



The Sixteenth International Congress on Sound and Vibration

Kraków, 5-9 July 2009

ACOUSTIC DESIGN ARTEFACTS AND METHODS FOR URBAN SOUNDSCAPES

Björn Hellström

ÅF-Ingemansson and University College of Arts Crafts and Design (Konstfack), Frösundaleden 2, SE-169 99 Stockholm, Sweden.

e-mail: bjorn.hellstrom@afconsult.com

The research question is: “How to develop and apply acoustic artefacts and design methodologies for improving soundscapes in urban outdoor spaces?” In the project, this research question is limited to one specific type of urban outdoor space – city-park – and to two types of acoustic design artefacts. These are: I. Dynamic promotion of qualitative site specific sounds (e.g., the overall site specific sonic atmosphere, sounds from activities, birds and fountains), which creates an improved soundscape. II. Sound-art installations, that creates delimited auditory sub-spaces within the park/square. The purpose and method is:

1. To provide case-studies of artistic soundscape improvement, in a noise polluted city-park. The case-studies will serve as models for future applications of the new acoustic design artefacts.
2. To create and validate an innovative acoustic design methodology based on state-of-the-art real-time acoustic simulation tools integrated into the design process. The methodology will be validated in psychoacoustic listening experiments and field studies.
3. To determine the potential of the two acoustic design artefacts (I Dynamic promotion of qualitative site specific sounds, and II Sound-art installations) for providing pleasant and restorative soundscapes, in order to strengthening the social interaction as well as the spatial and aesthetical qualities in noise polluted city parks/squares.

The present project beats a new track by combining *acoustic design* with *sound art research*, integrating methodologies based on *real-time acoustic simulation* and application of *psychoacoustic methodology* for validating simulations and for evaluating perceptual, emotional and behavioural effects on visitors to public open spaces. The ongoing research project, financed by the Swedish Research Council, is executed by the University College of Arts, Crafts and Design (Konstfack), the Department of Psychology at Stockholm University and the Interactive Institute, all in Stockholm, Sweden.

1. Introduction

1.1 Trans-Acoustic Design – a design tool for permanent sound-art installations in city-parks

The research project *Acoustic Design Artefacts and Methods for Urban Soundscapes*, described in the abstract, is a very extensive project in that it involves acoustic design with sound art research, as well as integrating methodologies based on real-time acoustic simulation and application of a psychoacoustic methodology. The ongoing project runs from the January 2008 to December 2010. Due to the extensiveness of the project, and in order to be as explicit as possible, this paper focuses on *sound-art research*, embracing one main question:

How to create sound-art installations in city-parks which are sustainable over time?

The motive why I put this question is due to the fact that people easily get disturbed and tired of sound-art that is installed in city-parks. The installations might be very stimulating and fascinating in the beginning, but over time people do not want to hear them anymore. The reason why people get disturbed is mostly due to the fact that the installations do not interact with the surrounding environment; in other words, they are not site-specific. Moreover, the soundscape is mostly considered as independently of visual configurations and representations, but what happens when we do not know who is executing the sounds, where the sounds derive from or what they are made of? This paper discusses this subject matter, mainly on the basis of the concept of acoustics. Regarding this, I would like to present a design tool that highlights this question. I denominate this tool in terms of *Trans-Acoustic Design*. The kind of space that I discuss concern mainly city-parks, but trans-acoustic design is also valid for public spaces such as shopping malls, galleries, airports, railway terminals and open squares.

Significant for sound-art installations, distributed by loudspeakers, is the use of the public space as a fundament. The concept of “art” implies that one of the main purposes of this genre deals with aesthetical issues, as well as sound-art is interconnected with subjects regarding, e.g., architectural, cultural and social matters.

Another issue that is scrutinised within this project is the *masking effect*, in that a sound-art installation also could be used in order to mask other unwanted sounds in a park, such as road traffic noise. For example, sounds from water (distributed by fountains or loudspeakers) may have a double function, both as provider of positive water sounds and as masker of unwanted city noise. This research question is crucial since scientific studies on the potential and limitations of promoting qualitative site specific sounds in noise polluted areas are lacking.

In the ongoing research project (see abstract), the above question is crucial. Recently, a *pilot project* was performed in a city park, situated in the central parts of Stockholm (Mariatorget – Maria Square). One basic idea with the pilot project was to investigate the potential of different types of sounds, for providing pleasant and restorative soundscapes, in order to strengthening the social interaction as well as the spatial and aesthetical qualities in the park. The investigated sounds where: natural sounds, e.g., water and birds; and artificial sounds, e.g., sounds of crystal glass and metallic rings. These sound where implemented in the park by four loudspeakers. The soundscape of the city-park and the installed sounds where recorded with ambisonic technique and also with an artificial head. Listening experiments will be conducted later on in this research project. The listeners’ soundscape perceptions will be evaluated, including perceived soundscape quality, road-traffic noise annoyance, aesthetical qualities and perceived potential for psychological restoration. One crucial issue concerns the impact of the tested natural and artificial sounds in the park. A primary concept that handles this question is *acoustics*, which refers to the condition when the sound is apprehended, but when the visual association to the source is detached.

The result of the pilot project will be evaluated during 2010, which means that it is not possible to present the outcome within this paper. Yet, the above questions will be further discussed from a theoretical and methodological point of view, focusing on the conception of *Trans-Acoustic Design*.



Figure 1 and 2: Photos from the pilot project, performed at the Maria Square in Stockholm

1.2 On Language Issues and Interdisciplinary Approaches

One crucial issue of sound-art concerns the descriptive dimensions in that the artist need a qualitative vocabulary when analysing and communicating in the design process; by focusing on conceptual tools, we can gain deeper knowledge of the semantic frame of environmental related issues. Concepts may also be borrowed, and possibly transformed, from one field of discipline (e.g., music, architecture, movie) to another. Such conceptual tools can be used in the art process; it permits a synthesis of the qualitative characteristics of a place. It is also a predictive tool in that it may serve as an instrument when creating qualities (of various kinds) of a planned place. Moreover, this conceptual tool may be used by the artist (as well as by designers, architects and others) in her/his practices; it should serve as an interdisciplinary tool with which one may conceptualize and create criteria with regard to the environment and perceiver space.

The environment in cities has changed radically in only one generation. Since we seldom perceive environmental urban actions as isolated phenomena – but interpret them in their context and related to situation, surrounding and human interaction – the understanding of urbanity requires an interdisciplinary approach.¹ In this respect, interest in links between environmental and artistic expressions has increased, e.g. to art, design, dance-choreography, architecture, acoustics and issues of sustainability.

One fundamental issue within the field of sound-art is to discuss and challenge the visual dominance in environmental thinking, and to raise competence among artists, architects, designers, et al, on urban environment issues. To promote a sustainable sound-art installation, time-space-based knowledge must be integrated in the complexity of urban design and development. There is, therefore, important to develop interdisciplinary theories and methods that are adaptable to the built environment. One single discipline can not embrace the whole subject area, so research must be conducted on an interdisciplinary level. The urban space works as an instrumentarium, a store of information, which brings form to social, perceptual, aesthetical, cultural and spatial configurations.² This means that knowledge of the environmental world cannot be reduced either to exclusively objective data or to exclusively subjective data, but it covers all kinds of objective, subjective and inter-subjective interrelationships and complex configurations in the built space.³ Accordingly, what is needed for is the emphasis on the creation of interdisciplinary qualitative tools, which can be adapted to various forms of the urban space.

1.3 Soundscape Conception

Within design, researchers have long been studying the interplay between perceived space and built space, especially regarding the dimensions of light and colour. But today one may add the dimension of sound as an important building block for design research in its entirety. It is important, though, to stress that this is not a matter of audibility in concert halls, or of sound absorbing measures, but rather about qualitative criteria on the whole, which is crucial concerning our experiences and understanding of the built space. Hence, it deals with the design of sound qualities in regard to the actual situation, which is analogous to the design process when deciding the range of colours for a place or for a building.⁴

Sounds are seldom perceived as isolated phenomena, but are interpreted in a context, in relation to situation and place. Therefore, soundscape conception deals with the adjustment of sound sources, and in regard to the design of the built space. In other words, one essential function of sounds is to support the activities at a place. A certain place that “sounds good” must not necessarily be quiet, but is established in regard to the whole situation; how sounds are articulated and perceived, how they activate people, how they are related to the built space as well as cultural and aesthetical connections. Therefore, to promote a sustainable urban environment, sounds must be integrated in the complexity of urban design and development.⁵

With regard to soundscape issues, sound-art involves the interpretation of sound; when listening we never attend to the sound itself, but we attend its context e.g. its spatial, temporal, cultural and aesthetic dimensions. A second aspect concerns the expression of sound. In daily life we are to some extent always aware of sounds in that the given sonic information works as a guide to inform us how to act in the environment. Consequently, this aspect concerns social interaction and people's practice. A third aspect deals with how we may conceptualize and create criteria with regard to the environment and perceiver space, which implies design of the environmental space.

2. Basic Qualities within the Frame of Trans-Acoustic Design

2.1 Introduction

One basic issue concerning qualities of environmental sounds is the listening perception itself. Sounds bring qualitative information regarding aspects of place characteristics, orientation and communication. For this reason the listening process is a tool for the interpretation and understanding of built space in that we decode the surroundings by listening. What is asked for is an exploration that approaches the relation between the listener's and the user's space, i.e. a qualitative investigation that explores how listening perception operates when acting in the built environment. This implies that sounds possess certain qualities by bringing qualitative information in many aspects and situations.

Two basic qualities regarding this are *sonic structural configurations*, which deal with the organization and patterning of individual sound-objects and its relation to the sound environment. One main concept that handles structural configurations is *metabolic effect*. The other quality concerns *perceptual configurations*, which deal with our interpretation and understanding of the sonic space. One main concept that handles perceptual configurations is: *acoustics*. Thus, the concepts of metabolic effect and acoustics constitute two main criteria within the process of trans-acoustic design.

2.2 Metabolic Effect

Metabolic effect is an interdisciplinary concept that describes the unstable relation between individual sonic elements and its constitution as an ensemble. The concept is defined by researchers at the institute CRESSON, in Grenoble France.⁶ The metabolic effect includes two fundamental criteria:

- the instability of sonic elements in a given sonic environment
- the stability of the sonic elements as an ensemble in the same sonic environment

In practice, the metabolic effect is a perceptual and structural effect, but it is hardly ever perceived at its full extent; one can say that a space could be more or less metabolic. The perception of the effect may be illustrated by a listening situation in which a sound-image is easily apprehended in its entirety, but not its constituent elements, which are perceived as being in transition. The single sonic element in a metabolic space is not apprehended within an extended linear and temporal succession; the moment one catches the sound it disappears and one's listening attention shifts to another sound, and so on. It is, thus, a matter of a dual perspective, where the 'exterior' of the metabolic sound-image is easily discernable, but not its 'interior', which lacks a distinct structure. In other words, the 'ultimate' metabolic space is a space where all its constituent elements are perceived as being in a non-hierarchical, constantly changing interaction.

Since the qualities of the individual elements within a metabolic space are disrupted in time, the impact of the effect may cause inconvenience when acting in situ. For instance, reverberant places such as railway stations and commercial centres are typical examples of metabolic milieus that reduce the possibility of orienting oneself by listening attention; the sounds are perceived as lacking temporal directions. It is not particularly easy to communicate in such metabolic milieu i.e.

a perceiving and communicating subject finds herself in an ambivalent position in that her voice becomes a part of the metabolic milieu, with which she in fact struggles; the more she endeavours to make herself heard, the more she supports the metabolic milieu, which means that she becomes an involuntary co-designer of a collective and impersonal space.

The phenomenon can also be discussed in terms of the relation between *figure-ground*, in that the sound space, as a whole, takes the shape of a figure, while the individual sound elements are operating in the background. The conception of metabolic effect also opens up the field to adjacent concepts, like masking effect, ubiquity and synecdoche.⁷ Metabolic effect is thus an interdisciplinary concept in that it can be discussed from different disciplinary angles.

2.3 Acousmatics

The other main concept that I will introduce is acousmatics, i.e. the process of apprehending any sound, the source of which is invisible. The concept is defined by the French composer, engineer and researcher Pierre Schaeffer, who also is the inventor of the Concrete music.⁸ Hence, acousmatics concerns the relation between the perceived sound and its producing media. According to the Dictionary, the adjective acousmatic derives from Greek and refers to the condition when the sound is apprehended, but when the visual association to the source is detached. Acousmatics was used in Ancient Greece when a lecturer hid behind a curtain to put the focus on the speech itself.⁹

When scrutinising the conception of the *acousmatics concept* it may easily be interpreted and designated to fit to all types of music – e.g. music heard on radio, stereo, telephone and computer. However, the concept of acousmatics is also an applicable tool when exploring urban spaces, such as city-parks. When acting in these spaces, you very often hear sounds that you are not able to verify visually – in other words you do not know what or who the producer is of the perceived sound. This might be very problematic since it can cause uncertainty and inconvenience. This also means that acousmatics is not an absolute concept, instead the concept can be discussed in terms of *varying acousmatic conditions*:¹⁰ one extreme condition I denominate in terms of a *figurative acousmatic condition*; in the sense that it is very easy to associate the sound to its producing media, for instance listening to the sound of an airplane or a car. Accordingly, the opposite condition is denominated in terms of a *nonfigurative acousmatic condition*, i.e., when it is impossible to associate a sound to a visual context.

So, the conception of acousmatics is an applicable conceptual tool when exploring the relation between auditory and visually representation.

3. The Conception of Trans-Acoustic Design

I will now go back to the initial question of this paper: *How to create sound-art installations in city-parks which are sustainable over time?* The reason why I put this question is due to the fact that most of the permanent sound-art installations in public spaces are not sustainable over time, in the sense that people get disturbed.

One basic prerequisite regarding the creation of permanent sound-art installations, distributed by loudspeakers, in public space is that they need to be site specific. To work site specific means that the artist cultivates and experiments with the local sounds in the surroundings, as well as the installation must communicate with the architectonic and social spaces. In other words, a sound-art installation can hardly be performed as an isolated phenomenon; instead the installation must support the context of the space.

Hence, Trans-Acoustic Design is a site specific tool in that it helps us to make analyses and to describe city-parks, and two main concepts are metabolic effect and acousmatics. I argue that it is especially important to establish site specific installations in this type of space. The sonic structure is often loud, blurred and confusing, with little correspondence between visual and aural perception, and with weak articulations of spatial dimension, distance, borders and orientation.

What is Trans-Acoustic Design? In brief, Trans-Acoustic Design deals with the *transformation* of one acoustical environment into a *new* designed acoustical environment. This design strategy might seem strange. But, the basic idea with Trans-Acoustic Design is to explore and to transform existing sounds at a certain place into new acoustical configurations. Every single urban place works as a store of sonic information, which brings form to social, perceptual, aesthetical, cultural and spatial configurations. Most of these sounds are acoustically perceived. By the use of this store of sonic information, you could reorganize and recompose the sounds into new acoustical configurations, by distributing sounds via loudspeakers. In practice – to work as a Trans-Acoustic Designer – you need to consider questions, such as:

- what does the city-park look like, from a spatial, temporal, cultural and social point of view?
- what is the city park connection to the surrounding infrastructure and urban area?
- what constitutes the audible interaction between the site specific sounds and sound installations with regard to the city park?
- what constitutes the visual interaction between site specific sounds and sound installations with regard to the city park?

The difference between the original acoustical space and the new transformed acoustical space is that the latter is contextual in that it communicates with the surrounding area; one could say that such transformed acoustical space strengthening the qualities of the space – for instance qualities such as atmosphere, spatial orientation, sonic comfort, time characteristics and aesthetics.

4. Conclusion

The sonic environment is an important element in urban outdoor space such as city-parks, as well as in indoor public pathways, communication spaces and semi-public commercial spaces. For these kinds of collective spaces, I argue, it is especially important to integrate architectural, acoustic, musical, artistic and social analyses.

Today the shopping culture dominates the urban space. Most public activities are connected to shopping; city-parks, as well as town centres, suburbs, streets, airports, museums and hospitals are highly influenced. Nowadays, it is almost impossible to find non-commercial public spaces. Shopping does not only dominate urban activities, it almost constitutes the construction of the city. In these environments we are exposed to all types of sounding artefacts: jingles from public loudspeakers, signals from mobiles, computers, technical installations, white goods, toys etcetera, as well as music and muzak directed towards consumption. These sound sources may together generate a chaotic sonic environment, or schizophrenia.¹¹ Since we very often lack of visual contact with these sounds, I will claim that the sounds of the shopping culture together embodies a kind of *acoustical environment*.

The reason why we need to develop deeper knowledge within this field is that these acoustical environments expand very fast. Due to the development of technology, new sounding products and services are incorporated in the environment continually. It is also important to emphasize that an acoustical environment not basically deals with single sound products, but instead it deals with sounding products as an ensemble. So the acoustical environment constitutes a *new type of sonic infrastructure*, which is problematic for different reasons. The major reason is that we do not have any natural connection to most of the sounds in that they are not directed to our personal activities; the sounds are associated to individual use in a collective space.

In conclusion, one essential issue in the ongoing research project *Acoustic Design Artefacts and Methods for Urban Soundscapes* concerns design of sound-art installations, distributed by loudspeakers, in city-parks which are sustainable over time. The main idea with these installations is to investigate the potential of different types of acoustical sounds, for providing pleasant and restorative soundscapes in city-parks, in order to strengthening the social interaction as well as the spatial and aesthetical qualities. A sound-art installation has also a double function in that it may

mask other sounds, for instance unwanted city noise such as road traffic. The masking effect is also investigated within the project. The outcomes of these studies are not finished, but the evaluation of perceptual, emotional and behavioural effects on visitors in city-parks will be presented later on, in 2010.

In this paper I have mainly scrutinized the question: How to create sound-art installations in city-parks which are sustainable over time? And, one valuable tool concerning this is *Trans-Acoustic Design*.

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