

New Dimensions in Compositional Practice: Spatialization and Sound Movement

Technological advancements in the field of electronic music has provoked the exploration and use of spatial elements in music composition not as a cosmetic application but as a fundamental component of dimensionalized, sonic experience. The spatialization and movement of sound through space, two non-interchangeable but interconnected concepts, pose considerable artistic challenges for the contemporary composer, which may, for example, be addressed through his/her familiarity in the areas of psychoacoustics, notation (codification of spatial elements), and electronics. A discussion of technical methodologies is outside of the scope of this paper and has been well documented by leading researchers in the field of electronics.

By deemphasizing technical means and assuming the position of an artist confronted with a new set of tools, this paper may divert attention toward questions in spatial composition generally left unturned—for example, in what capacity can spatial elements serve as structural information carriers or as an equivalent to the parameters of rhythm, dynamic, and pitch? Therefore, the aim of this paper, after identifying the necessity to venture into this new terrain and establishing a historical and technical context, is the postulation of strategies to effectively employ sound spatialization and movement in musical composition as posited by contemporary composers, including the author. The genesis of this present discussion is greatly indebted to similar concerns expressed by Jonathan Harvey and Roger Reynolds.

As a point of departure, I would like to clarify what constitutes and justifies the use of spatial elements. Although there is a tendency to associate the antiphonal music of historical

composers, such as Gabrieli, to contemporary spatial thinking, I believe the connection exists only indirectly taking into account two key factors: such use of spatiality highlighted surface level features as evident by the decision to distinguish between soloist(s) and choir(s) and the limitations imposed by the non-existence of electronic technology— sound sources existing in a static state, for example the voice of soloist “x” designated to a single point within the space. As Reynolds states:

Static antiphonies, even if complex, are readily noted conceptually *and discounted*. They involve only an interplay of successive statements each of which emanates from a physically stable source position. We observe where instruments are and are rarely in doubt about who produces which sounds. When loudspeakers enter the picture things change. The movement (or, to be more accurate, the apparent movement), of whatever kind of material and in whatever host environment, is in some sense a richer (or more complex) experience.¹

The intertwining of spatiality and movement of sound is therefore fully realized with the integration of a multichannel, loudspeaker arrangement in a live performance setup. Other factors, related to hall acoustics, enter the equation increasing the number of viable musical opportunities from which the composer may decide to draw upon. Electronic spatialization becomes a refinement of the inherent tendencies of a particular sound in the ability to emphasize its relation to the acoustic space.

What constitutes the existence of spatial elements in a musical composition is the compositional awareness and intentional revelation of a dialogue in three-dimensional space among musical materials. The inclusion of such features should be fundamental to the construction of the composition and clearly manifest in its execution. The necessity to implement spatial elements in music relies on the verifiable assumption that richer, artistic experiences are begging to be uncovered by the willing (and adventurous) composer. The issue of practicality is

¹ Roger Reynolds, “Thoughts on Sound Movement and Meaning,” *Perspectives of New Music* 16, no. 2 (Spring-Summer 1978): 186.

satisfied by modern innovations in software design, affordable hardware, and portable computing. Therefore, if the contemporary composer is to be held responsible and accountable for the development of musical art it appears he/she must confront and assimilate the use of spatialization and sound movement. The brunt is also placed on musical institutions to encourage such endeavors and provide adequate resources.

The recent trend towards the spatialization and movement of sound, as a compositional element, traces its origin to the seminal works of Karlheinz Stockhausen beginning in the 1950's.² Written in 1957, *Gesänge der Jünglinge*, for electronic sounds on tape, features the performance of the work through four loudspeakers situated horizontally across the stage so as to simulate movement (left and right panning) within a two-dimensional plane. Also written in the same year, the instrumental piece *Gruppen* surrounds the audience with three orchestras as the sound world is refined through interplay among the ensembles— the movement of sounds or the illusion perceived to be occurring through static points in the hall.

Nevertheless, the first work considered to be specifically written for surround sound capabilities in mind was Stockhausen's *Kontakte* (1960) for piano, percussion, and quadraphonic tape playback. Among the spatial techniques experimented with were the rotation of sounds at various speeds, the creation of pointillistic electronic textures, and *Flutklang* or “(flood sounds) sounds coming from one loudspeaker, then successively from others, which gives the impression of the sound flooding through the hall.”³ Aware of the seemingly limitless function of spatial technique, Stockhausen further developed the notion of “multi-layered spatial composition” in

² Richard Zvonar, “A History of Spatial Music,” Richard Zvonar, http://www.zvonar.com/writing/spatial_music/History.html (accessed November 28, 2007).

³ Jonathan Harvey, *The Music of Stockhausen* (Berkeley: University of California Press, 1975), 55.

which layers or walls of sound are uncovered before the audience through the exploitation of spatial depth—the lateral distance of a sound object or panel.⁴

British composer Jonathan Harvey has stated that the origins for his interest in spatialization came through early encounters with the work of Stockhausen.⁵ His observations regarding the compositional significance and application of spatial elements were clearly delineated in an interview conducted by Nicolas Donin at IRCAM in 2004. Harvey states:

What is fundamental to my thinking is that there be a dialogue in space, and that is something which one can, as a composer, make clear and interesting, or else ignore. More interesting is the question of *moving* spatialization, which is equally present in life. We ourselves move all the time, and we hear sounds from a moving perspective... In the concert hall, however, it is not normal at all. For centuries, we have had static sound, static spatialization. Now, we are changing all that in music.⁶

Harvey proposes certain strategies for the effective use of spatial elements in music composition. A key relationship is noted between rhythm and its spatial demarcation. A rhythmic pattern can be set in motion through space and reinforced in such a way that “rhythmic themes” can be differentiated according to their trajectory across the hall and localization. In other example, Harvey cites his fourth string quartet in which he alternates between two playing states: a “normal” state in which electronic spatialization is non-existent (likened to the presentation of traditional, concert music) and a state of loudspeaker activity which imbeds the listener in a world of fluctuating musical materials. A psychological change is dramatically established from a more passive, traditional approach to an active listener-immersed state of consciousness.

Interestingly enough, Harvey discusses the possibilities of electronically spatializing even traditional music in order to gain a deeper sense of the work. He notes that a work by Brahms may be interesting to hear from different acoustical angles, distances, and orchestral

⁴ Karlheinz Stockhausen, *Stockhausen on Music* (London: Marion Boyars, 1989), 105-108.

⁵ Nicolas Donin, “Spatialization as a compositional tool and individual access to music in the future (interview with Jonathan Harvey),” *Musiques contemporaines* 16, no. 3 (2006): 76.

⁶ Donin: 75.

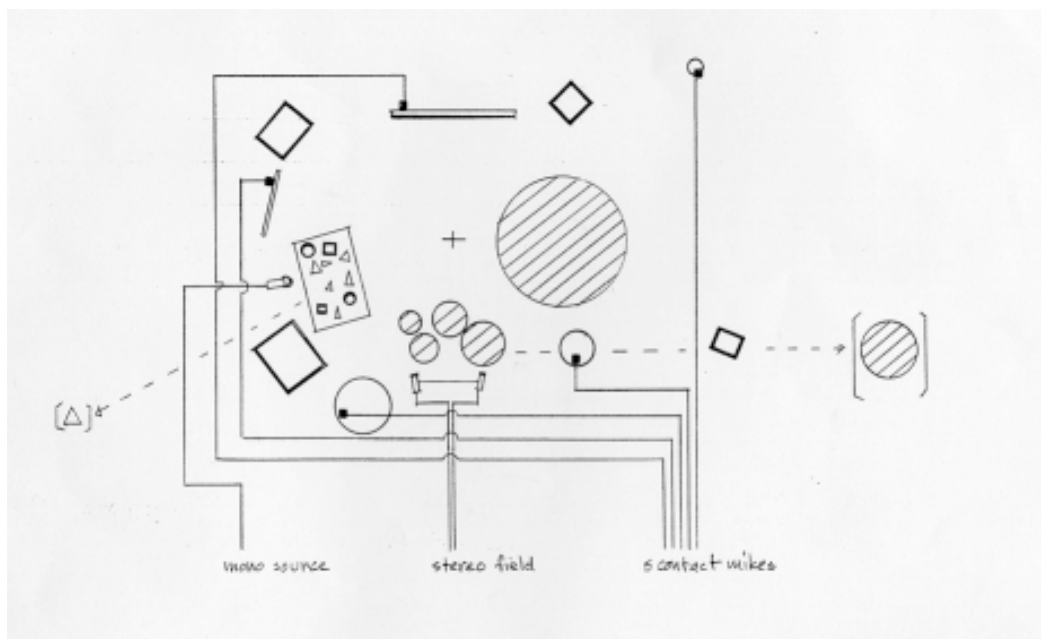
arrangements if multiple microphones, left to be accessed at the discretion of the audience member or home listener, are placed throughout the ensemble space. The listener having the ability to hover above the orchestra and zoom in on the accompaniment or woodwind section or whatever it may be that is relevant to the understanding of a piece may engage in new musical experiences unheard of before. This theory therefore postulates a type of imposed spatialization not as a deconstructive tool but as a means of further artistic enrichment whose successful incorporation may become a testament to a composition's withstanding power and rich complexity revealing itself on repeated listenings.

One of the most active contemporary composers in the realm of music spatialization, or to a broader extent the implementation of technology in composition, has been Roger Reynolds. Reynolds firmly believes that the use of technology ultimately redeems itself (i.e. the risk of running unstable electronic systems and the setup time involved) by opening the door to new compositional dimensions never before explored, for example the sound of a trumpet player gliding through space.⁷ Thus, since the 1960's, Reynolds has been employing spatial elements as another means of fully exploiting the range of compositional tools at the disposal of the modern composer towards the accurate realization of his imagined ideas.

Reynolds' early explorations in spatialization involved the use of vocal movement through the theatricality of performance in his composition *The Emperor of Ice Cream* (1962) for eight voices, percussion, piano, and double bass. Example 1, an excerpt from the composition, graphically demonstrates Reynolds' experimental notation patterns for the codification of spatial elements as dotted lines and arrows direct the vocalists from one part of the stage to another, as

⁷ Roger Reynolds, *Watershed*, DVD, Steven Schick (New York, NY: Mode Records, 1998).

listeners), sometimes the listeners themselves seem to be in the performer's position at the center of the percussion kit, and at other times individual instruments are heard to be flying around the room.”⁹ The concept of positing the audience member in the performance space of the percussionist is a key component of this work. As seen in Example 2, the instrumental setup concentrates on a tight spiral arrangement surrounding the performer. Additionally, I would like to note that, unlike *The Emperor of Ice Cream*, Reynolds does not explicitly, notate the spatial aspects of the piece, perhaps due to the extreme level of operations present at any one particular moment in time, but opted to provide written instructions for the technician involved in the execution of cues.



Example 2: *Watershed IV*, instrument and microphone setup¹⁰

Reynolds’ compositional processes and decisions are heavily based in psychoacoustic research. Therefore, his musical use of spatial elements in composition is generated from such a

⁹ Richard Zvonar, “Watershed,” Richard Zvonar, <http://www.zvonar.com/writing/Watershed/Watershed.html> (accessed November 28, 2007).

¹⁰ The Library of Congress: “The Roger Reynolds Collection”

perspective. In his 1978 article *Thoughts on Sound Movement and Meaning*, Reynolds proposes further research on the trajectories of sound through space in order to recognize the “rightness” of a particular movement. In other words, our senses are keen to perceive when a movement is flawed or unnatural. Thus, Reynolds argues that there must be a strong consideration of trajectory profile and direction on behalf of the composer before activating a sound through the concert hall space. Reynolds also addresses the need to develop a grammar for positional relationships: the geometries of a source sound and its relation to other established spaces of sound within the composition and ultimately the performance space. He notes that a major barrier in this regard has been the establishment of an accurate method for notating spatial elements.

I will now proceed to a discussion of my personal application of spatialization and movement as it pertains to a current work in progress titled *Une*. Similar in many respects to the model presented by Reynolds, *Une* is for solo percussionist and real-time spatialization that, in its current state, is based on the distribution of sound through six channels. The intention of the work concerns the exploration of individual instrumental forces within the set-up towards a unified whole. The emphasis is therefore targeted on musical elements of expressive gestural and, as a contrast, mechanical reproduction towards their ultimate unification. From this premise, the use of spatialization is justifiable considering my desire to create varying spaces or pockets of sound throughout the performance space in which musical elements interact, develop, and disappear from. These established spaces become the “fusion” centers in which multiple sounds arrive at to be amalgamated.

At the heart of my compositional approach is the extension of acoustic forces through technological means and a brief note will be made regarding my choice of software for this

project. Of particular interest are the capabilities and aural qualities offered by IRCAM's *Spatialisateur* software running in Max/Msp. Of paramount importance to my compositional toolbox, are two characteristic features of this software. First, the natural reverb of an acoustic instrument in the hall will not be overshadowed by the artificial qualities of the system. Instead, the speakers act as *reinforcements*, modifying the acoustic quality of the room to meet the desired level of modification. Secondly, the *Spatialisateur* algorithm is such that the loudspeaker setup appears as transparent as possible so that, for example, sounds placed by the composer outside of the speaker field will sound as if they were *originating from beyond the field* as opposed to one discretely hearing the individual loudspeaker(s) emanating the sound. The result is an incredibly flexible application that can be easily modified for loudspeaker configurations involving four to sixteen channels.

Certain musical challenges have presented themselves in the composition of *Une* and the workshop performance that I received of the work was evidence of other glaring issues. In order to preserve complete performer control over the execution of the work, I decided to have all sound trajectories be triggered by the instrumentalist through a foot pedal. Therefore, the performer gained access to types of performance nuances, such as the use of rubato, which would have been defeated by following pre-recorded media. However, failure to simultaneously activate the foot pedal and strike "x" drum would foster a spatial sound trajectory seemingly lacking in coordination. The complex nature of my musical language, in terms of rhythmic density, added to an increased level of difficulty in such cases. Therefore, my current revision will attempt to make use of a tracking system that will activate sound trajectories according to the computer's reception of cued moments in the piece.

The musical use of spatialization in *Une* benefits from the dialogue established between the acoustic and electroacoustic sound worlds. I made it a primary concern not to overuse the electronic medium in order to preserve moments of dramatic surprise in the work. Most of the instruments in the composition are slightly amplified with portions of intense reverb, spatialization, or sound movement reserved for key structural moments. For example, the use of the woodblock is associated with varying levels of reverb— from an intimate space to large church-like resonances. As the piece progresses from subtle, dynamically soft textures, the role of the woodblock increases and this is blatantly delineated by the aggressive strikes and reverb times electronically induced by this particular member. The structure of the piece emerges from the combination of subtle textures and electronically intense sections.

The extension of acoustic instruments through electronic means offers tantalizing new frontiers for the contemporary composer, performer, and listener. As it specifically pertains to the use of spatialization and sound movement, compositional practice must learn to adopt and reflect upon the ramifications of these new dimensions towards the creation of new artistic experiences only before dreamed about. The stark difference between historical static spatialization and the now “active” type, fostered through the use of multi-channel loudspeaker systems, should be recognized considering the work pioneered by such composers as Karlheinz Stockhausen, Jonathan Harvey, and Roger Reynolds.

The compositional challenges facing today’s composers rests on the integration of spatial elements into their own work, striving for musically sound conclusions. The use of spatialization and sound movement must be justified not as a cosmetic mean but as an integral feature of the composition parametrically significant as other such elements as rhythm or pitch. In this regard, musical works may be enriched by further levels of dimensionality.

Bibliography

- Boulez, Pierre. *Orientations*. Cambridge: Harvard University Press, 1985.
- Dhomont, Francis et al., "Is Tape Music Obsolete? Is Spatialization Superficial?" *Computer Music Journal* 25, no. 4 (Winter 2001).
<http://web.ebscohost.com/ehost/detail?vid=11&hid=14&sid=24634839-bdc5-4c3f-94b2-5e95644b5f47%40sessionmgr2> (accessed October 10, 2007).
- Donin, Nicolas. "Spatialization as a compositional tool and individual access to music in the future (interview with Jonathan Harvey)." *Musiques contemporaines* 16, no. 3 (2006).
<http://web.ebscohost.com/ehost/detail?vid=10&hid=14&sid=24634839-bdc5-4c3f-94b2-5e95644b5f47%40sessionmgr2> (accessed October 12, 2007).
- Harvey, Jonathan. *The Music of Stockhausen*. Berkeley: University of California Press, 1975.
- Kendall, Gary S. "A 3-D Sound Primer: Directional Hearing and Stereo Reproduction." *Computer Music Journal* 19, no. 4 (Winter 1995). <http://links.jstor.org/sici?sici=0148-9267%28199524%2919%3A4%3C23%3AA3SPDH%3E2.0.CO%3B2-8> (accessed October 16, 2007).
- Lennox, Peter P. "3D Audio As An Information-Environment: Manipulating Perceptual Significance For Differentiation and Pre-Selection." Lecture presentation, proceedings of the International Conference on Auditory Display, Espoo, Finland, July 29, 2001.
- Lippman, Edward A. *The Philosophy and Aesthetics of Music*. Lincoln: University of Nebraska Press, 1999.
- Malham, David G. "Toward Reality Equivalence in Spatial Sound Diffusion." *Computer Music Journal* 25, no. 4 (Winter 2001).
<http://www.jstor.org/view/01489267/ap060093/06a00080/0> (accessed October 10, 2007).
- Malham, David G., and Anthony Myatt. "3-D Sound Spatialization using Ambisonic Techniques." *Computer Music Journal* 19, no. 4 (Winter 1995).
<http://links.jstor.org/sici?sici=01489267%28199524%2919%3A4%3C58%3A3SSUAT%3E2.0.CO%3B2-Q> (accessed October 15, 2007).
- Moore, Brian C. J. *An Introduction to the Psychology of Hearing*. 5th ed. San Diego: Elsevier Science, 2003.

- Moore, Brian C. J., ed. *Hearing*. 2nd ed. San Diego: Academic Press Inc., 1995.
- Raaijmakers, Dick. *Cahier M: A Brief Morphology of Electric Sound*. Leuven: Leuven University Press, 2005.
- Reynolds, Roger. "Thoughts on Sound Movement and Meaning." *Perspectives of New Music* 16, no. 2 (Spring-Summer 1978). <http://links.jstor.org/sici?sici=0031-6016%28197821%2F22%2916%3A2%3C181%3ATOSMAM%3E2.0.CO%3B2-3> (accessed June 28, 2007).
- Reynolds, Roger. "Interviews." *Watershed*, DVD. New York, NY: Mode Records, 1998.
- Riikonen, Taina. "Shared sounds in detached movements: flautist identities inside the 'local-field' spaces." *Organized Sound* 9, no. 3 (December 2004). <http://search.ebscohost.com/login.aspx?direct=true&db=mah&AN=MAH0001396890&site=ehost-live> (accessed October 10, 2007).
- Stockhausen, Karlheinz. *Stockhausen on Music*. London: Marion Boyars, 1989.
- The Library of Congress. "The Roger Reynolds Collection." The Library of Congress. <http://lcweb2.loc.gov/diglib/ihas/html/rreynolds/rreynolds-home.html> (accessed November 28, 2007).
- Varga, Bálint A. *Conversations with Iannis Xenakis*. London: Faber and Faber Limited, 1996.
- Zvonar, Richard. "A History of Spatial Music." Richard Zvonar. http://www.zvonar.com/writing/spatial_music/History.html (accessed November 28, 2007).
- Zvonar, Richard. "Watershed." Richard Zvonar. <http://www.zvonar.com/writing/Watershed/Watershed.html> (accessed November 28, 2007).