Spatialization as a Musical Concept

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ABSTRACT

Space, time and sound have always been tightly bound to each other within our musical consciousness; yet this interrelationship was identified only relatively recently with respect to the history of music. From the time that space was discovered as a part of musical structure and performance, it took many years to recognize spatialization as an aesthetic musical concept. Since 1950, spatialization has become an inevitable part of musical composition, and a major part of academic research. Electroacoustic music, because of its capability in terms of simulating space, played—and still plays— an extraordinary role in this development. This paper proposes and proves spatialization as a musical concept within electroacoustic music through discussing three characteristic genres, namely: Soundscape, Musique Acousmatique and Sound Installation.

Index Terms: A.1 [General Literature]: Introductory and Survey—Music, Sound Installation, Spatialization, Electroacoustic, Acousmatic, Soundscape;

1 SOUNDSCAPE AND REAL SPACES

The inclusion of real spaces in electroacoustic music presupposes, on one hand, the simulation of real spaces, and, on the other hand, the use of recorded natural sounds. The simulation of a real space is carried out by electronically simulating its acoustic features, such as distance, direction, movement, and particularly reverberation. Additionally, the impression of a real space relies on the inclusion of real sounds. The rapid development of recording techniques in recent decades has been vital, particularly the application of multi-microphone recording from the 1960s, and the emergence of SoundField microphones in the 1980s. The recording of a sound field with all of its acoustic features is so rich in information that it can be regarded as a reductive copy of the natural sounds. However, the recording of real spaces translates into many technical difficulties in practice; natural sounds are therefore saved on the computer in order to simulate their spatial features using computer-assisted technology.

Another solution to the problem of simulating real spaces lies in the formation of a sound atmosphere as it is usually performed in radio plays, in which the interaction of the sounds belonging to a certain spatial atmosphere permits the illusion of a real space through listening. Sound positioning according to analogous principles is also an important element of a realistic experience of spaces in music. Everybody knows that familiar sounds can be identified more easily than unfamiliar sounds. How far the familiarity of a sound can influence the perception of space is a question which has not yet been answered systematically. It should be admitted, nevertheless, that the sound positioning of an airplane sound in height will create a real impression of space due to its agreement with the experience itself. Bernard Parmegiani's instruction for the performance of his work *Violostries* illustrates this concept in a key example of electroacoustic music. Parmegiani remarks that the sound of the violin

should not "run around" over the loudspeakers in the performance space, but, on the contrary, the sound which indeed introduces the player should take a static and realistic position in space "exactly as a violinist is positioned in a concert hall."[1]

The inclusion of real spaces in electroacoustic music is associated particularly with the Soundscape genre, in which natural noises established a musical language for the first time in the history of music. The fascinating aspect for Murray Schafer, one of the pioneers of this kind of composition, is the continuity, reciprocity, and liveliness of the sounds of nature. For Hildegard Westerkamp, the term not only unites facts, it also creates a certain subjectivity. According to Westerkamp, a Soundscape-composition is strictly influenced by the interaction between the subject and the object. In this way, Westerkamp approaches impressionistic art in which the subjective perception of the visual landscape is the starting point for the construction of paintings, an artistic concept that elevates the status of Soundscape as a kind of art defining itself with space.

Barry Truax, one of the most important composers in this genre, distinguishes two types of Soundscape composition: a type which cuts the sound material from its context by framing and presenting it again untransformed, and a type which transforms the original sound substance to varying degrees by means of digital or analog technology. A Soundscape composition will stand out in both cases mainly due to the relationship between the listener and the sound landscape in which the spatial character of the sound field and its contents form a reality that is perceived through listening. Soundscape not only implies recording and computer-assisted sound processing in the studio, but also a performance-practical concept for a composition.

Soundscape composers prefer a surround system for performing their compositions. This may have to do with the genre of Soundscape itself, in which the nature of noises refers to the reality of a surrounding space character. For Truax, this aspect is natural. He defines sound projection with regard to the Surround version without mentioning the frontal loudspeaker system as a possibility. According to Truax, "Diffusion refers to the practice of performing electroacoustic music by projecting it through multiple loudspeakers placed around the performance space."[2] Whereas decorrelation is used as a spatialization method for the creation of haptical qualities, Truax conceives a system which is based on the total separation of audio channels.

His works are performed with an instrument in Vancouver known as a DM 8, designed by Tim Bartoo. Discrete audio channels, Surround-concept, and automation are the technical opportunities offered by DM 8 for the performance of Soundscape-compositions. Since 1983, Truax has designed spatial sound waves with techniques that do not involve post-processing. For example, the works *Wave Edge* (1983) and *Solar Ellipse* (1984-85) are composed according to this principle. *Wave Edge* was the first composition composed for the PODX-system developed by the composer. Truax also developed a program so that he could realize automated sound waves. *Wave Edge* is a sound wave in which an audible wave breaks on the shore.

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[1] In a workshop in Montreal, 1998
[2] Truax, Barry in: Truax, Barry in: http://www.sfu.ca/~truax/dm8.html (March 98)

For Westerkamp, composing is a process in which the acoustical perception of surroundings holds a special place. Westerkamp first familiarizes herself with surrounding noises, largely in order to be realistic in the technical processing and projection of their temporal, spectral, and spatial qualities. Westerkamp: "For me generally composing means to get to know the world acoustically and musically better. This means also, quite conscious and detailed to listen and to not leave any sound unnoticed." [2] Computer-assisted sound processing is not a means of defamiliarization for Westerkamp in order to remove the noises from their natural origin, but a tool which provides a powerful way to study sound. Westerkamp: "Experimenting technically is actually less important, although I do it with pleasure and make the sounds sometimes unrecognizable too. But the reason of this change is always actually to get to know the sound in a deeper way. If I work in the studio longer with a sound, I'll change it very much and then go back to the original again, in this way I'll get a better understanding for the sound. It is so as if you leave your country and get to know a new culture. If you then come back to the original country, you may recognize it in a newer and deeper way. In the same way I also see the change of the sound." [2]

Westerkamp does not conceive of a generalized performance instrument. For her, every hearing has a specific situation from binaural up to sound projection with a multi-loudspeaker system, which can extrapolate different dimensions of the sound. Westerkamp not only relates her sounds and sound atmosphere to the available situation, she also tries to give a spatial character to the surrounding sounds in a way she has experienced during the recording. Westerkamp: "When I compose with environmental sound, which is what I do mostly, I listen very carefully to the recordings I make in the field and accept the spatial elements that are already inherent in the recordings. But I may extend or exaggerate them in my compositions in order to point the listener more clearly to the spatial dynamics as they exist in the environment. In the same way in which a caricaturist clarifies the features of someones face by exaggeration, in the same way I like to emphasize any of the environmental characteristics of a soundscape or a sonic experience through exaggeration."[3] For example, a bird in *Beneath the Forest Floor* (1992) spontaneously moves quickly from side to side. While the natural behavior of the bird would involve flying across the space, the bird's movement in this composition is accented and the attention steered toward it with an exaggerated Doppler effect and an emphasis on the noises of the bird. If the space processing of Truax can be considered to attain an utterly new quality, the space presented by Westerkamp remains faithful to the initial experience.

For Westerkamp it is more about exaggeration than producing a new spatiality. She compares her own method with Truax's and writes: "I think, I am working slightly differently with space than Barry. Whatever decisions I make about spatial organization, come directly out of the recording/listening/composing process, i.e. not artificial additions, but rather an organic development from the place of recording (and of the experience of that place) to the place of composition (and its experience) to the place of the audience (and its experience of the place). I also want to remember the experience of the space and of listening to it while recording and then compose that experience into my pieces. That can mean that I will create some more artificial spatial aspects later into order to give the listener in his/here listening experience an experience similar to that in the Field. I want to create a place of listening for my audience that does not try to simulate a specific environment, but more the experience of an environment, or a relationship to it." [2]

In *Cricket Voice* (1987), for example, Westerkamp moves the percussive sounds and changes their tone color during the movement. Westerkamp: "When I recorded them I found that the timbre of the sound changed drastically depending on where exactly I hit

a cactus or a dried palm leaf. This was not only motivated by the recording experience but also by the experience of being in a very quiet place for three weeks. The absence of any music or motorized sounds created a desire in all of us to make sounds and to move/dance. So when I listen to *Cricket Voice* now, I can hear a certain energy in it that was very much experienced because of the weekslong silence or quiet in the desert." [2]

2 MUSIQUE ACOUSMATIQUE AND IMAGINARY SPACES

Imaginary spaces are those spaces which are not perceivable in reality. These spaces arise when one alters the acoustic features or spatial indicators of the space so much that the space impression seems unrealistic or imaginary. The succession of such spaces can produce an imaginary sound world. However, this is strongly connected with the perceived impossibility of the sequence, i.e., a sequential connection of real and imaginary spaces. In the formation of imaginary spaces, and even in the stimulation of the listener's imagination, electroacoustic music provides a degree of control that is superior to instrumental music. Electroacoustic music is thus suitable in many contexts, as in the case of Virtual Reality computer games and the film industry. Electroacoustic music also provides composers with flexibility in the formation of abstract ideas and the development of a new musical language which identifies itself with sound metamorphoses. Such a sound art makes sounds whose unknown tone colors, unrealistic space impressions, and abstract contexts detach the listener from the real world and intensely activate his or her imagination. Although the use of imaginary spaces or a combination of imaginary and real spaces in an abstract musical context is nowadays used at least partially in composing, musique acousmatique identifies itself particularly with such a musical language. It is hence a music which serves subjective stimulation through sound metamorphosis in a narrative context. This is exactly what, for example, Christian Calon describes as *une machinet à métamorphoses*.

Francis Dhomont also creates with a focus on this subjectivity, and so defines acousmatic art as follows: "Acousmatic art is the art of mental representations triggered by sound." [3] The year 1948 marked a turning point in the history of music. The musical ideas of Pierre Schaeffer and Pierre Henry opened the door to a new world which would engage a multitude of composers for the next 50 years. The most important achievement of the so-called musique-concrète composers was not the discovery of concrète sounds, which had already been known since the work of the futurists, but, primarily, a discovery of the musical potentiality of these sounds. Composers could observe how complex natural noises could morph in form by means of new technology. Apart from these contributions, it should also be emphasized that the relationship of object and subject in composing was defined anew with musique concrète. Christian Calon points out the similarities between methods of working in electroacoustic music and film production, and, on the other hand, emphasizes the differences between a musical composition and a work of literature or a painting. Although musique concrète marks an important transition from subjective to objective conditions in the music of the 20th century, its most important successor - musique acousmatique - demonstrates to what extent subjectivity plays a decisive role, if not in composition, then most definitely in the listener as he or she engages in the design and decoding of a mysterious musical language.

Music behaves differently if it stands alone as opposed to arising in combination with other art forms. According to Gary Kendall, the combination of visual and aural phenomena provides a more complete experience. Visual perception is more primary in our lives than aural perception, and it strongly influences the latter. Many authors have called the human being an "eye-creature." Regarding space and spatial perception, visual influence is particularly critical. It is not difficult to come upon concepts or terms, even in techni-

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[3]Hildegard Westerkamp in an email exchange with the author (Aug. 98)

cal literature, which point to the power that vision holds over our perception. For example the term "visual capture" describes visual dominance over spatial localization. Begault offers another relevant example: "although a loudspeaker may be displayed from the actual location of a visual image on a television or movie screen, we can easily imagine the sound as coming from an actor's mouth or from a passing car." [1] This is noticeable also in the performance of electroacoustic music when frontal visual attractions affect the perception of sounds originating from behind. Another example marking the priority of visual perception takes form in the term Ventriloquism Effect (Begault 1994, 84), which holds that when visual and aural perceptions do not match each other, the spatial perception of visual factors will dominate. It is not by chance that attendees at performances of musique acousmatique prefer a dark atmosphere with visual influences reduced to a minimum. Musique acousmatique describes not only a hearing situation, in which the original sound sources remain invisible, but also a music style which began in the 1970s after overcoming the initial theoretical and technical problems marked by the discoveries of musique concrète.

The starting point in the definition of musique acousmatique as a music style is the breadth of expression possibilities by means of which sound morphology or, as D. Smalley calls it, spectromorphology, can provide a wide spectrum of abstract and real sound atmospheres. Two inherent qualities of sound, i.e. the power of raising dual associations and the anchoring of a sound in reality, have inspired different musical concepts. Musique acousmatique is a good example of the application of defamiliarized sounds in order to provide a virtual sound atmosphere in which "the listener's aural imagination can be drawn into personal, psychological realms quite different from other musics." [6] The idea is based on those human capabilities which interpret unreal sound structures arbitrarily and connect real and virtual worlds. Smalley: "When the source cannot be identified with certainty or is ambiguous, there is a strong tendency either consciously or unconsciously to scan one's experience for significance beyond the immediate musical context." [6] Indeed, spectromorphology forms only the technical means for the production of music. Reception and perception of the temporal development of the morphological figures are, on the other hand, based on the mental ability of the listeners to connect distorted aural images to a corresponding reality. So it is about the revival of a reality (not necessarily the original one) in the mind of the listener, based on sound material that once existed but has lost its identity. P. Ascione describes this process as a presentation of an illusion, the embodiment of a dream which is marked individually and differently by every composer.

Although every single electroacoustic work inevitably defines a relationship between the listener and the performance instrument, it seems that this relationship points out certain trends for many composers and interpreters of musique acousmatique. It is important to emphasize that the spatial configuration of the sound components of an acousmatic composition plays a decisive role in the design of an acousmatic texture. The liberation of music from the studio and its projection over a loudspeaker system in real space provides other considerations. At the end of the definition of musique acousmatique, Dhomont makes a short mention of this realization phase: "It [the term acousmatique] refers to a theoretical and practical compositional approach, to particular listening and realization conditions, and to sound projection strategies." [3] Sound projection strategies not only form a bridge between the compositional and performance ideas of this music, but, apart from the strong dependence of their texture on the sound space, they also connect this music to real space in a way that makes space one of the most important components in its makeup.

As a result, musique acousmatique is on its way to extrapolating a virtual world in real space; thus, it can be understood as spatial music in the truest sense. Apart from compositions which are designed for a certain space, the unpredictability of acoustic features in performance spaces yields many problems that can have a considerable influence on the impression of an audible space. There are not many studios which can offer composers a working environment in which the spatial behavior of the composed sounds can be experienced. In this way, since the birth of electroacoustic music, this sound art has had to deal with acoustic compromise and artistic interpretation, or, as it is called, sound direction. The role of the interpreters, who try to realize composed sounds in real space, is comparable with the role of the conductor, which involves much more than technical processing of musical substance. The task of the interpreters lies primarily in letting the spatial potential of the composed space spread and depart from real space in favor of the articulation of both the imaginary and the simulated space.

No doubt, the stereophonic sound system has been a decisive technological innovation. On one hand, stereophony has a more ancient background in comparison to multi-channel systems, yet, on the other hand, it is accessible, reasonably priced, and space saving. The idea of stereophony existed already in the 19th century. In 1881 Clément Ader had experimented with a procedure analogous to the two-channel system in Paris. [5] However, it was not until the 1930s that experiments with stereophonic sound systems received a real uplift. Originally, the Greek word "stereo" pointed to solidity, hardness and three-dimensionality. The stereophonic sound system has become alienated from its semantic origin as a spatial location regulator for sounds on the left-right axis. Although a stereophonic loudspeaker system permits few possibilities for real localization, it instead offers major possibilities for the virtual one and the formation of a full space impression. The capability of the stereophonic sound system in the production of spatial metamorphoses has given musique acousmatique one of its character-forming features. However, the greatest advantage of stereo technology lies in the flexibility of its suitability for many performance spaces.

3 SOUND INSTALLATION

An intimate relationship between space and sound is observable in the genre "sound installation." The music in a sound installation does not consist of parallel or succeeding spaces, but instead of spaces which are characterized by different musical processes. It is obvious that a global music reception in this context makes sense only by walking around the sound installation. In an arbitrary time period, alternating space experiences are the basis of a peculiar musical experience which is marked by the perception of space in the highest degree. Time plays a double role here: it develops a static space state, but it also works passively in combining different spatial stations. From this point of view arises an important difference between an electroacoustic concert piece and a sound installation, namely a fixed structure of time in the former and the interaction between the music and the listener through temporal flexibility in the latter. The second difference concerns duration. While the duration of a concert piece is fixed by a long-standing tradition, the duration of a sound installation remains open, as it depends on the choice of the listener. Although the possibility of walking around is often counted as one of the characterizing criteria for a sound installation, there are sound installations which do not allow this. Non-narrative character is also a quality which distinguishes the sound installation from many concert pieces. This is related to the temporal structure of the sound installation, in which narrativity loses its meaning and its content by discontinuity, disorder, and lack of purpose.

Robin Minard writes: "Traditional musical parameters get new functions and new meanings: The narrative qualities of the conventional music are replaced by qualities which correspond to the spatial perception." [4] Another characteristic of a sound installation is sound reproduction technology. This technology is not optimized for the purpose of highly-qualified sound reproduction, but is used rather for the expression of musical ideas as a means. Minard uses

the term Not-High-Fidelity and, instead of expressing the qualitative functions of the technique, emphasizes its uses for artistic purposes. In this way, two prerequisites for the emergence of a sound installation by Minard can be considered: the non-narrative character of the music and the Not-High-Fidelity quality of the sound reproduction technology.

Unlike compositions which are intended for imaginary spaces and space metamorphoses, the sound installation identifies itself with real space. It is not about a simulation of spaces which will be presented independently of the performance space, it is about real spaces which are articulated and modified. The performance space is a composed space and, therefore, an inseparable part of the composition. This is another point which distinguishes a sound installation from sound art in the field of Virtual Reality. With the idea of a non-frontal instrument set up in the fifties and the use of multimedia art, the role of the observer has increased considerably. The frontal situation between audience and scene in a sound installation is completely lifted. So, in a sound installation, the scene appears as a sculpture in space, i.e. the sound sculpture enters into a multilayered interaction with its surroundings. With this the development of spatial music reaches a special peak. Here music turns into spaces instead of music from spaces.

For Robin Minard, the sound installation is not only a musical form but also a concept that—by combining space and sound—has developed a set of aesthetics which assign a certain task to sound for the purpose of producing desired spaces. Minard's more refined concentration on subject-space and sound appears clearly in the concept Environmental Art as opposed to Sound Installation, and redefines the space-sound-continuum by prioritizing the role and creativity of the composer in articulating real spaces. The two important prerequisites for the realization of Environmental Art are the non-narrative character of the music and the not-high-fidelity of sound production technology as mentioned above. The most important aspect here, according to Minard, is the restriction of musical hearing to a concentrated reception of the space.

Since environmental art can be presented in both closed and open spaces, electronic sounds can be included in situations in which they have to stand in a determined relation to architecture or daily noises. The goal of such an art seems to be clear for Minard: Harmony with and enrichment of our urban spaces. Environmental art is, however, primarily an artistic work which shall remain faithful to our environmental sound and not serve as a tool for the diminution of noise in industrial areas. Environmental art makes spaces more agreeable in its effort, primarily providing sound spaces which enrich space perception at different levels and satisfy the audience musically and acoustically.

Minard emphasizes the task of environmental art and distinguishes again between its aesthetic and industrial functions. Enrichment of space perception by traditional means, i.e. instrumental music, is not attainable. Minard argues, instead, that electroacoustic music is the most suitable music in this context. Minard studies two aspects of environmental art: Conditioning and Articulation of the space. Conditioning refers to "the creation of a static or uniform spatial state, that is to say the colouring of space or the utilization of sound masking" [4], a concept which fulfills an important function in Minard's works. Masking is not a means for Minard to give certain sounds priority for any reason; it is a technical tool which manages spatial modifications with emphasis on certain spatial elements.

Through the conditioning of space, musical spaces arise which point to the aesthetic and constructive contributions of the composer. As a result, the composer can modify musical dimensions so much that the composed sounds resound brightly/dark, heavy/easy, dynamic/static or clear/diffuse. Here, the control of musical dimensions means actually developing architectonic metamorphoses, something which in turn points to the secondary role of music in

this context. The conditioning of spaces emphasizes the necessity of computer-assisted technology in the development of modified spaces that arise from the control of musical dimensions. An example of the conditioning of a space can be examined in the work *Music for Environmental Sound Diffusion* (1984), in which "the aim . . . was to create a perfectly uniform and continuous spatial effect." [4].

In this work, Minard holds back on intensity as an acoustic structure to award a volume to the sounds, on one hand, and create certain colorations, on the other hand. While Conditioning involves trying to establish special spaces by controlling and defining musical dimensions, Articulation connects Environmental Art with spatial qualities of sounds such as movement, direction and distance. Articulation of a space not only has its own method and own means, but is also aimed at the creation of other spaces. Conditioning strives for spatial uniformity and static space, but spaces created by Articulation are "spaces in which one would perceive gradations in colouring effects, in which there would be different regions of colour or luminosity instead of one uniform spatial colouring. Let us consider spaces in which different musical elements would be localized at different points in space, or areas in which sounds would move through space in a sort of decorative gesture." [4]

4 CONCLUSIONS

Regarding different genres of electroacoustic music, those genres with a clear space-concept have been discussed, namely Soundscape, Musique Acousmatique and Sound Installation. Soundscape composition and the works in musique acousmatique show a clear trend to certain space concepts. It was pointed out that Soundscape composers prefer to use untransformed sounds, retaining the original spatial qualities in their work, and, due to their realistic attitude, prefer to project their work over a multi-channel surround system. The musique-acousmatique composers have a tendency against this and try to transform the sounds and to develop a musical language from sound morphology. Space, by different means of transformation, is given an imaginary quality, which preferably will be projected over a frontal stereophonic loudspeaker orchestra. The last part of the paper was devoted to Sound Installation, which is used for the Articulation and Conditioning of musical space. Although musique acousmatique, Soundscape and Sound Installation show a clear space concept (with some exceptions), no generally-accepted concept exists regarding musical space.

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