exterior with sound and light sources.

Reading while making a telephone call, turning their backs to the sonic front.

The person stays in the passage while making the telephone call. He does not move (as the telephone was placed there on a stool during the first tests).

Another attitude that one participant adopted was rather revealing: she exploited the proximity of the two walls, slipping her head between them and making a 'helmet' that surrounded her head. Here, for example, the body can slip into the gaps left empty in the construction as the sound diffuses.

An original use of the telephone, ears are located between the two walls.

A close view, showing the narrow slit, we can still perceive the sound from the exterior.

A photograph of a split from another position; we no longer perceive the exterior sound.

issn 1904-500X

These interstices created by the split offer certain corporal postures and generate particular relationships with sound.

The types of action produced during the experiment are thus very different. If the majority had chosen to stay in the most closed part of the model in order to be able to hear better, other participants tried different seats located in the interior. Others made different choices: they either moved or remained obstinately leaning, when reading the article (which takes about 4 minutes). No one sat down on the principal bench to read during the telephone call, as if facing the sound is not appropriate for this task. On the contrary, the principal bench was used for watching and talking, when the experiment was made by a couple.

Adaptation: a temporary refuge in the 'inclusion' room:

				
Seated.	Standing (when the telephone rings) to answer the phone.	Takes the journal and begins to move while reading.	Reading while walking towards the inclusion.	Seated in the inclusion facing the open space.

This behaviour reveals the main polarising spaces that attract people. No one moves towards the 'prow' during the telephone call.

Other types of use:

Another use was observed: sitting down, facing the sonic front and sharing opinions. The slightly recessed seat in the frontal façade is suitable for talking and induces conversation. We also see that the seats' varying depth modifies the perception of both sound and environment.

issn 1904-500X

Conclusion

Experimentation and design by sound

We have to emphasise the richness of this experiment and the varied lessons it offers in the domain we wanted to explore. The research process is quite loud and complex, but it opens a field of observation and reflexion about the way we really use sound and not only listen to it. On the one hand, the developed method for investigating spatial and sonic situations allows us to systematise the observations and collected data. Now it has been developed in a more extensive and detailed way. Since we are interested in the relationship between sound and motion, the design process based on sonic hypotheses can largely depend on such categories (articulation, limit and inclusion). Other categories are of course to be explored and added to refine the annotated catalogue, under the condition that they derive from sonic experiences to benefit from the active relationship between sound and space.

The protocol of the experiment corresponds to the scale of the model. Of course, we can point out the limits of the experiment: the artificial situation. Implementation in a real site could offer more evident conditions in a second phase and raise questions about public security, such as stability and fire resistance. We can also point out that, contrary to what was planned, model adjustments were not made after the first version. It could also be interesting to test relatively more complex architectural systems and enable other experiments, especially those related to the technical performance of materials, walls or structures.

But we also have to point out the links that have been drawn through this experiment between two aspects of the work: it shows a field of articulation between fundamental research and design that could be developed further with advantage.

Firstly, we have to get a better knowledge of the ecological approach to sound living and active dimensions. These fundamental aspects need to be explored in more detail. In this direction, we have identified more precisely what we have called 'sonic kinesthesia'. According to the observation protocol, the different attitudes of movement relevant to sound have illustrated the model's potentials. It allows us modestly to develop a typology of these relationships between sound context, space and movement. On the one hand, it could be used to enrich architectural thinking and making spaces in consideration to ecological dimensions, like sonic living. The 'sonic kinesthesia' that we identified include the following:

Walking along a wall, with variations in distances, heights or sources
Moving towards the sound/moving away from the sound
Putting one's head through an opening in order to hear
Stopping on a sonic threshold
Searching for the source of the sounds

issn 1904-500X

Turning one's head towards the dominant sounds
Turning one's back to the sound to talk
Crossing a solid by the sound (communication through an opening or through a spatially separating element)
Touching a solid element to make it ring
Varying the seat depths

We aim to continue this study, focusing on 'kinesthesia' that could cross other senses.

As regards the second aspect, one of the major lessons of this experience is that it seems to be clear that the kind of furniture we have designed can play a major role in different spaces to afford several potential uses. This may provide clues to different urban or architectural situations that require new solutions to create ambiant qualities with a lot of potential actions.

This work falls under this title due to its ambition to renew certain design tools by linking the conception process to the fundamental research on mechanisms of perception and action, especially the sensitive kinesthesia that operate the ordinary usage. However, it must be said that the philosophy of this research is not relevant to 'behaviouristic' thinking. It is quite the opposite: the aim is to work in order to afford and diversify potential human adaptations. In that sense, it is to renew a design that resembles our multisensory body more than it does a single eye. And we can think that the social imagination is not independent of each inhabitant's hearing, talking and moving. New experiments and research has been planned in this context.

Notes

1. We have selected the three categories after previous research implemented in extremely varying sites where we made daily observations.
2. About 80 cards were implemented of which 45 examples were used (15 for each category).
3. These workshops at L'Isle d'Abeau have specialised in the experimental domain. From the beginning, we have the opportunity to profit from the ambience of the multidisciplinary field of these experimental workshops.
4. Note indsat i teksten, men ingen referencetekst!!!

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