

*Robin Minard*

Over the past years, the term »sound installation« has been used to describe a wide variety of interdisciplinary art making. The term has been adopted with reference to any number of works which in some way integrate the element of sound – generally in a non-conventional manner – and which may otherwise be hard to categorise. This very broad use of the term has made it difficult to propose one single, clear definition for the concept of sound installation. As part of the broader category of »installation art«, though, the term may be more exactly understood. This category of works has been defined as an art form »which rejects concentration on one object in favour of a consideration of the relationships between a number of elements or of the interaction between things and their contexts«<sup>1</sup>. In sound installation we find this particular quality of relationships expressed firstly between the audio, visual and/or architectural elements of the work and secondly between the sound and the space for which the work is conceived as well as between the sound, the space and the observer.

Furthermore, installation art has been described as being »concerned not only with art and its boundaries, but with the continual rapprochement, or even fusion, of art and life.«<sup>2</sup> We will find this to be an ever more relevant aspect of sound installation as works are increasingly created for presentation within everyday environments and situations.

Interest and activity in the area of sound installation has increased dramatically over the past decade. Such an increase in involvement on the part of artists may be seen simply as a natural tendency for them to fuse various artistic areas within their exploration of technology or, even more simply, as their direct reflection of our multimedia-oriented society. I would argue, however, that the cause for this rise in activity lies more deeply within a basic need for artists to merge (or re-merge) art with life; with a need for them to find new and socially relevant modes of artistic expression.

In my own work, the idea of sound installation has meant something very specific: the integration of sound in public environments and therewith the merging of works not only with existing architecture but also with everyday situations and real functioning surroundings. Visual elements of the work have been linked to acoustic considerations and to the broadcasting of sounds in specific ways. Such work inevitably eliminates the boundaries which exist between conventional forms of art making (music, visual arts and architecture) and creates new relationships between the art work itself and the art »consumer«.

The *fusion of art and life* is an essential aspect of the installations. One of my primary concerns has been to establish a dialogue between the work I create, the space within which I install the work and a public who either experiences my work in passing or who lives or functions with my work over a longer period of time. My installations most often aim to intensify the public's experience of the chosen space or to provide the public with a new or enriched perception of their surroundings. In this sense, the essence of the art work is expressed not solely through the work itself but also through the relationship which is established between the work and the space for which it is created.

As a composer, when I began creating sound installations in the mid-1980s, these concepts confronted me with a very new approach to music making. First and foremost, it meant conceiving works within a new social context. The removal of music from the traditional concert hall and the placing of it in the much less formal surroundings of public spaces held implications not only for the character of the music itself but also for my basic attitude as a composer. Emphasis was now to be placed on adapting works to existing conditions and on the merging of them within given surroundings. This meant that the specific needs of the individual space would guide the creative process, that in essence »the artistic component [of the work] would be supportive rather than primary.«<sup>3</sup> This approach contrasted sharply with the traditionally isolated act of music composition, to its autonomous conception and to its almost exclusively spectacle-oriented character of presentation.

Within such a new approach to music making, traditional musical concepts of form and structure, of register, rhythm, timbre, and so forth, seemed neither adequate nor suitable. Traditional methods and goals were therefore re-examined, and the groundwork for a new approach to working with sound was proposed.

Within this new approach, differences were to be reflected not only in the general objectives of the works and in their ultimate »musical meaning«, but also in their most basic aspects of conception, such as sound medium and methods of broadcast. The fact that works would be designed for integration in public environments in *permanent* or *semi-permanent* fashions strongly influenced artistic choices in these areas. Thoughts were eventually directed exclusively to the field of electroacoustic music and to the non-conventional use of loudspeakers. As this essay proceeds, it will become clear that the medium of electroacoustics is particularly suitable for the concepts proposed: it permits the broadcast of sounds in a continuous fashion and within an unlimited time frame; it allows the creation of quasi-static sound textures – which may be employed to homogeneously »colour« space with sound. Furthermore, electroacoustics allows for the controlled movement of sounds through space, the creation of new acoustic situations and the slow metamorphosis of sound-space applications.

From this point on I will deal specifically with sound installation concepts pertaining to electroacoustics. This is not to rule out other sound installation applications which might

have similar objectives or aesthetics (for example sculptural works involving the acoustic generation of sounds) nor to say that the principles proposed here may not be applied to other mediums, but as we narrow our focus on the specific genre of *electroacoustic* sound installation, it will become clear that this medium is the most flexible and appropriate for the processes I wish to describe.

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Laying the groundwork for this new approach to working with sound requires, above all, the understanding of two basic concepts. The first concept relates to form and musical syntax and deals with the idea of a »non-narrative« mode of musical expression. I will deal with this concept at some length below. The second concept relates directly to the medium of electroacoustics and deals with what I will call »relative-fidelity«. Because this second concept deals not only with basic technical questions, but also with our complex relationships to media and technology, describing it in any depth would take me outside the scope of this essay. For the purpose of this text, it will suffice to briefly point out the fundamental differences which I would make between concepts of »high-fidelity« and »relative-fidelity«.

High-fidelity is concerned with conserving a musical work – most often as a recording on tape or CD – and with reproducing this product as faithfully as possible (hence the term high-«fidelity»). In the case of hi-fi, the tape or CD becomes an entity on its own; it is transferable to other locations and situations; we *reproduce* its sounds on loudspeakers with varying degrees of fidelity.

In the case of sound installation such concepts of »fidelity« and »reproduction« do not exist. In sound installation there is an inseparable relationship between the sound source, the method of broadcast and the space for which a work is conceived. All of these function together to form a *single* entity. There is no notion of transferring the work to other locations (except perhaps to very similar locations) because transferring locations inevitably changes relationships within the work. In sound installation – unlike hi-fi – we are not listening to what the speakers *represent* or *reproduce* or *simulate*: Sound installation is concerned with building real spatial experience. It deals with building *new* realities and not with *re-constituting* or *simulating* them. It is exactly for this reason that one will frequently find the use of low-fidelity loudspeakers in sound installation projects. Speakers are often chosen for their individual sound characteristics related to specific projects rather than for their ability to respond faithfully to any number of inputs. In the area of sound installation, a speaker with a non-linear frequency response is not necessarily a bad commodity.

Within the context of high-fidelity vs. low-fidelity, it is important to note one more point: Virtual Reality – which in the domain of electroacoustics is often confused with sound installation – is, in its basic form, an extension of hi-fi. The area of Virtual Reality is concerned

with *representation*, *reproduction* and *simulation* and is not »installation art« as it has been defined here.

The other important concept related to sound installation is that of a non-narrative musical expression. Guidelines within this mode of expression place emphasis on acoustic and psychoacoustic principles rather than on traditional musical concepts. Musical parameters such as register, timbre and rhythm take on new meanings as work is guided by the influence of sound elements on spatial perception rather than on the listener's interpretation of a musical narrative or a particular musical syntax. The overall approach to this non-narrative method of working with sound is founded on the basic notions that sound has a direct influence upon our perceptions of space and that we are integrally affected by the sounds which surround us.

In my own investigations, I have defined two fundamental and contrasting categories of works or methods for working with sound in this manner. These are, on the one hand, concepts which deal with the conditioning of space and, on the other hand, concepts which deal with the *articulation* of space. I will now briefly outline these two contrasting categories. (Each of these categories and the role of individual sound parameters within them are also described in my book *Sound Environments / Klangwelten*.<sup>4</sup>)

### **The Conditioning of Space**

In general, the »conditioning of space« implies the creation of a static or uniform spatial state – that is to say the »colouring« of space or the utilisation of sound masking to dissimulate other (unwanted) sounds. The term »static« is employed to describe the immediate nature of a space and does not exclude slow evolutions in spatial characteristics.

This type of sound application is best described with visual analogies. When working with sound in this manner, one may refer to the »light colouring of space with sound«, or to sound's »luminous« effect on the character of a space. Spatial conditioning has much to do with both our conscious and unconscious assessments of general spatial qualities. Here, I am referring not only to sound's influence on our perceptions of the general character or »atmosphere« of a space, but also to much more specific spatial assessments such as perceptions of spatial volume or depth.

We are all familiar with the visual effect of painting the walls of a space with a dark colour. Here, the space seems to close inward: we perceive the space visually as being much narrower than if those same walls were painted with a light colour. I would draw a parallel in working with sound. Experience has shown that different types of sounds, when broadcast homogeneously within a space, may cause that space to appear open and voluminous or close and intimate.

We do in fact perceive space with our ears as much as with our eyes. Sounds orient the body in space and even guide our visual interpretations of our surroundings. Through factors such as room reverberation time, resonance, sound-reflection characteristics and types of frequency absorption, quite accurate impressions of spatial dimensions, architectures and even construction materials are ascertained by the ear. Once we accept the fact that sound plays such an intricate role in our perceptions of physical space, we must also recognise the fact that the sounds we put into a space can, in turn, affect our subjective, physical impressions of that space. From this perspective, architecture is no longer a static, hollow object but rather a multi-sensory event; and sound composition deals as much with architectural as with musical concerns. With the application of sound we are able to change the perceived character and volume of a space. With slow temporal changes in the characteristics of these sounds, architecture becomes fluid, subtly evolving over time.

It has been pointed out by architect and sound-artist Bernhard Leitner that »time« is not usually considered to be a part of traditional architectural concepts, except perhaps in very elementary ways, such as in considerations for the changing of natural daylight in the morning and evening.<sup>5</sup> In the context of his own work, Leitner was referring here to specific uses of sound for the demarcation of space in a very localised, physical sense. His own concepts are concerned much more with the articulation of space rather than with spatial conditioning. His reference to natural light has, however, brought me to the conclusion that certain applications of sound may influence our perception of space in a manner comparable to that of light and that a musical form can express an architectural metamorphosis which might best be described as a type of »luminous evolution«.

Musical register has been found to be a particularly important element in this type of spatial treatment. With the accentuation of different registers, we may obtain the effect of »heavy and sombre« or »light and clear« spaces. This hypothesis gave rise to *Music for Environmental Sound Diffusion*, a work I created in 1984. This work, an electroacoustic music composed on tape, was conceived for broadcast over ten ceiling-mounted loudspeakers and two loudspeakers installed at floorlevel and placed under large wooden resonators. The installation was first presented at Montreal's Tangente gallery in a large entrance and passage area (situated between a performance hall and office spaces). The use of auto-reverse tape players allowed for an uninterrupted broadcast in the installation space.

The aim of the work was to create a perfectly uniform and continuous spatial effect. The ten overhead loudspeakers, distributed at equal intervals throughout the space, created an unbroken layer of sound above the listener. The floor-level loudspeakers, placed in two corners of the space and installed under large resonators, accentuated certain lower frequencies in the overall sound. This offered a warm acoustic colour to the tones, helping immeasurably to immerse the listener in a quasi-static sound state. Slow evolutions in the accentuation of musical registers were composed on tape.

Similarly, in other works which are designed to condition space, the intensity of sound was found to be a fundamental factor. As a rule in such works, I look for an intensity which entirely fills and colours the space without exceeding an effect of colouration or luminosity.

The theory that the accentuation of musical registers may influence our spatial perception and that there exists an apparent relationship between the influence of sound and the influence of light on this perception is supported by Kurt Blaukopf in an article which appeared in «La Revue Musicale» in 1971. In «Space in Electronic Music», Blaukopf states that »the application of reverberation to bass frequencies gives the impression of ›obscure‹ space, while the augmentation of reverberation in the upper frequency range produces the impression of ›clear‹ space.« Blaukopf goes on to say that »clarity and obscurity also existed in live conventional music: Besseler, Schering, Dart and other musicologists pointed out the ›clear‹ character of music played in baroque churches (where wooden interiors favoured an increased reverberation in high frequencies), as opposed to the ›obscure‹ character of music played in Gothic cathedrals (characterised by a longer reverberation time in bass frequencies).« Blaukopf adds that »degrees of obscurity or clarity are, in live music, constants which can only be modified by transferring the concert to another building, whereas the gradation of light and shade can, in electronic music, be modified within the framework of a single musical structure.«<sup>6</sup>

Although Blaukopf is referring here to an electroacoustic music conceived for the concert hall, we arrive (as concerns sound installation concepts) at the same conclusion: electroacoustics offer the possibility of modifying our perceptions of space through the use of sound. Through the use of electroacoustics we can simulate, independently of the broadcast area, different spatial qualities: »sombre« to »light«, »static« or »evolving«.

Furthermore, if a quasi-static sound texture – designed to condition space – is composed of precise frequencies or in precise frequency bands, it may also serve to mask certain »undesirable« sounds (either static or intermittent) which are present in a particular environment. It was at first astonishing for me to find that in my own installations in public spaces, even the workers in those spaces would often choose to sit and carry on quiet conversation within the installation area, instead of going to offices where sounds of the installation could not be heard. This should not have been so surprising. Because the temporal fluctuation of noise is one of the most important factors in determining its tolerability, the integration of quasi-static »masking« textures in certain areas which are disturbed with intermittent noise, can help to make these spaces effectively calmer.

This effect of sound masking on the general quality of a space is considered to be an important factor in most of my sound installation concepts. This is not by any means to say that the sounds of an installation are considered a »positive« element and the sounds of the environment a »negative« element, nor that the sounds of an installation should dominate or

»drown out« the sounds of an existing environment. Suffices to say here that the objective of many of my works has been to create an atmosphere of silence and that this is often achieved through carefully considering the role which sound masking plays in a particular work.

When considering the effects of sound masking, it is important to note the following points: 1. low-pitched tones produce a marked masking effect on high-pitched tones whereas high-pitched tones produce little masking upon low-pitched tones (all sounds, regardless of register, will considerably mask tones higher than themselves), 2. the auditory masking of one sound upon another is greatest when the frequencies of the »masking« sound lie within the same frequency band as those of the »masked« sound. In other words, it is possible to increase the effectiveness of a sound texture destined to dissimulate noise by incorporating into the structure of the sounds themselves frequencies lying in the same frequency band as that of the noise or noises in question.

In his 1965 article, »Acoustical Privacy«, American architect William Farrell alludes to this manner of integrating sound in architecture.<sup>7</sup> Farrell's article states that in the acoustical planning of public buildings, »much of earlier work has been devoted to specifying what [noise]-levels should not be exceeded.« He proposes, however, that there should exist »a second criterion which indicates levels below which noises should not fall.« For Farrell, an important element in the »insulation« of certain public spaces, apart from the installation of acoustical barriers, is the presence of a steady and low-level »functional noise« which would serve to mask disturbing sounds. Unfortunately, his solution for generating this steady noise is questionable from an artistic viewpoint: he proposes to generate a low-level noise through the use of undersized air diffusers and grills on the ducts of existing air-conditioning systems. Although Farrell is correct in his observation that a steady, low-level sound can serve to mask other »unwanted« and otherwise unavoidable sounds, it is argued that sound elements should not be introduced to *dull* our sense of hearing but rather to *sharpen* it. Even if one is not immediately aware of ambient masking sounds, it seems important to me that these sounds work on several levels. On the one hand they may well go unperceived, but at the same time they must invite a listening in infinite detail. Nature works in this way. As we are all aware, a walk in nature can be at one and the same time an experience of quiet solitude and an experience of great aural complexity. Here we find the example of a silence of intricate and ever-changing detail, one which may be listened to in infinite depth.

And although Farrell's viewpoint may be extreme – it would be presumptuous to assume that in our battle against noise, we should simply coat all of our public spaces with a layer of continuous sound emitted from maladjusted air-conditioning systems – experience indicates that the presence of a steady, low-level sound texture, with its ability to mask other sounds, can in fact make a space considerably calmer and therewith more favourable to concentration or relaxation.

Up to this point I have touched on certain aspects which characterise the »conditioning of space«. As suggested, concepts of this type are characterised by a uniform and quasi-static spatial treatment. Electroacoustics allow for absolutely continuous and homogeneous broadcasts. With the accentuation of different registers, it is possible to obtain certain effects of colouring or luminosity. In addition, sound conceived to condition space is capable of masking undesirable noise: register, timbre, and the specific frequencies which constitute a musical texture play important roles in the effectiveness of sound masking. In my consideration of the second category, namely that of »spatial articulation«, I will examine sound from quite a different perspective.

### The Articulation of Space

The »articulation of space« generally implies a spatialisation of sound, and is concerned with the movement of sounds through space or the spatial localisation of sound elements. Here we are concerned with localising sounds in space in order to create effects of movement, distance, or spatial depth in relation to the listener. Although convincing impressions of moving sounds are particularly dependent on available technologies, psychoacoustics will support the experience that certain »musical« parameters are important contributors to achieving clearness in sound localisation and spatial movement.

I have already pointed out that musical register, in association with reverberation times and specific types of broadcasting, plays an important role in the colouring of space. It must also be considered that since higher frequencies are much more directional than lower frequencies, register also enters into consideration in the localisation of sounds and therefore in the articulation of space.

Psychoacoustic research shows that angular localisation depends largely on the difference in a sound's intensity as it reaches the two ears. This loudness difference is caused by the shadow of the head; and since this shadow causes an intensity difference which is greater at higher frequencies than at lower ones, high-frequency sounds are much easier to locate.<sup>8</sup> This same research also tells us something about the relationship between musical timbre (the spectral content of a sound) and spatial localisation. »Because the loudness difference at the two ears depends on the frequency of the sound, the quality of a complex sound is not the same at the two ears.... this difference aids in auditory localisation.«<sup>9</sup> We may conclude that by paying close attention to the *spectral content* of sound materials, even in the use of lower tones, one will gain some control over their amount of localisation in space. It is essential to note here that the spectral character or the »timbre« of individual sounds becomes an important compositional consideration. In this example, however, timbre is directly associated with concerns in the area of *psychoacoustics* (i.e. with degree of spatial localisation) rather than with more traditional musical concerns such as, for example, the relationship between the timbre of a sound and its »dramatic« or »narrative« significance.



There are other cases, too, where psychoacoustics provides clear guidelines in the area of sound installation composition. For example: 1. In general, our ability to distinguish between sounds of similar timbre increases when these sounds originate from different directions. This factor allows for the combining of sounds of a similar timbre or texture in different parts of a space, without reducing the clarity and the independence of each sound element. At the same time, and for the same reason, the spatial localisation of a particular sound considerably reduces its ability to mask exterior noise. The presence of certain elements conceived for the conditioning of a space can also, then, be useful within a music concerned primarily with spatial articulation. 2. As already noted, spatial localisation depends to a large extent on the difference in a sound's intensity as it reaches both ears. Slight differences in the time at which a sound reaches the ears also play an important role in spatial localisation. For this reason, our ability to localise sounds in the horizontal plane is somewhat greater than it is in the vertical direction.<sup>10</sup> This fact must be taken into consideration within certain concepts or applications concerned with spatial articulation. 3. Most listeners perceive high-pitched tones as being above lower tones in space.<sup>11</sup> In some instances, this allows the creation of a certain »spatial dimension« in a music which is broadcast from a fixed point. When sound moves in space above the listener, for example, it is possible to create impressions of either straight or slightly curved lines by varying the level of a sound's overtone content over its path through space. A line seems to curve subtly upward in space as its harmonic content increases.

Still another comment concerning the relationship between register and vertical perception may be taken from an article by American composer Henry Brant. From a different perspective, Brant observes that »in general, vertical height creates a persuasive impression of higher pitch, even when the pitches are not actually higher than those being simultaneously produced at a lower positional level.«<sup>12</sup> According to Brant, the *position* of sounds in space can also influence one's perception of *musical register*.

In concluding, I note that the ear is »drawn« to rhythmic sounds. For this reason, certain rhythmic elements may contribute to the articulation of space. However, one must also consider the fact that rhythmic elements often lend themselves to narrative musical qualities rather than to the creation of spatial states. Apart from the micro-rhythmic structuring of individual sounds (sounds which are characterised by rhythmic pulses or by granular textures), rhythmic considerations in the area of sound installation are most often associated with rhythm of form, and not with immediate rhythmic or metric qualities.

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In the preceding sections it has been my aim to point out that, in the area of sound installation art, we are no longer dealing with a traditional musical language. The composer's approach and intentions have changed. Whereas the traditional composer might, for

example, have chosen a sound material for its narrative significance or symbolic meaning, choices now are based on quite different criteria, ones which often have to do with psycho-acoustic and architectural concerns.

Conventional musical concepts most often deal with narrative forms – closed and self-contained – communicated through a musical syntax which unfolds in time and conceived as a function of the traditional concert hall or the traditional mode of music listening. In contrast, this new approach to sound composition considers the element of sound to be a main contributing factor not only to our conscious and unconscious perceptions of space but also to our conscious and unconscious relationships with our surroundings. It considers architectural space to be a multi-sensory event rather than a static object and deals with art in general as a perceptual experience, one whose essence is no longer communicated through a temporal narrative progression or a physical object, but which instead unfolds in space through our spatial perceptions and our perceptual investigations of our surroundings.

- 1 Nicolas de Oliveira, Nicola Oxley and Michael Petry, *Installation Art*, London 1994, p. 8.
- 2 *Ibid.*, p. 7.
- 3 Barry Truax, Letter to the author, July 4, 1995.
- 4 Robin Minard, *Sound Environments / Klangwelten*, ed. Akademie der Künste Berlin, Berlin 1993.
- 5 Bernhard Leitner, interview with the author, Berlin, November 18, 1985.
- 6 Kurt Blaukopf, *L'Espace en Musique Electronique*, in: *La Revue Musicale*, 269, 1971, p. 162. Transl.: Robin Minard.
- 7 William R. Farrel, (Bolt, Baranek and Newman, Inc., Consultants in Acoustics, Cambridge, Massachusetts), *Acoustical Privacy*, Rpt. in: *Architectural Engineering: Environmental Control*, ed. Robert E. Fischer, McGraw-Hill Inc., USA 1965, p.186.
- 8 Vern O. Knudsen and Cyril M. Harris, *Acoustical Designing in Architecture*, publ. The American Institute of Physics for the Acoustical Society of America, 1950, pp. 146, 147.
- 9 *Ibid.*
- 10 *Ibid.*, p. 163.
- 11 A.S. Bregman and H. Steiger, *Auditory Streaming and Vertical Localization: Interdependence of ›What‹ and ›Where‹ Decisions in Audition*, in: *Perception and Psychoacoustics*, 1980.
- 12 Henry Brant, *Space as an Essential Aspect of Musical Composition*, in: *Contemporary Composers on Contemporary Music*, ed. Elliott Schwarz, Barny Childs, New York 1998, p. 229.

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