

Modelling of Sounds in Public Spaces

Conference paper: Sound Practice, College of Arts,
Totnes, England, 16-20 Feb. 2001.

Abstract

A common conception of architecture is that it consists solely of material artefacts, i.e., a built environment where the physical shapes constitute static values. This is partially true, but architecture is just as much a question of immateriality as well as acquired experience. Such approach implies a dynamic understanding of architecture as a reservoir that gives the shape of the activities within it. The architectural conception is thus a matter of the context of place, where criteria such as social pattern of behaviour, cultural-/aesthetical expressions and spatial-/temporal understanding are basic functions.

The sound environment represents one fundamental dimension of architecture in the sense that sounds deal with our interpretation and understanding of built space, and when it comes to architectural research the sonic environment is a design problem that one has to consider. Concerning spatial and temporal criteria, sounds bring qualitative information regarding the territory of place, orientation (we act and respond to the given sonic information) and communication etc. The sonic interpretation is necessary since it helps us to understand the context of place.

The basic instrument when acting in the environment is the listening perception itself. This process is a multi-dimensional tool and simultaneously and continuously it operates between an active/passive, determined/undetermined order by decoding sonic information: we “create” the surrounding space by our listening apparatus.

Hence, the overall topic of this paper concerns the *listening perception*. The paper consists of a presentation of different works that address the perception of sound. Consequently, this paper is to be seen as the result of an exploratory study, and a presentation

of problems rather than solutions to these problems. The purpose is to investigate the conception of the listening perception; to search for a deeper knowledge of how the listener acts but also to gain deeper knowledge of the semantic frame of listening. Thus, I’m focusing on the concept.

Preface

Primarily, this paper is framing Design Theory, with regard to the discipline of sound design. According to Jerker Lundequist, the meaning of the design concept basically concerns the qualification of the characteristics of a product that is made in order to help a future user to manage certain problems.¹ Accordingly, one basic task regarding design research of design is to define concepts that can be applied by the designer, i.e. to define a repertoire of concepts that function as a tool in practice. Consequently, the design doesn’t in the first place deal with resolving problems, but deal more with managing problems. Moreover, the development of a repertoire of concepts must also be made in regard to a context. The concepts are therefore seldom general in the meaning that they are suitable within different disciplines, but instead the concepts demarcate a specific disciplinary context.

However, it must be noted that sound design encompasses a vast field of theories and the subject can be scrutinised from, e.g., a perceptual, semantic, social, acoustic, spatial, medical, musical and anthropological viewpoint. In this sense, this paper is very narrow since it basically deals with the *listening perception of sound*, but to some extent it also deals with the *semantic understanding* of sound. Thus, the main purpose has been to scrutinise a conceptual appara-

¹ LUNDEQUIST Jerker, *Design och produktutveckling – metoder och begrepp*, Studentlitteratur, 1995:61

tus concerning the different ways that we perceive sounds.

By way of introduction, Pierre Schaeffer, the inventor of the musical style *musique concrète*, (concrete music), and especially his principal lines of the listening perception, is discussed. The continuing text is outlining how the realm of his thoughts is used and discussed by different contemporary music theorists. The last part is continuing the discussion of the listening perception by a presentation of some of the multi-disciplinary qualitative tools, denoted as *sound effects*, which have been invented at the French research institute Cresson.

Despite the obvious relationship between the work of Schaeffer and the work at Cresson, it's important to bear in mind that Schaeffer's research work mainly investigates the sound themselves, i.e., a *laboratory approach* that focuses on the smallest musical building stone: the *sound-object*. Cresson, on the other hand, mainly investigates sounds' relation to built environment, i.e. an *environmental approach* that is fulfilled through the *sound effect* paradigm.

Sound-Object Realm

With the development of *concrete music* and a new type of music theory, Pierre Schaeffer, the French pioneer laid the foundations of modern methods of viewing sound, noise and music. Above all, Schaeffer's invention of concrete music implied a transformation of sound from function to a more esthetical approach, i.e., to use noise as a musical building stone and simultaneously disconnect the listener's association to the origin of a sound. The use of environmental sounds as musical material is, however, not a new phenomenon in music history.² But, the fundamental difference was that Schaeffer separated the noise from its environmental context and, instead, viewed the intrinsic sonic qualities of noise. In his work *Traité des Objets Musicaux* (Treatise on Musical Objects) and *Solfège de l'Objet Sonore*

(Music Theory of the Acoustic Object) he founded three basic concepts: *acousmatics*, *reduced listening* and *sound-object*.

The concept of *acousmatics* concerns the intrinsic properties of sound. According to the French Larousse Dictionary, the adjective acousmatic derives from Greek and refers to the condition when a sound is apprehended, but the association to the source is detached. Acousmatics was used in the Ancient Greece when a lecturer hid behind a curtain with the aim to focus on the speech.

With the concept of *sound-object*, Schaeffer refers to all sorts of sound phenomena that can be regarded as a coherent whole. The definition doesn't really concern acoustics, but rather the psychoacoustics field. Sound-object can thus be described as a perceptual concept. It's important not to mix the concept of sound-object with the object that emits the sound, e.g., in Schaeffer's piece *Étude aux Chemins de fer* the locomotive is the object – *le corps sonore*³ – which creates the sound. But, the concept of sound-object concerns the intrinsic properties of the “locomotive sound” and, thus, in spite of its name the concept shall not be connected to a measurable physical shape or the source itself.

According to Schaeffer, a chain of single objects can be regarded as a coherent whole and thus be perceived as one single sound object. E.g. an arpeggio (arpeggio: to rapidly play each tone in a chord in a row instead of playing all the tones simultaneously) played on a harp that constitutes one sound-object. Each single note is a micro-event, but the unity of the notes is apprehended as a *gestalt*, i.e. a sound-object.

When Schaeffer defined the concept of sound-object he also introduced the listening perspective *reduced listening*, which correlates to the concept of acousmatics, and which implies a type of listening perspective that can be regarded as an objective listening process, i.e. when listening, the focus is on

² One of the pioneers who worked with environmental sounds and noise was the Italian futurist Luigi Russolo.

³ SCHAEFFER Pierre, *Traité des Objets Musicaux*, Editions du Seuil, 1966:53

the one isolated sound-object and not the source that emitted the sound or the environmental context.

Referring to the definition of the concept of *acousmatics* – i.e., the process of apprehending any sound, which source is invisible – the concept can easily be interpreted and designated to fit all kinds of music and noises which causes cannot be visually observed, e.g., music heard on the radio, the stereo, the telephone or the computer. However, this is just partially true. Denis Smalley, the English music theorist, discusses the realm of the concept in terms of varying *acousmatic conditions*. He states that the concept of acousmatics is broad and that it can be treated within a wide frame of references. According to Smalley the heart of the *acousmatic perception* concerns the daily life identification process: when one is prevented from visually verifying a sound-source, one automatically proceed to associate the sound by comparing with past experiences, using the memory as a “reference-bank of correlation between sound and experience”.⁴

Besides the reduced listening technique, Pierre Schaeffer also distinguishes four different modes of listening: *écouter* (*listening*), *ouïr* (*hearing*), *entendre* (*attending*) and *comprendre* (*understanding*).⁵ These four verbs are subordinated to the listening perspective that Schaeffer entitles “*écoute ordinaire*” (*ordinary listening*), which concerns an identification process in the sense that the sound is used as a medium: the surrounding sonic information is decoded with these four listening modes. Briefly, the *listening*, *hearing*, *attending* and *understanding* can be outlined as:

- *Listening* deals with the attention to someone or something: the intermediation of sound and the event that caused it. The sound is treated as indicia of the source.
- *Hearing* concerns the most elementary rough order of listening perception. One listens passively without specifically searching for a

certain sound without explicitly understanding the sonic information.

- *Attending* deals with the perceptual stage when one doesn't etymologise the sound: the derivation and origin of sounds are not searched for. Instead the perception operates on a selective level: one searches the specific qualities of a certain sound.
- *Understanding*: is a semantic listening mode. The sound is treated as a sign or a code that consists of certain values.

In *Traité des Objets Musicaux*, the relation between these four listening perspectives has schematically been outlined by Schaeffer as follows.⁶

1. Table of the listening functions

4. UNDERSTANDING <i>reference confrontation</i>	1. LISTENING <i>emission</i>	1 and 4 : objective
3. ATTENDING <i>selection</i>	2. HEARING <i>reception</i>	2 and 3 : subjective
3 and 4 : abstract	1 and 2 : concrete	

The previous table displays the crossing of the four listening perspectives and their relation to the two dualistic orders abstract/concrete, and objective/subjective. The *abstract* order concerns the qualities of sound that circumscribe a perceptive or a semantic level (the intention to understand the message). In opposite, *concrete* refers to the causal references and the given sounds (the intention to apprehend the message). Moreover, *objective* refers to a condition when one confronts the object (the sound itself). *Subjective*, on the other hand, refers to when one confronts the activity in regard to the perceived sound.

⁴ SMALLEY Denis, (ed. A. Vande Gorne) *Acousmatic music: does it exist?* in *Vous avez dit Acousmatique?*, Ed. Musiques et Recherches, 1991:21

⁵ SCHAEFFER Pierre, *Traité des Objets Musicaux*, Ibid p. 112-128

⁶ Idem p. 116. N.B. The table is a simplification of the original.

What can one say about the measurability of a sound-object? As have been stated, Schaeffer did not mean that the sound-objects should be traced with physical devices, but they should be considered as perceptual objects and, thus, the best way to analyse them would simply be to listen. Above all, the sound-object is analysable by its *morphology*⁷ that concerns the spatial, spectral and structural configuration over time. A sound-object is finite in time and its temporal shaping is also discussed in terms of its *envelope*, which characteristics concern the “attack, body and decay”.⁸

In *The Tuning of the World*, R. Murray Schafer, the Canadian composer and sound researcher, makes a distinction between sound-object and *sound-event*.⁹ As has been mentioned, sound-object is correlating to the concept of acousmatics and reduced listening, which implies a reduction of the associative meanings of sound. The measurability of a sound-object has in this sense a laboratory approach since the analysis concerns the intrinsic properties of sound. The limitations of such a method of measurement is obvious, and therefore, Schafer proposes the concept of *sound event* in order to broaden the references of the sound-object. *Event* is defined as “something that occurs in a certain place during a particular interval of time”,¹⁰ and, consequently the conception and measuring of a sound event includes the environmental context. In other terms, one can say that the sound event implies that the correlation to the acousmatic and reduced listening approach is disconnected.

To summarise, the sound-object can be regarded as the smallest building stone in the sonic environment and musical landscape, and it can be viewed from two different angles: Firstly, it can be viewed from an acousmatic point of view implying that it is the

intrinsic qualities that matter: and secondly, from a contextual point of view – treating the object as an event – which implies that it is the environmental qualities that matter. For example, when investigating the sonic properties of a Zippo lighter the former – the acousmatic, reduced listening approach – concerns the qualities of the sound itself, and the latter – the contextual approach – concerns aspects such as the symbolic, semantic and referential qualities of sound.

The ordinary listening and the reduced listening are two different listening perspectives. The former perspective concerns the identification process when decoding the context of sound, i.e. we consciously or unconsciously search for explanations such as: who/what emitted the sound? Why does it sound? The latter – reduced listening perspective – concerns the behaviour when perceiving the sound itself. This process consists of the *identification* and the *qualification* of the sound object. The identification deals with the isolation and identification of an object, e.g., to identify a certain object from a chain of objects. The qualification consists of the description and the qualification of the object through its internal qualities. Thus, identification refers to a superior level of context (form), and qualification refers to the internal structure of the object (values).¹¹

In order to achieve a reduced – acousmatic – listening condition, a momentarily listening technique is needed simultaneously with a sublimation of the environmental context of sound as well. Indeed, this technique is a transient process since a lot of concentration is demanded. In practice, it's only possible to listen during a short period of time before getting lost in the sonic forest. To facilitate the reduced listening process it would be necessary to have an “acousmatically aware composer”¹² who could compose music that would draw the listener's attention to the sonic interior beyond the contextual frame.

⁷ SMALLEY Denis, (ed. Emmerson S.), Spectro-morphology and Structuring Processes in *The Language of the Electroacoustic Music*, Harwood Academic Publishers 1986:68-73

⁸ In *The Tuning of the World* (Alfred A. Knopf, New York, 1977:129) R. M. Schafer discusses the envelope object of sound in terms of “attack, body and decay”. In *The Language of the Electroacoustic Music* (Ibid p. 69) D. Smalley discusses the envelope object of sound as the “onset, continuant and termination”.

⁹ SCHAFFER R. Murray, *The Tuning of the World*, Ibid p. 129-131

¹⁰ Idem, p 274

¹¹ CHION Michel, *Guide des Objets Sonores*, Buchet/Chastel, 1983: 59-60

¹² SMALLEY Denis, *Vous avez dit Acousmatique?*, Ibid p. 21

On the Perception of Sound-Object

Can one recognise the sound-objects themselves? According to Trevor Wishart, the English composer and music theorist, the concept of acousmatics can be discussed in terms of *contextual clues*, and he states that:

The development of the concept of the acousmatic and the general tendency in mainstream musique concrète to destroy clues as to the source or origins of the sounds can be seen as a specific reaction to the problem of landscape in electro-acoustic music.¹³

Even when sounds are directly recorded, or sampled, from a natural environment they may be devoid of their environmental context. This is due to the relationship between sound and environment: if a natural sound is removed and put into a new real or imaginary environment it might not be possible to recognise the environmental qualities of the sound-source anymore and, thus, the sound has lost its function as a contextual clue.

Furthermore, Wishart discusses the recognition of the sources in terms of *intrinsic recognition* and *contextual recognition*. The intrinsic category concerns the sounds themselves. Firstly, in a narrow sense, concerning the frequency, spectra and duration etc., and secondly, in a broader sense, the distortion, coloration, envelope etc. The concept of contextual recognition refers to the relation between different sound-sources.

One aspect of the contextual recognition between sounds concerns the *masking effect*. In the everyday life, different types of juxtaposition of sounds will always be found, and this sonic interference can cause the masking effect. The main masking factor is the volume. Factors such as timbre, articulation and duration etc. also affect the ability to identify the sounds. Wishart when composing music utilises the

juxtaposition effect in terms of an “interplay between the recognisability and lack of recognisability of various sources”. This interplay and use of different degrees of recognisability can be created in a surrealist manner by partially hiding sound-objects or by a gradual transformation of one aural image into another. Wishart says that “the brain is capable of reconstructing a message from partial information, even when the remainder of the message is not present”.¹⁴ The juxtaposition of sounds – or the masking effect – is, thus, an important parameter when composing music in a virtual acoustic space, but as have been stated it’s also possible to discuss this phenomenon from the experience of natural sound-events in the environment.

The masking effect of sound is also discussed in terms of *figure-ground*.¹⁵ This dual relation that emanates from Gestalt Theory basically concerns the visual perception, but it can in a transferred sense be discussed within an aural context as well. Briefly, within Gestalt Theory it’s the figure that makes sense in contrast to an irrational ground. When acting in the sonic environment, our perception operates on a selective level: we search for a specifically qualitative sound information. Our hearing can perceive multiples of sounds as an entity, but simultaneously has the faculty of selecting certain sounds from each other. To imagine this process one can say that certain elements release themselves and form a *figure* when the other sounds remain in *ground*. Figure is, thus, the sounds that we are listening to – the sounds that catches our attention – while the rest of the sounds are constituting ground.

In *The Tuning of the World* Schafer discusses the masking effect by using the terms *hi-fi* and *low-fi*,¹⁶ Schafer applies the concept of hi-fi into the sonic environment, and, briefly it designates an environment in which discreet sounds can be heard clearly

¹⁴ Idem, p. 152

¹⁵ The dual relation of *figure-ground* is discussed by Pascal AMPHOUX in *l’Identité sonore des villes Européennes* (CRESSON, Grenoble 1993:21), in *A l’écoute de l’environnement* (AUGOYARD, TORGUE Editions Parenthèses, Marseille, 1995:87), and by SCHAFFER in *The Tuning of the World* (p. 151).

¹⁶ SCHAFFER R. Murray, *The Tuning of the World*, Ibid p. 43

¹³ WISHART Trevor, *On Sonic Art*, Harwood Academic Publishers, 1996:139

because of the low ambient noise level. The lo-fi, on the other hand, designates an environment in which the silent sounds cannot be heard. The discreet sounds are masked because of the overcrowded and/or high ambient noise level.

To summarise, one can say that Wishart doesn't only discuss the sound landscape from a musical viewpoint, but he also considers the user's space. Within this frame, Wishart's way of regarding music can be characterised as a shift of focus from the musical material itself (the sound-source) to a mere viewing of the material from the outside, i.e. to scrutinise in which environmental context the material is utilised, expressed and perceived. Wishart does not present any solutions how we can handle these questions in public life, but without doubt, he has broadened this issue by his investigation of the interaction of different sonic entities.

Sound Effect Paradigm

A neighbour concept to Pierre Schaeffer's sound-object is *effet sonore* (sound effect), that has been invented at the French research institute CRESSON.¹⁷ The sound effect itself is an integral part of a repertoire of sound effects that are scrutinised in the book *A l'écoute de l'environnement – répertoire des effets sonores* (Listening on the Environment – repertoire of sound effects).¹⁸ When the book was published in 1995 the research and elaboration of the repertoire of sound effects had been going on at Cresson for more than ten years. One can say that this work mirrors the dominating attitude at Cresson, i.e. to approach the urban environment from a multidisciplinary point of view, and through detailed investigations elaborate design tools that are suitable within the architectural sphere.

¹⁷ The institute CRESSON (Centre de recherches sur l'espace sonore et l'environnement urbain) is located in Grenoble, France.

¹⁸ AUGOYARD, TORGUE, (editors), *A l'écoute de l'environnement – répertoire des effets des sonores*, éditions Parenthèses, Marseille, 1995

N.B.¹ The English translation of the title of this work is my own.

N.B.² Colette and Jean-François Augoyard have made the translation of *effet sonore* to *sound effect* in order to approach the denomination of *soundscape* (R.M. Schafer) and *sound-object* (P. Schaeffer).

What is then a *sound effect*? In brief, a sound effect can not be described as a pure concept but is rather a generic concept since it functions as an intermediate link between different disciplines. The repertoire of sound effects – that encounters of sixteen major and about sixty minor effects – is to be used in order to identify and describe the vast amount of sonic configurations that arise in a built environment. Each of the major effects is systematically defined into acoustical, architectural, sociological, psychological, cultural, philosophical and musical contexts, and consequently the approach is multi-disciplinary. Moreover, one can say that the ensemble of sound effects constitutes a paradigm and together they function as a guide that supports a general discourse of sound. Thus, in comparison with Schaeffer's methodological work, which basically deals with the intrinsic qualities of sound, the repertoire of sound effects is a qualitative tool to depict the context of sound in the sense that it embraces the interaction between human, spatial and physical dimensions.

Four Perceptive Sound Effects

In the work *A l'écoute de l'environnement* each of the defined sound effects is classified into one of five categories in regard to its environmental approach. One of these five categories comes under the heading of the order of perception, which aims at the organisation, memory and/or culture. Moreover, four basic effects within this category are *metabolism*, *synecdoche*, *asyndeton* and *ubiquity*,¹⁹ and they are indeed close to the realm of Pierre Schaeffer's work. The best way to understand these effects is not to scrutinise them one by one, but instead look upon them as entities where each sound effect basically demarcate one certain issue – like the pieces of a jigsaw puzzle.

The *effect of metabolism* is truly an intricate effect since its characteristics concern the instability of sound. The overall definition of metabolism has been outlined as follows:

¹⁹ *Métabole, synecdoque, asyndète, ubiquité*. The translation of the sound effects from French into English has been made at Cresson.

The effect of metabolism is a sonic perceptual effect describing the unstable and metamorphic relation between the elements that composes a sound unit. From a classical rhetoric perspective, the metabolic effect characterises the instability of the structural relation that ties parts of a unit together, and therefore, the possibility to switch between any order of the elementary components of a totality, which makes the sound perceived as a perceptual transition. In old Greek, the word *metabolos* signified something changing, something that is in metamorphosis. Here the change considers the relation of the elements that together create the sound environment, which can be defined as the addition and the superposition of the multiple of sources that can simultaneously be heard. The effect of metabolism includes two fundamental criteria:

- The instability of the structure discerned in time.
- The distinctibility of the parts or of the whole in a given sonic composition.²⁰

One main aspect regarding the effect of metabolism concerns the faculty of globalising separate sonic elements – or sound-objects – in the sense that they together form a whole, but simultaneously maintain the possibility to select each of them in an analytic perspective. This ambivalence between a single sound element and a whole is certainly close to Schaeffer's distinction between the material elements and the sensible elements of the sonic perception. As mentioned previously, this duality can also be discussed in terms of figure–ground. When perceiving the effect of metabolism in a real situation one selects the sounds – the figures – that attract our attention.

According to *A l'écoute de l'environnement*, Schaeffer's definition of one of the four ordinary listening perspectives, i.e., the *hearing*, may to some extent be regarded as metabolic. This listening process implies that the listener doesn't have any intention to search

for a certain sound, but instead the sound can be described as a floating or a disconnected listening process, which means that the environmental sounds are attended as one single sound.

This selecting process – to take a part of a whole – is denoted as the *effect of synecdoche*. This is a complementary perceptual effect to metabolism and when listening to a complex sonic environment, the effect of synecdoche concerns the faculty of operating on a selective level in order to value the one or the other element. Fundamentally, the selective listening technique crosses the whole of the conducted daily sounds. Moreover, the effect of synecdoche is complementary to the *effect of asyndeton*, which concerns the faculty of assessing certain sounds and simultaneously erasing other sounds that are regarded as purposeless. It's, thus, a matter of suppression of the perception of one or several sound elements. According to *A l'écoute de l'environnement*, these two effects form the basis of all interpretation of the sonic environment: namely the possibility to differentiate between the physical reference and the concrete situation when 'attending' a sound.

Another effect that is complementary to metabolism is the *effect of ubiquity*, which is related to the conditions of spatio temporal propagation, and, which concerns the difficulty or the impossibility to locate a sound source, i.e., the sound seems to come from everywhere and nowhere at the same time. One can say that the effect of ubiquity is for space what metabolism is for time. In *A l'écoute de l'environnement* it is stated that:

The effect of metabolism is characterised by the permanent instability of references in time (i.e., the constant reversal of the relation between the sound figure and the ground). The effect of ubiquity is characterised by the instability of references in space (i.e., the constant replacing of the positioning of the sound-sources).²¹

²⁰ (my translation) *A l'écoute de l'environnement*, Ibid p. 86

²¹ (my translation) Idem p. 88

When acting in urban space the effect of ubiquity often implements a degree of uncertainty since the propagation and the spatial condition of sound prohibit the listener from depicting and materialising the location of sound. This loss of spatial orientation can, of course, be very problematic in certain situations.

In what kind of actual situations can one confront the effects of metabolism and ubiquity? According to *A l'écoute de l'environnement* the emergence of the effect of metabolism is especially exposed in public spaces with large reverberant acoustics. The mixture of singular sources at such places are almost always predominant, i.e., no source dominate another. Characteristic examples of such places are reverberant railway stations and commercial centres of which the population density produces a multiple of sound sources.

The effect of ubiquity arises at similar places as the effect of metabolism. They especially emerge at closed reverberant places such as squares, narrow streets, galleries and passages that consist of reverberant surfaces. Besides the reflection of sound, the position of the listener is also crucial. The effect can be perceived when one are exposed to a multitude of surrounding sources – standing in the focal point of sounds – with the effect that one doesn't know which side to turn. The effect can also be perceived from a distance. For example, when standing on the fringes of a place one can localise where the sounds come from, but not exactly where they come from regarding the interior – the sounds lack spatial position. Places such as corridors, landings and cross-roads, which create a condition of superimposition of sounds, are a breeding ground of the effect of ubiquity as well.

Finally, within the musical field one often encounters the *effect of metabolism*, and in some cases it seems as the composers deliberately uses the effect as a basic parameter when composing. One explicit example is composer David Tudor's musical work *Rainforest*, the first version (1968) and the fourth version (1973). In these pieces Tudor establishes a sound environment

where the sound-objects within it are perceived as continuously being in transition, which causes the effect of metabolism.

Another example is *Concret PH* by Iannis Xenakis. In this composition Xenakis creates the image of *one* single sound in the meaning that one apprehend the sound objects separately, but the vast amount of objects makes the listening effect to be a whole, i.e., the transition of one sonic entity. Moreover, another cause for the effect of metabolism in this piece is that the sound-objects don't follow a linear musical evolution. The music doesn't develop in a successive order, which gives the impression that the sounds lack an explicit time direction

Conclusion

Regarding the context of sound, it's important to bear in mind which type of sound landscape that is discussed. On the one hand, is it the sound themselves that matters – focusing on the interior of sound – when exploring the sound landscape? Or, on the other hand, is it the environmental context of sound, the exterior of sound, that matters? In daily life, however, there are no clear-cut dividing lines between the *interior* and *exterior* sound landscape, but instead they are usually perceived conjointly. Wishart states that:

In practice the nature of the perceived acoustic space cannot be separated from our perception of the sound-objects within it. We obtain our information about, for example, the reverberant properties of the space, by hearing out the temporal evolution of the sound-objects within the space and, for example, the different reverberation times of different objects within the space may give us further clues as to the overall acoustic quality of the implied sound-environment.²²

²² WISHART Trevor, *On Sonic Art*, Ibid, p. 140

In conclusion one can state that sound is never an isolated phenomenon, but related to physical, psychological, social, cultural and esthetical circumstances. Thus, we need a contextual thinking when discussing the relation between sound and listener's space. As well as the sound themselves our listening behaviour operates simultaneously on different levels: reduced/ordinary, undetermined/determined, objective/subjective, abstract/concrete – our listening perception crosses between different perceptual orders. The title of this paper *Modelling of sounds in public space* implies, thus, that one activate the surrounding space through their listening – one *models* the sonic world by being an integral part of the environmental process itself.

Björn Hellström, 12 Feb. 2001

References

- P. Amphoux, 'Identité sonore des villes Européennes', Volume 1, CRESSON/IREC, report No. 117, Grenoble/Lausanne, 1997
- J-F. Augoyard, H. Torgue, (editors) 'A l'écoute de l'environnement' – répertoire des effets sonores, Editions Parenthèses, Marseille, 1995
- M. Chion, 'Guide des Objets Sonores', Buchet/Chastel, 1983
- J. Lundequist, 'Design och produktutveckling – metoder och begrepp', Studentlitteratur, 1995
- P. Schaeffer, 'Traité des Objets Musicaux', Ed. du Seuil, 1966
- R. M. Schafer, 'The Tuning of the World', Alfred A. Knopf, New York, 1977
- D. Smalley, 'Spectro-morphology and Structuring Processes', ed. by Simon Emmerson, The Language of the Electroacoustic Music, Harwood Academic Publishers, 1986
- D. Smalley, 'Acousmatic Music: Does it Exist?', ed. by A. Vande Gorne, Vous avez dit Acousmatique?, Ed. Musiques et Recherches, 1991
- T. Wishart, 'On Sonic Art', Harwood Academic Publishers, 1996