THE "SONIC SPACE" IN ARCHITECTURE

THE NEED OF TAKING INTO ACCOUNT SOUND AS AN ESSENTIAL COMPONENT OF ARCHITECTURAL SPACE

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Abstract

Multiple forms were developed along the last decades by means of which the problem of sound in architectural space has been approached; it is, however, to some extent strange that even today most architects have only very few ideas about the meaning of sound in architecture, mostly because these developed forms were contributions of physics, electronics and other disciplines, far away from architectural design and research. The sonic experience in architectural space is a matter that implies a great deal of subjectivity for most people but, no doubt, it is one of the forms for perception of the architectural space. Normally, people perceive sound in architecture rather unconsciously, even though they are part of the experience in an architectural space. Sound describes the space and helps both placing and feeling it, and it is precisely for this reason that it is very important moving in this direction from an architectural point of view. Understanding the architectural space by means of sound helps architects in designing better spaces and buildings, by applying an integral way of conceiving them. This paper describes the kind of research that the author is currently doing, leading to a closer relation between the disciplines of architecture and sound, by describing the natural relationship between them and the new and unexpected opportunities for design when sound takes part in it.

INTRODUCTION

It is most likely that sound has been the field of least architectural interest in history. In contrast, there are many other subjects that have been of more interest to architects

than sound, such as light, temperature, ventilation and air conditioning, except sound. Sound has been the matter of other disciplines such as physics and electronics, but not of architecture. These fields of knowledge regard sound from a strictly scientific and technical point of view, and are not entitled to face the problem of sound behaviour in terms of space and architecture, and sound needs to be considered as an ingredient of architecture, as part of the way architects create spaces, as a piece of the box of design tools that the architect applies to make architecture possible.

However, there are many examples of architectural spaces where architects have done a very good job for sound, namely those dedicated mostly for music or other specific sound activities, like concert halls, theatres and auditoriums. In these cases, architects seek for some advice; although in many other occasions ask for the direct design help of acoustic consultants to do this work, and for assessing the results of design. Design is then a direct effect of the professional advice of a consulting firm and in all probability the architect didn't feel the sound as part of his design.

Sound is raw material for musicians, acousticians, sound engineers, since they understand it in its own way, but most architects don't. Sound is a kind of magic substance without matter – immaterial – that can be perceived but not seen and, therefore, this is why architects possibly do not take it into account.

Architects must consider sound as one of the chief ingredients of architectural space that contributes to an integral view of its quality. They should think in this way for a better design. This paper is intended to show that these elements contribute to such an effort.

SOUND, PERCEPTION AND ARCHITECTURE

From centuries, architecture has been taken as being part of the Fine Arts and, consequently, beauty has been its main line of reasoning. This way of thinking has influenced things in such a way that visualization has been and is almost the only approach to judge architecture.

However, if we think of architecture and, for example, in a specific space, then we realize that the kind of images reaching our mind are of many types, since all of our senses are connected with this experience. These images are not at all isolated visual images, but the part of a whole of sensory perceptions that contribute to the total "picture" of the space.

Sound is a perception phenomenon and our aural system is the main structure that makes it perceivable. We cannot isolate the aural perception from the whole picture, but we can make it clearer to us, and it is in this sense that we can include sonic impressions, sonic stimuli and auditory sensations as proofs of it.

Blind people have developed many tools and parameters to perceive space as if they were actually seeing it, and this is mostly due to their auditory system. Blind people perceive boundaries, echoes, reverberation, pitch and noise in such a way that they know where they are in space. Materials, textures and volume are the elements that contribute to a good control of their space. The human ear is enabled to

recognize elements of space like bats do, as an extension of his essential skills (Cohen, 1969).

We experience the architectural space with our senses and due to the reflections of light we perceive color, shape and volume. The same phenomenon occurs with sound since, because of sound reflections we perceive size, volume and the nearness of many elements like walls and other kind of boundaries.

A concept that summarizes all these kinds of perceptions is the perception of quality. Light and sound are the main tools that architects can use to make the quality of space evident. Actually, we perceive the quality of space as much on what we see as on what we hear and in more detail as on what we smell and feel.

SOUND IN ARCHITECTURE

Does architecture produce sound? Do people hear space? These are questions that define the sonic dilemma in architecture. People believe that buildings do not produce sounds because of their very soundless nature and, therefore that these structures cannot be heard.

Architecture is a manmade object and consequently modifies the natural environment of any place where it stands, producing new atmospheres whether these may be either external or internal. We know that sound is the result of a disturbance in an elastic medium produced by a source taking a path to reach the ears of the receivers (Cavanaugh, 1999). Architecture modifies the natural paths of sound by its mere presence, and the manner in which space modifies a path depends of its architectural configuration.

Architecture produces sounds and people hear spaces in spite that most of the time they are not conscious of it. Architecture creates sounds by the combination of at least one sound source, a path defined by the configuration of the space, and at least one receiver. Sound sources are all those objects and subjects that produce sound. Music, speech and noise are the main type of sounds generated by specific sound sources. Sound sources in space can be of the following kinds:

- Natural sources (bio-sounds, nature-sounds)
- Human sources (footsteps, voice, whistles, applauses, snaps)
- Carried sources (sound objects and instruments)
- Mechanical sources (equipment, machinery, engines, systems)

All these kinds of sources may contribute to the sense of a sonic space when they are performed either consciously or not, thus giving space the opportunity to express its own presence.

Paths are traced by the ways sound can disseminate through space to reach the receiver’s ears. This propagation of sound is determined by many factors where the

main ones being

- Geometry
- Size and volume
- Materials

Geometry is one of the issues by means of which the architect expresses his design ideas, and therefore a natural way towards a sonic design. Geometry defines shape and order in space, and these concepts have to be crossed with reflections and scattering of sound in space to describe the way sound travels through it.

The geometry of space is critical because sound does not move in a straight line but tangentially. Therefore, regular space geometries are more predictable than complex ones. In a complex geometry, sound travels dynamically with fuses and flows in many possible forms, generating an environment of continuous change of sound. Geometry generates also many possibilities of sound reflection and diffusion to produce one or another type of sonic environment. We know today that fractal geometry is a very valuable material for generating very high sound quality environments due to sound diffusion.

Size and volume describe the amount of space that we have to fill with sound. We know also that size and volume are main factors in defining reverberation, which is one of the main parameters in room acoustics that describes and characterizes the quality of sound in space.

Materials are intrinsically the main ingredient to obtain sound quality in space. Their shape and acoustical properties allow sound to be reflected, absorbed and/or diffused to various extents. A wrong mixture of geometry, size, volume and materials can derive into a chaotic sound environment; on the contrary, if there is a good mixture of chosen materials, then it will be almost certain that the acoustical environment will be acceptable. Materials allow spaces to be closer or away from sound by isolating them from unwanted or aggressive noise sources, and by conditioning them for a satisfactory internal acoustical environment.

One important aspect of an architectural space is the activity to be performed. Every human activity has a close relation with sound because the former is immersed in it. Almost any activity generates and receives sound, and consequently there are some activities that need an appropriate space to generate sound as well as some other activities that need a space to receive it.

The human being is the main component of an architectural space, he/she is the objective of space, and without humans space has no meaning and cannot even be perceived. The human being, the fundamental piece of an architectural space,

- is the receiver,
- suffers the act of hearing,

- hears in a completely open way, and...
- ...cannot close his/her ears

Although the human being could be also the sound source, he/she receives sound in such a way that to be able to judge the response of the architectural space to the source of excitation, evaluating whether it affects him/she or not, pleasant or unpleasant, annoying or enjoyable.

THE SONIC SPACE

“As an architect . . . I have been keenly aware of the intense and often reciprocal dialogue between the audible and the visible. Buildings provide spaces for living, but are also de facto instruments, giving shape to the sound of the world. Music and architecture are related not only by metaphor, but also through concrete space. . . In the Imperial War Museum North in Trafford, Manchester, I have created a relationship between the atmosphere of the various components of the building and a particular "soundscape". The composition of the building is a four-movement experience. . . Architecture can only be appreciated by transforming size into scale, matter into light, and time into rhythm, colour and key. . . Without music, architecture would disappear altogether. Reducing architecture to a material reality only is to create a city of noise.” (Libeskind, 2002)

These words show the way one architect makes use of sound as a raw material for creating space in architecture and also the way space is being suggested as an instrument, a sonic instrument, a sonic space.

Daniel Libeskind was trained first as a musician than as an architect and through these foundations he developed a particular sense for perceiving and designing space in his own works. His training in music has been of great advantage and he can be regarded as an object lesson of an architect as composer, a visual composer, a sonic composer. To be a composer is an approach by which the architect could think in a more integral way his design tasks.

Sound can be taken as an inherent element of space due to the presence of air, and therefore has more incidence in space than light. Sound prevails even in the darkest space, and its specific sonic character depends on how such space is architecturally configured.

Sound reverberation and diffusion are the chief concepts in room acoustics. There is a consensus that a suitable reverberation makes music sound good and pleasant, and speech be clearly recognized. Enough diffusion assures an appropriate distribution of sound and gives to the receivers the feeling of being immersed in sound (Rodríguez, 2002). These are the main tools by which an architect can design a configuration for a sonic space, and in essence these depend on the reflection and diffusion possibilities of sound due to shape, size, volume and materials.

A true sonic space is that having a natural response to sound. There are new

trends in performing electronic and other artificial sounds in space so as to create a "soundscape" which is a very expressive form of art, a sonic art, to be more precise. Architects could be artists in this way if so they please, but the true architectural space has to react satisfactorily to everyday sounds, and this is the kind of "sonic space" that I am herein proposing.

Some contemporary architectural examples

There are some examples of architecture in the world that summarize the main ideas expressed here, the first one being a little cabin designed for an open air museum in Germany by architects Gigon & Guyer, based in Switzerland. The second one is a building designed for thermal baths in Switzerland by architect Peter Zumthor from Switzerland, and the last one is a superb building for a museum in Germany by architect Daniel Libeskind, settled in the USA.

Hearing Pavilion in Osnabrück, Germany, by Blelb and Gigon & Guyer, architects

This is a small cabin designed for bringing natural sounds into space. In a sound insulated chamber the amplified sounds from the natural environment can be heard through a large, gyratory "ear": the ear of space. (Fig. 1)

Stone Thermal Baths in Vals, Switzerland by Peter Zumthor, architect

The thermal baths were erected layer by layer with slabs of stone, creating a space like a grotto with sounds of water and people that are enhanced by resonances and reverberation, thereby creating an atmosphere that touches in a considerable way the human auditory system. Something like an inner magic world where people interact with space producing sounds with whistles and water splashes, and generating special effects as a response of space. A sequence of rooms of huge, medium and small sizes produces a changing sound environment. (Figs. 2 and 3)

Berlin Jewish Museum by Daniel Libeskind, architect

This museum is another sound composition of architect Daniel Libeskind. Because of the strong significance of this space, sound is one of the means by which deep feelings are expressed. The design includes six empty towers that express solitude, helplessness and sometimes anguish. These towers are like reverberation chambers which are treated as vacuums. There is no way to come inside them from the upper levels, but at the lowest level small metal pieces were placed on the floor and in case somebody dares to step on them they create a very impressive sound like dragged chains. (Figs. 4 and 5)

Figure 1- View of the cabin from outside with its gyratory "ear"

Figure 2 – View of the main room with water pool and stone walls

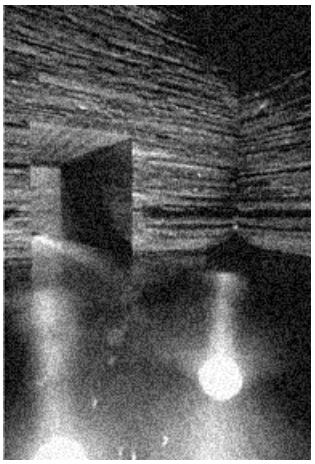

Figure 3- View of one of the small spaces created like a grotto

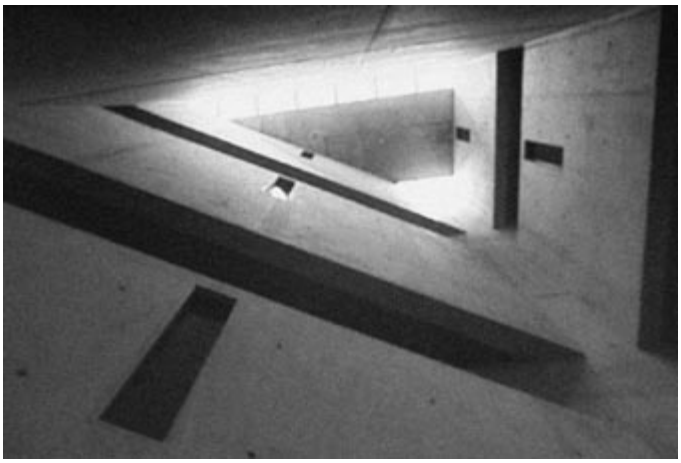

Figure 4 – View towards upper levels of one of the empty towers of the museum

Figure 5 – View of the lowest level of an empty tower with metal pieces on floor

SUMMARY

The “sonic space” is a concept that deserves to be handled more by architects as part of their daily design tasks. Sound is no doubt a chief component of the architectural space and therefore an important tool for its design. New trends in architectural design have to be established to foster a better and integral way of conceiving architecture. Research in this field has to be developed so as to put in the hands of architects as many tools as possible in order to achieve their best comprehension of the phenomena of sound in space, that in turn may lead to a better design application.

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