COMPOSITION PORTFOLIO

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THESIS CONTAINS CD

Abstract

This portfolio includes four electronic pieces as well as three works especially devised for dance and theatre. The electronic music compositions *Plastiches*, *Clangor*, *Showtime!* and *Ciguri* investigate different approaches to the use of space and temporal structures. The works *Dance studies Nos. 1 & 2* were created as collaborations with choreographers and explore aspects of the relationship between music and contemporary dance. The large-scale dance-theatre work *To have done with the judgment of Artaud* explores different aspects of experimental music and contemporary dance and is related to the later works of Antonin Artaud.

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Author's declaration

The conference articles *Some considerations for spatial design and concert projection with surround 5.1* and *Shaping sounds in York Minster,* enclosed as appendices, were published as part of the proceedings of the following conferences: Digital Music Research Network Conference (July 2005) and the Doctoral DRMN Conference (July 2006).

The peer-reviewed articles *Creating sonic spaces: an interview with Natasha Barrett* and *Contemporary trends in the use of space in electroacoustic music,* enclosed as appendices, were published in the *Computer Music Journal (31, 2, 2007)* and *Organised Sound (13, 3, 2008)* respectively.

Introduction

"Most artists are sincere and most art is bad, though some insincere (sincerely insincere) works can be quite good."

Stravinsky (Auden 1975)

These notes aim to give an insight into some of the ideas which shaped the works included in this portfolio. The approaches for these works are based on three main aspects of composition that relate to electronic music and the performing arts: temporal structures, spatialisation of sound and an integrated approach to the development of music theatre works.

The first aspect I was concerned with when developing the works submitted was to find temporal structures that would work well with specific sound materials. Wishing to confront the fact that many listeners feel alienated from electroacoustic music because they cannot hear a sense of structure in it (Landy 1991), I have tried to develop temporal structures in which timbral developments could be organised in a way that would add cohesion to the composition.

The spatialisation of sound is the second aspect that I have explored in the works presented here, and this is also documented in detail in the publications enclosed as appendices. Having a background in room acoustics and perception of sound, I have applied ideas from my own research in a practical context. Between the extremes of space as an independent musical dimension and as a final complement detached from the compositional process, I have tried to develop an integrated compositional approach to spatial design that would inform the goal of each compositional project. This is related to the idea discussed in an article about recent trends in the use of space in electroacoustic music (Otondo 2008), namely that the spatialisation of sound can be used effectively in a piece at the levels of structure, clarity of material, gesture and functionality.

An integration of ideas related to the performing arts and music is the third aspect that I have investigated in many of the works presented here. This interest stems from my own experience as an amateur actor and performer and the frustration to see that very few productions integrate music effectively into the creative process. In an attempt to tackle this problem, a number of the works presented here have been devised as active collaborations with performing artists, including the large scale project *To have done with the judgment of Artaud* presented at the Edinburgh Fringe Festival 2007.

Plastiches (2005)

"some sounds need space around them
some sounds have space in them"
Sylvia Hallet (Tufnell and Crickmay 2001)

Constructing and de-constructing the sonic material

The experience of making recordings in an anechoic chamber during a research project made me aware of the complexity of timbre perception in the absence of sound reflections (Otondo and Rindel 2004). This inspired me to think about how the acoustic void of the anechoic chamber could be translated into a piece of music in which the listener's normal timbral and spatial relationships with conventional sounds could be transformed by a different environment. For this purpose I recorded several sequences of sounds of resonating objects in an anechoic chamber. The idea was to see the extent to which the nature and character of the generated material would be recognised by the listener if these sequences were fragmented and played in a different way (Smalley 1997). I was therefore interested in constructing and deconstructing timbral and temporal relationships using the original recordings as a point of departure.

This process of construction and deconstruction relied to a large extent on the listener's memory of certain specific events and the multiple relationships that he/she can create from that specific reference. Different recorded improvisations with objects in the anechoic chamber, in a specific order, were used as references for the idea of construction and deconstruction throughout the piece. This was done by taking short samples of sounds from a specific sequence which were then re-united and re-assembled throughout the piece. Figure 1 shows an example of a continuous sound of foam that has been fragmented to create short textures that are played against the original continuous sound in the background. As seen in the figure, layers of fragments of continuous sounds were used to create texture and contrasted to the original sound played in the background. This method proved to be a very simple and effective way to add diversity to the articulation of the sounds, which could be later translated into spatial developments as explained further down.

Two different types of anechoic sounds are used throughout the piece: foams and plastic sounds. The natural contrast in timbre and articulation between these two types of sounds led to the idea of exploring different types of contrasts related to the nature of sound. Following the idea of contrast and integration of these two basic materials, the piece is structured in two parts. The first part explores the idea of the construction and deconstruction of sonic relationships that relate to sequences of sounds from the original anechoic recordings, while in the second part the relationships of the first part are echoed and transformed using the convolution as a way to blend different sonorities (Otondo 2003).

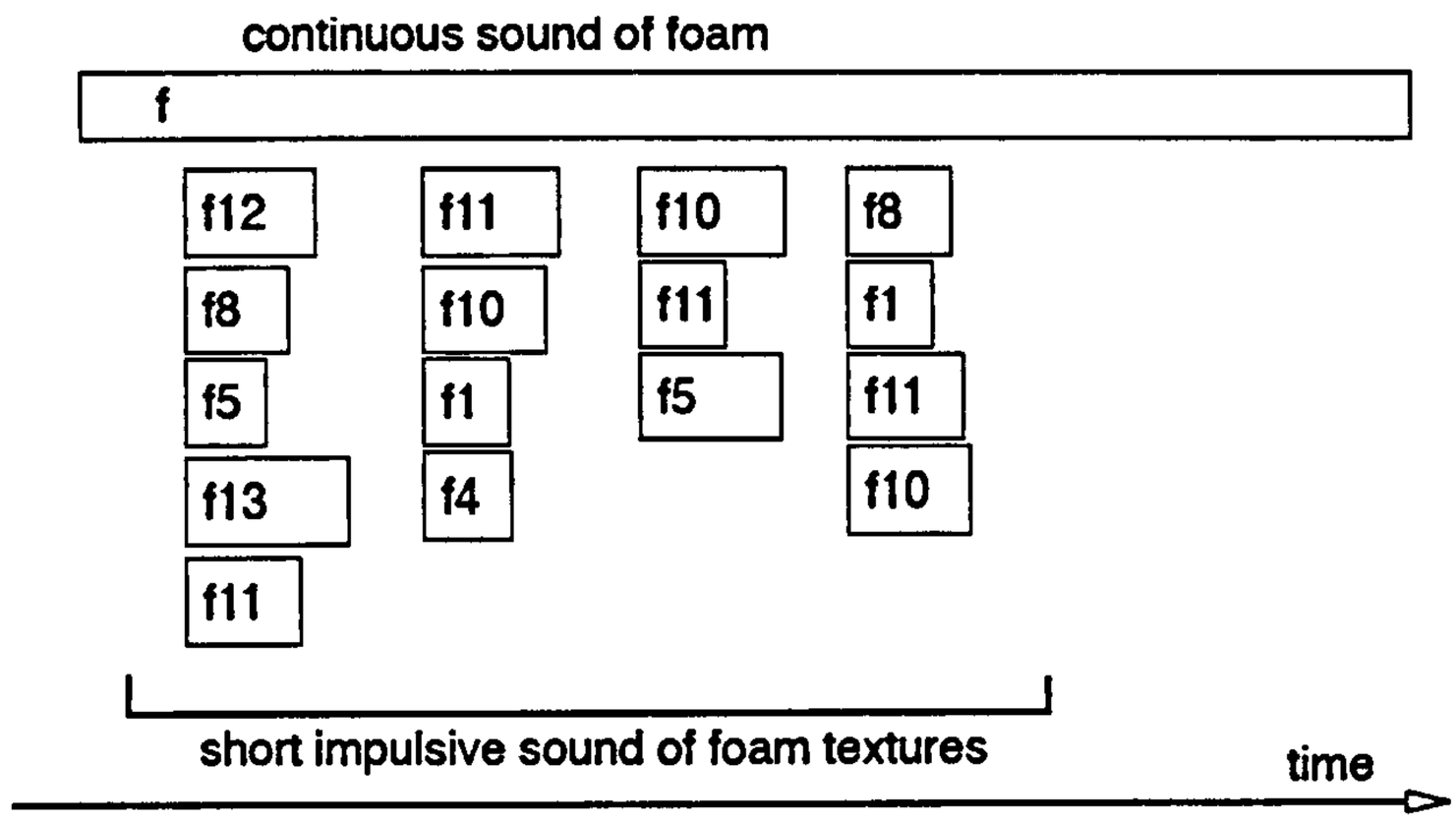

Figure 1. Example of textures of fragmented sections of a long continuous foam sound played together with the original in *Plastiches.*

Mapping timbral and spatial frameworks

Throughout the process of composing the piece it was important to relate timbral developments to a suitable spatial design. I was interested in understanding the role of space in connection with timbral developments as well as the limitations of the spatial design in the implementation process for a concert performance. At a macro level I wanted to see to what extent I could use space as a means of structuring and clarifying the sonic material in time. At a micro level I wanted to study in detail the relationship between timbral articulations with very detailed and complex spatial developments.

The first main idea explored in the spatial design of the piece was motion and interaction of sonic elements in the specific spatial framework provided by the 5.1 surround sound system. Timbral interactions like the ones mentioned above were related to different types of spatial interactions inspired by the ones proposed by Wishart using quadraphonic systems (Wishart 1996). This was done by trying to develop as much as possible the idea of unity between timbral and spatial developments, as well as a sense of counterpoint linked to contrasts in the material.

The second main idea explored in the composition was continuity and discontinuity in the perception of space. As mentioned by many composers in an article surveying contemporary trends in the use of space (Otondo 2008), and by Natasha Barrett in an interview (Otondo 2007), there are important aesthetic considerations related to different types of spatial systems. I wanted to explore the idea of the continuous character of sounds in the depth of the stereo field contrasted to the more discontinuous and monophonic character of a multi-speaker configuration. These ideas, as well as the transition to a coherent translation of the piece in the concert hall, are explained in detail in the article *Some considerations for spatial design and concert projection with surround 5.1,* included in the appendices (Otondo 2006).

Dance studies Nos. 1 and 2 (2005/06)

"Sound as a holding device
to give the work continuity
a sense of time or timing."
Miranda Tufnell (Tufnell and Crickmay 2001)

Dance study no.1: Sharing the physical space

This work was composed in collaboration with the choreographer Daliah Touré from the Northern School of Contemporary Dance (NSCD) in Leeds. The piece was developed during a series of workshops focusing on ideas related to movement in space from the perspective of dance as well as sound. The main goal of the collaboration was to gain an understanding of the ideas that choreographers and composers hold of physical space and how they can relate to each other. By working with choreographers as they develop the tasks for the workshop exercises, it became clear to me that, for dancers, space is something organic and embedded in their creative process, as shown in different approaches to contemporary dance (Tufnell and Crickmay 2001). I was therefore interested in exploring the sonic relationship that would relate to the evolution of the choreography.

With this in mind, the choreographer Daliah Touré and I tried to find common strategies to approach the use of space from the perspective of physical movement and sound. The initial idea was to use the physical space in the same way a painter would approach a canvas, as explained by Daliah Touré in the programme notes for the performance of the piece:

> "The space is my canvas. I paint a picture with my dancers, who wave in between the sounds, which fills the negative space. At times the sounds feel like rushes of water, like the tide; sometimes it feels like a thunder; sometimes it feels like a dagger cutting through the charged space. Always however it is a presence that is felt as well as heard." (Touré 2005)

Throughout the collaboration we were interested in developing relationships between spatial elements of the dancers' movement and the spatialisation of sound. After some discussions about the topic and some tests with sounds, we came to the conclusion that movement and positioning were two simple and straightforward things that a composer and a choreographer use when talking about space. With this idea in mind, the choreographer designed a basic description of movements in space, which I used as a basic framework for the development of the initial drafts of the music. We were interested in creating a non-direct relationship between music and dance: a music with space for dance as well as a choreography that would allow space for the music to unfold. With this in mind, I aimed to develop a piece that would relate the

sound to the movement of the dancers at different levels, exploring the possibilities for contrast and integration. In order to achieve this, I selected sonic materials that would allow contrasts between continuous and impulsive sounds. The main source of these materials were sounds from components of the gamelan with a very distinctive timbre like the *kecer*, *gongs* and *slenthem*, which were used to create motifs and rhythmic cycles related to sections of the dance. Since the choreography was created as a relationship between a solo and a duo, different levels of movement are explored which relate to different cycles of sounds, with a distinctive use of space as shown in table 1.

Dance	Music
Movement across and on the sides of the stage (mapping the space)	Movement of long continuous sounds
Slow movements in one position	Changes of depth with the convolution
Absence of movement	Swift changes in position of soft percussive sounds
Repetitive sharp movements	Beating in the back of a gong with hard sticks creating circular movement

Table 1. Examples of relationships between the movement in the dance and spatial design in *Dance Study 1*.

Dance study no. 2: Using rhythm and the convolution to build tension

This piece was developed as a collaboration with the dancer and choreographer Vicci Viles from the NSCD. The choreographer's idea was to work with the concept of memory, incorporating the performers' experience as an important aspect in the conception of the work. For this purpose she worked closely with two dancers to collect and develop different ideas related to their experience in previous couple relationships. Very much in the spirit of the choreographer Pina Bausch (Fernandes 2001), she developed the choreography through a process of workshops, trying to generate movement material directly from the experience of the dancers. Her aim was to develop the work with narrative elements and tension as the main source for movement development.

This idea of working with tension and a dramatic structure implied a very different compositional approach from the one adopted in the previous work for dance. So for this project I was interested in developing the structure of the music related to the narrative idea proposed, but also to allow space for a free relationship between movement and sound. For this purpose I developed two different approaches to generating sounds that would relate to the specific features of the choreography. The first type of sounds were mostly based on several studio recordings of different types of percussion skin instruments. These recorded sounds were arranged in sequences and then modified using detailed tempo variations like the ones that will be explained in detail for *Clangor* in the next section. Through the use of different types of simple and extreme tempo variations, it was possible to achieve a rich palette of sounds related to the original percussion samples, ranging from continuous sonorities with no sense of pulse to sequences of sounds with detailed regular and irregular rhythmic patterns.

The second approach was to use high-pitched sounds closely linked to the development of specific dramatic moments, reinforcing the build-up of tension in the work. These sounds were created by convolving the sound of an alto saxophone with different tones of wind instruments as a way to create a sort of resonating filtering effect, following a similar procedure used in a previous piece (Otondo 2003).

Clangor (2005/06)

"....gamelan recordings should have body and clarity"
Neil Sorrell (Sorrell 2006)

The sound of the gamelan

For the last few years I have been interested in the unique sound of the gamelan as well as the rhythmic structures found in traditional Javanese gamelan music (Sutton 1982). I therefore started working on ideas for a tape piece inspired by the timbral character of specific gamelan instruments as well as by how the roles of these components shape the structure of the music (Sorrell 1990). The goal of the piece was to explore the sound of the gamelan from different perspectives, using temporal structures related to traditional gamelan music as a global framework that would enhance the body and clarity of the original sound.

In order to familiarise myself with the sound of the gamelan, I experimented with playing and recording most of the individual components of the ensemble. It became clear to me that the distinctive sonic character of the individual components, as well as the performing techniques for the gamelan, required a careful approach. One of the first things that caught my attention was the duality of the gamelan as a pitched and percussive instrument. This duality is evident in the types of instruments present in the gamelan, like the *sarons* and drums, but also in the performance techniques of many of the individual components. Some instruments can have a very distinctive pitched sound when played normally but can also have a very percussive sound when played muffled. This duality gave me the idea of exploring the timbral relationship between the continuous pitched components of the gamelan and the more contrasting percussive instruments. I thus decided to make two types of recordings of the gamelan to be used as raw material for the piece. The first recording was done by playing individual instruments at different volumes, while the second was a recording of the university's gamelan ensemble rehearsing in the recording studio with multiple microphones.

Timbral and rhythmic structures within a variable temporal framework

Once I had made numerous recordings of the gamelan I started working with the samples, exploring different ways of organising the material. After some experimentation with the recordings, I decided that I would need to work mostly with the untransformed sound of the gamelan in an organic fashion, trying to find a structural framework that would allow me to develop changes from continuous to more rhythmic sounds. I therefore started looking at formal and rhythmic structures in Javanese gamelan music, and I became interested in the idea of interlocking and overlapping layers of instrumental parts. According to Sutton (Sutton 1982), this

is usually done using a cyclic structure marked by the gongs which is further subdivided by different instruments, creating the base for the interlocking textures of the music, as shown in figure 2. Inspired by the relationship of individual components in this cyclic structure, I tried to apply the idea to textures of timbres related to the original components of the gamelan as a way to create layers of rhythmic sequences or textures of timbres. I was interested in exploring the gradual transition from textures of continuous sounds to sequences of fragmented sounds that could be perceived as rhythms by the listener.

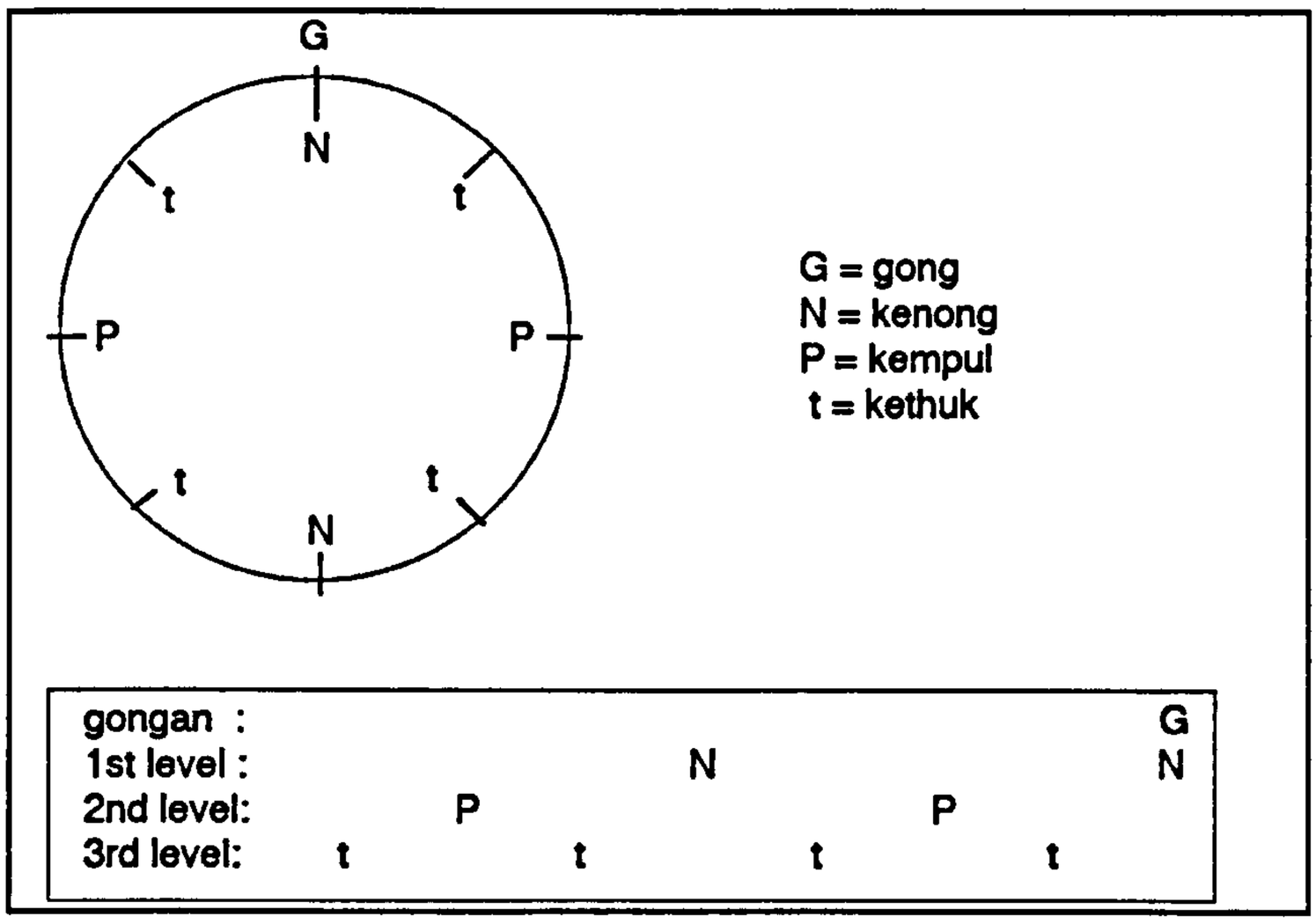

Figure 2. Subdivision of the Gongang cycle (top) and hierarchy in the Gongan subdivison (below) (Sutton 1982).

By manipulating the tempo of the sequences created, I realised I could easily make transitions from timbral textures to sequences of organised sounds with a very strong rhythmic character. This allowed me to use tempo variations as a way of articulating changes in sequences with a limited amount of material. By using this method I could easily transform textures into rhythms and vice versa, making the listener wander from rich textures with a very timbral character to streams of organised events that would be perceived as rhythms. Figure 3 shows an overview of the sonic materials used in the piece in relation to the tempo changes, and table 2 provides a detailed description of the sound materials used for each of the sections of tempo variations.

An idea that arose from the use of tempo variations in the piece was to use tempo changes actively to create short re-mixes of different parts of the piece, which would work as 'recounts' within the work. As the piece evolves, the use of these recounts increases, creating direct and indirect timbral and temporal relationships with new materials, as well as reinforcing the sense of structure in the piece. This technique proved to be an effective tool to develop the sound material in such a way that it would add cohesion to the piece.

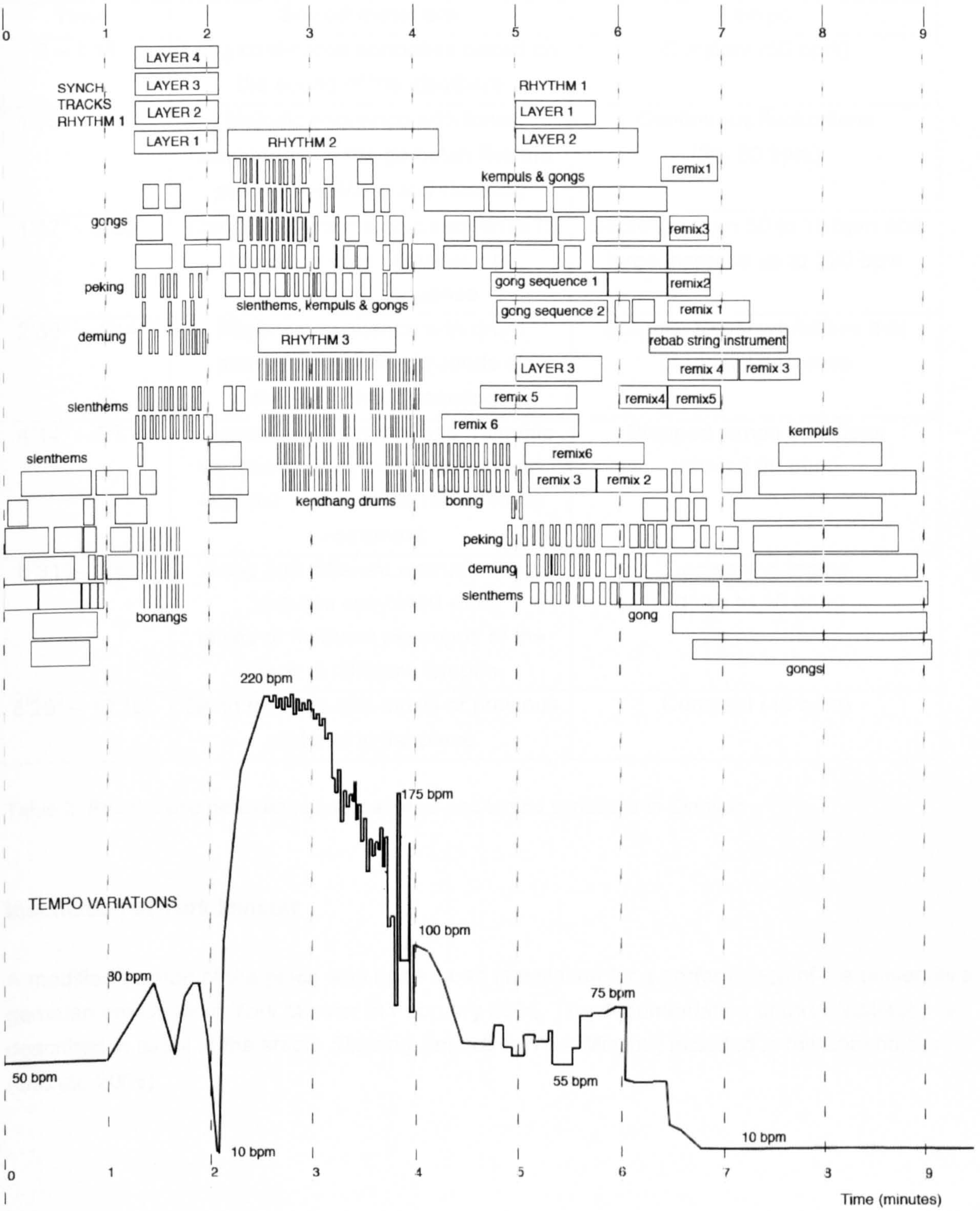

Figure 3. Overview of sonic materials in relation to tempo variations in *Clangor*.

Time	Sound materials	Tempo
0 – 1'15"	Long continuous sonorities based on the sound of the *slenthem*	Constant (50 bpm)
1'15" – 1'47"	Melodic sequence with tonal components of the gamelan like the *peking*, *slenthem* and *demung*	Continuous fluctuations (50- 80 bpm)
1'47" – 2'30"	Transition from melodic sequence to timbral textures and back to percussive sequence	Decrease from 50 to 10 bpm and large increase up to 220 bpm
2'30" – 4'14"	Rhythmic sequence with drum sounds and muffled sounds of previous melodic sequence	Stepped tempo variations that gradually decrease
4'14" – 6'31"	Sequence with timbral and rhythmic variations using gong sounds and later the sound of the *rebab* string instrument	Stepped tempo variations (around 60 bpm)
6'31" – 7'50"	Gong and different instruments in textures combined with mixes of rhythmic passages of the piece at different tempos	Decreasing tempo (down to 10 bpm)
8'29" – 10'16"	Gong textures and mixes of previous material in the piece	Constant (10 bpm)

Table 2. Relationship between sound materials and tempo variations in *Clangor*.

Installation at York Minster

A modified version of the piece was done as an installation for a performance of the university's gamelan ensemble in York Minster in February 2006. The documentation of this installation is described in detail in the article *Shaping Sounds in York Minster*, included in the appendices (Otondo 2006).

Showtime! (2007)

"...humour in music is a difficult topic,
jokes just ain't funny any more,
once you've explained them!"

(B. Heile, Heile 2005)

Does humour belong in electroacoustic music?

The inspiration for this work stems from the first pages of the English version of the book *Three Trapped Tigers,* by the Cuban writer Jose Cabrera Infante (Cabrera Infante 1990). These pages are an imaginary transcription of the bilingual speech routinely performed for tourists by the master of ceremonies at the Tropicana cabaret in Havana in the years before the Cuban revolution. The text starts with the following sentences:

> "Showtime! *Señoras y señores.* Ladies and gentlemen. And a very good evening to you all, ladies and gentlemen. *Muy buenas noches, damas y caballeros.* Tropicana! the MOST fabulous night-club in the WORLD—*el cabaret más fabuloso del mundo*—presents—*presenta*—its latest show—*su nuevo espectáculo*—where perfomers of Continental fame will take you all to the wonderful world of the supernatural beauty of the Tropics—*al mundo maravilloso y hermoso:* The tropic of the Tropicana! *El Trópico en Tropicana!...."* (Cabrera Infante 1990)

I was interested in the comical and theatrical character of the bilingual text and its potential as a thread in a piece inspired by different styles of cabaret music. I was also interested in Cabrera Infante's comical approach to translation, shown at the beginning of the book as well as throughout in the English translation of the original text in Spanish. The use of translation as a tool to explore ambiguities and puns that can lead to a comical and absurd outcome, as expressed by the author (Gazarian Gautier 1984), was a driving force for the piece.

As a whole, my aim was to develop an electroacoustic piece within a theatrical framework that would challenge certain common stereotypes of Latin American culture related to entertainment and light music that exist in Europe and the United States. The voice is used actively in the piece as a way to reinforce the theatrical situation proposed and also as a way to structure the work. In this case I recorded the text myself improvising different ways in which a master of ceremonies could introduce different parts of a show. Different recordings of applause in different concert halls in York were also used in order to mark the transitions from one show to another and to add a distinctive character to the piece.

Re-constructing the sound of the cabaret through improvisation

Inspired by a show that I once saw at the Tropicana cabaret in Cuba, I tried to build the sections in the piece by means of different rhythms and specific instruments of a small orchestra. I therefore selected rhythms of salsa, jazz, mambo and Cha Cha Cha with specific tempos on which the piece would be structured and also to be used as a basis for the improvisations to generate material for the piece. I played these rhythms through headphones to a group of jazz musicians in the studio and asked them to improvise on top of them. I then recorded a synchronised version of individual and group improvisations with the original rhythms, trying to link different types of instruments with specific rhythms at specific tempos. Following this idea, the structure of the piece is based on three main instrumental sections of the show that alternate with sections of the presenter mentioned above. The first section is based on the trumpet and a salsa rhythm, the second part is based on the double bass and a jazz rhythm and the final part is based on the trombone and a Cha Cha Cha rhythm. Figure 4 shows a diagram with the main components of the different sections of the piece. Different sound transformation techniques were used to develop the material for the three instrument parts. One of the most important was a pitch tracker connected to a synthesiser, which magnifies and echoes the sound and articulation of the improvisations of the instruments throughout the piece.

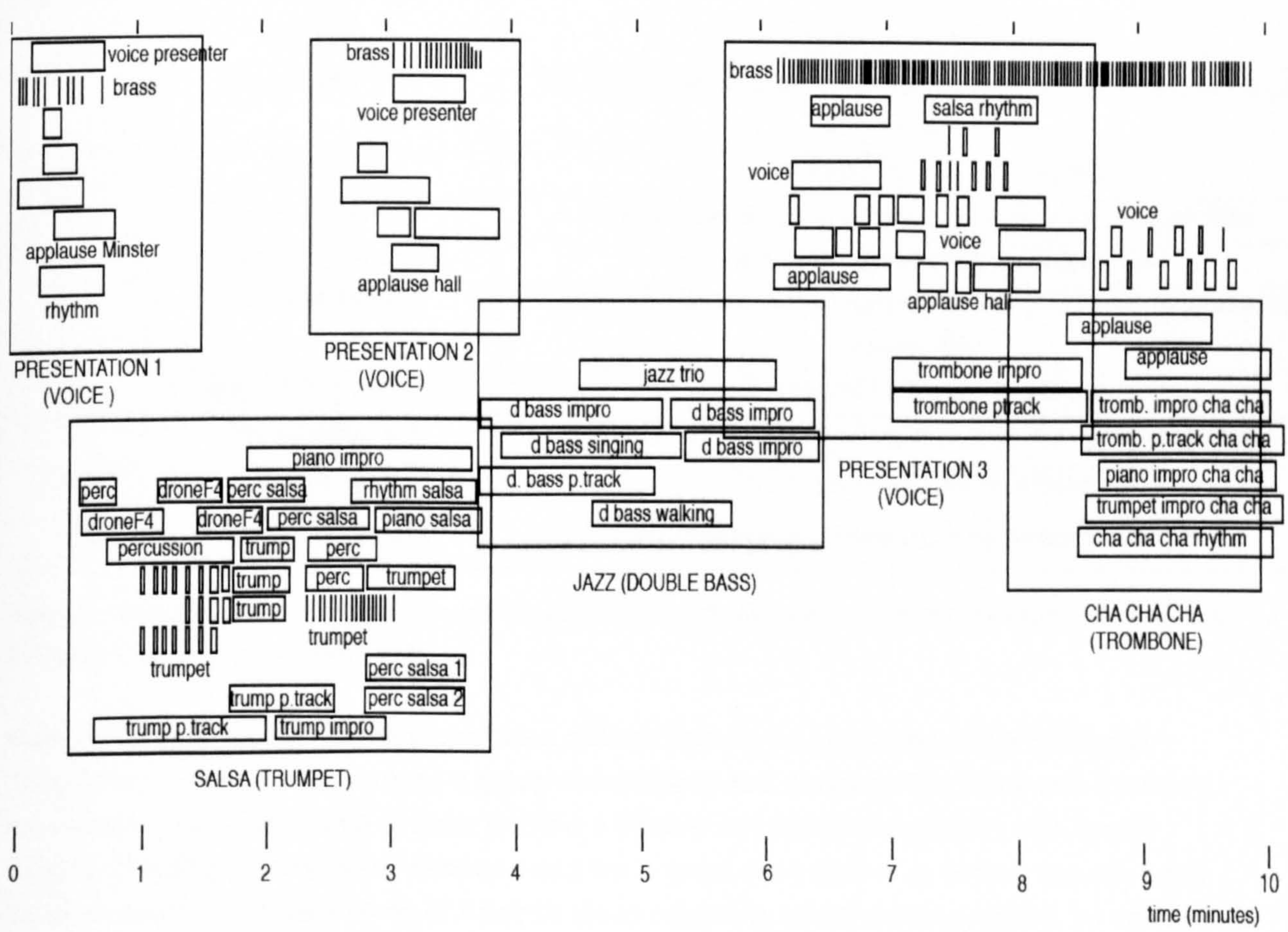

Figure 4. Structure of *Showtime!* with specific sound materials in sections of the piece.

To have done with the judgment of Artaud (2007)

"Everything must be arranged to a hair in a fulminating order...."
Antonin Artaud (Artaud 1995)

Exploring Artaud's fulminating order

While searching for ideas for a large-scale music theatre piece, I came across the later works of the French writer Antonin Artaud. I became particularly interested in the last work that Artaud conceived, the radio play *To have done with the judgment of god* (Artaud 1995). This piece, originally commissioned by Radio France in 1947 and banned because of its strong anti-American and anti-religious content, provided a very rich source of material with a great potential for development. This was reinforced by the fact that the piece existed both as a text and as a recording performed by Artaud and actors, allowing the possibility of working at different levels with the original sounds of the recording. Table 3 shows the original structure of the radio play with its ten sections.

Section	Title	Content
1	Opening	Text read by Antonin Artaud
2	Sound effects 1	Shouts and percussion sounds by Antonin Artaud and Roger Blin
3	Tutuguri	Texts read by María Casares
4	Sound effects 2	Xylophones sounds played by Artaud and Roger Blin
5	Research on fecality	Text read and glossolalia by Roger Blin
6	Sound effects 3	Voice and percussion improvisation by Antonin Artaud and Roger Blin
7	To raise the question of..	Text read by Paul Thevenin
8	Sound effects 4	Voice and percussion improvisation by Antonin Artaud
9	Conclusion	Text read by Antonin Artaud
10	Sound effects 5	Percussion improvisation by Antonin Artaud

Table 3. Sections of the radiophonic work *To have done with the judgment of god* as recorded by Artaud in Radio France in November 1947.

With the aim of developing the project as a collaboration to be presented at the Edinburgh Fringe Festival 2007, I assembled a group of musicians and dancers. The piece was therefore conceived for a small troupe in order to allow a flexible and dynamic approach with simple means. The piece would be developed using the original radio play in its written and recorded version, aiming to explore some of Artaud's ideas related to sound and movement, as well as to re-assess the relevance of Artaud's work today.

After discussions with the other members of the group, I came up with a proposal to approach the work using a structure similar to that of the original radio play. The five main text sections of the original work would be the structural basis of a piece called *To have done with the judgment of Artaud,* which would also use as a framework the material of the original text and the ideas on which it was based. The fact that the original work existed both as text and as recorded sound material offered the possibility of going beyond an interpretation of a text, allowing us to integrate sound and movement as much as possible, following some of Artaud's early ideas related to the use of sound (Artaud 1974). The non-linear structure of the original work and the diversity of material, in both text and recordings, provided considerable scope for interpretation. With this in mind, I decided that sound and space should play an important role in the piece, integrated as much as possible with the action on stage in a similar way to that proposed by Barker (Bicât and Baldwin 2002). I was interested in developing a sonic framework that would create an effective use of space, keeping a clear sonic reference for the audience and, at the same time, exploring the idea of sonic mobility in connection to the choreographed movement of the performers. After experimenting with different devices I came to the conclusion that a good way of doing this would be to use portable CD players, carried by the performers in certain parts of the piece. On the one hand this would allow the audience to make the connection with the radio as an object linked to the nature of the radio play and the voice of Artaud, and on the other hand, it would allow us to create relationships between the performers' movement and sounds on stage. The piece itself was created considering a spatial design that aimed to be simple at the level of implementation but carefully detailed in the design of the mix. This was achieved by composing the work as a multi-channel piece, combining throughout the piece the two stationary loudspeakers of the PA in the room with the two mobile sources carried by the performers. This allowed me to develop a framework to explore relationships between the performers' movements, their voices and the reproduced sound as shown in table 4 and figure 5.

Section	Sound and spatialisation
Sound Installation	Sparse use of speech in relation to reproduced sound through a four-channel soundtrack using the PA system and two mobile sources (no. 1 in figure 5).
Opening	Use of a 2-channel mix with noise for two radios synchronised with speech spoken by the 4 performers (no. 2 in figure 5).
Interlude	Use of one radio with noise and the voice of Artaud blending into the speech of the performer holding it and moving forward (no. 3 in figure 5).
Tutuguri	Dance section with a stereo mix played through the PA system.
To raise the question of..	Dance section with a 4-channel mix played through the PA system and the mobile sources (no. 6 in figure 5).
Conclusion	Small percussion instruments played by the four performers synchronised with a stereo mix played through the PA system.

Table 4. Examples of sound and spatialisation in different sections of the piece *To have done with the judgment of Artaud,* as presented at the Edinburgh Fringe Festival 2007.

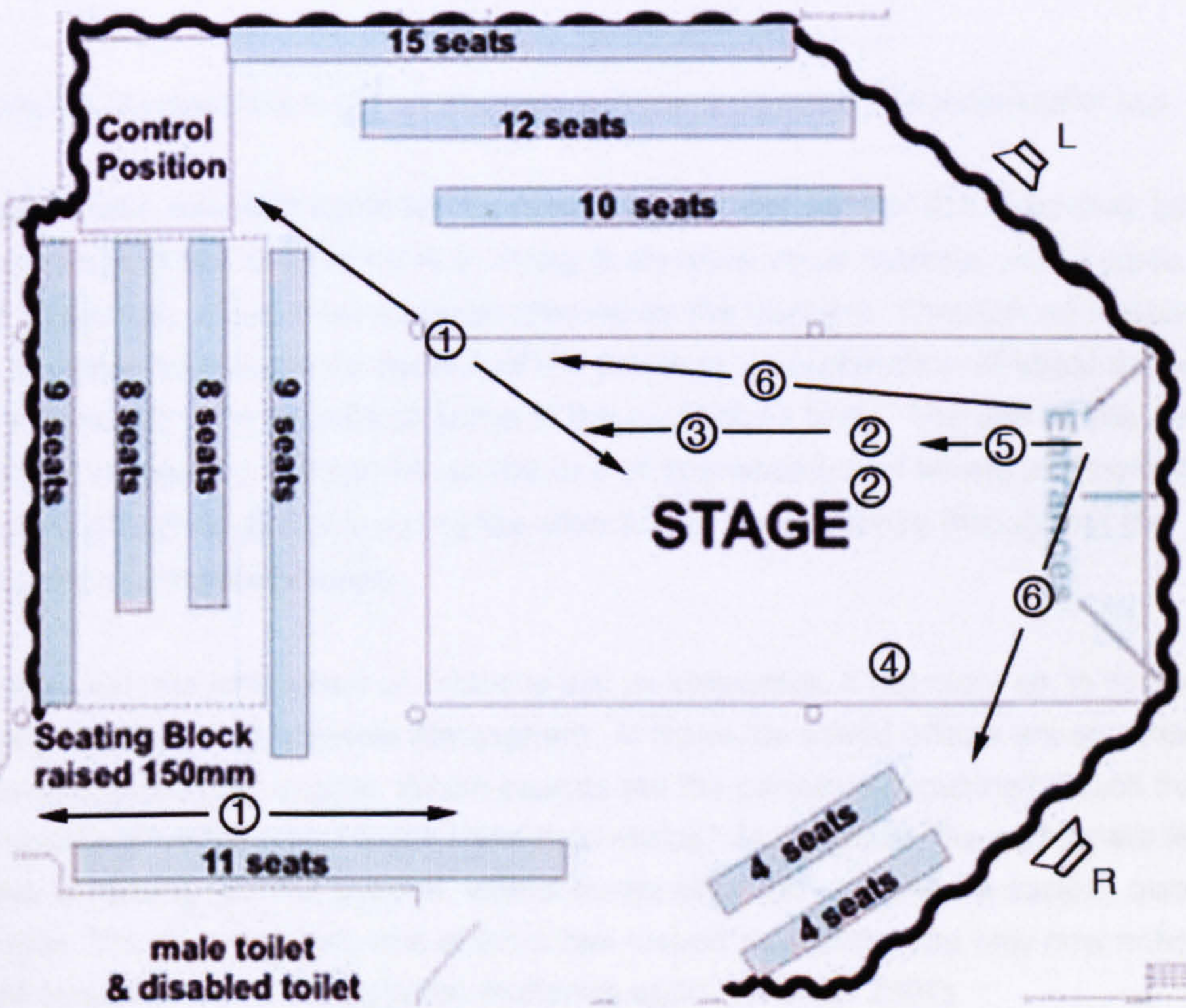

Figure 5. Position and movements of the two portable radios used in the piece in relation to the main PA system in the venue at the Edinburgh Fringe Festival. Numbers refer to positions and movements of one or both sources in different sections of the piece as shown in table 4.

Pure sound and muttering

Artaud was interested in the use of the voice as an active and flexible tool, going beyond its traditional role in the theatre as an extension of the text (Artaud 1974). This becomes clear when listening to the recordings of the radio play in which he shows a remarkably varied and extended use of the voice using glossolalia texts. Glossolalia has been described as: 'a type of speech or babble characteristic of certain discourses of infants, poets, schizophrenic, mediums, charismatics. The manifestation of language at the level of its pure materiality, the realm of pure sound, where there obtains a total disjunction between signifier and signified. As such, the relationship between sounds and meaning breaks down through the glossolalic utterances; it is the image of language inscribed in its excess, at the threshold of nonsense' (Weiss 2004). Table 5 shows the glossolalia texts from the script of the radio play.

kré	puc te	o reche modo
kré	puk te	to edire
pek	li le	di za
kre	pek ti le	tau dari
e	kruk	do padera coco
pte		

Table 5. Examples of glossolalia in the original text of *To have done with the judgment of god.*

Using the glossolalia excerpts recorded by Artaud and Roger Blin for the radio play as a starting point, we worked with the texts of table 5, trying to develop vocal material with a close relationship to the new movement material created by the dancers. Through an intense series of workshops we developed a whole section of the piece as a combination of vocal and dance improvisation based on the sounds of some of the glossolalia texts. The use of this new generated vocal material in connection to the use of spatialisation of sound mentioned above proved to be an effective way of keeping the attention of the audience throughout the performance, as one reviewer wrote:

> "*To have done with the judgement of Artaud* is just as innovative, if not more so, in its use of sound to help create the appropriate atmosphere. At times the sound effects are so consuming, it is hard to distinguish their origins. Which sounds are the performers making? Which from the overhead speakers? What about those hand-held radios? At one point, the performers leave the stage. There is nothing, but the sudden, violent bursts of sound - behind the curtain, overhead, all around you. The next moment, one of them has moved so silently, you only now notice they're right beside you and have started muttering again." (Powell 2007)

The piece in its final format was conceived as an open project that could be implemented by a choreographer or theatre director with a small company. Enclosed is the performance kit containing the information and materials needed to perform the piece.

Ciguri (2007/08)

"I have much more control temporally with these pianos than these electronic composers have [.....] they're not interested in the temporal thing."

C. Nancarrow (Nancarrow 1977)

Using the spectra to create a rhythmic and timbral developments

This piece was developed from some of the sound material used for the Artaud project mentioned earlier and inspired by the atmosphere described in the section *Tutuguri* of Artaud's original radio play (Artaud 1995). The goal of the piece was to use sounds produced with different types of metallic instruments, like bells and triangles, as a way to explore transitions from temporal structures to timbral developments derived from the inharmonic character of the spectra of these sounds. The piece is mainly based on sound material generated from two similar bronze bells and three triangles of different sizes. Figure 6 shows the inharmonic spectra of the two bells.

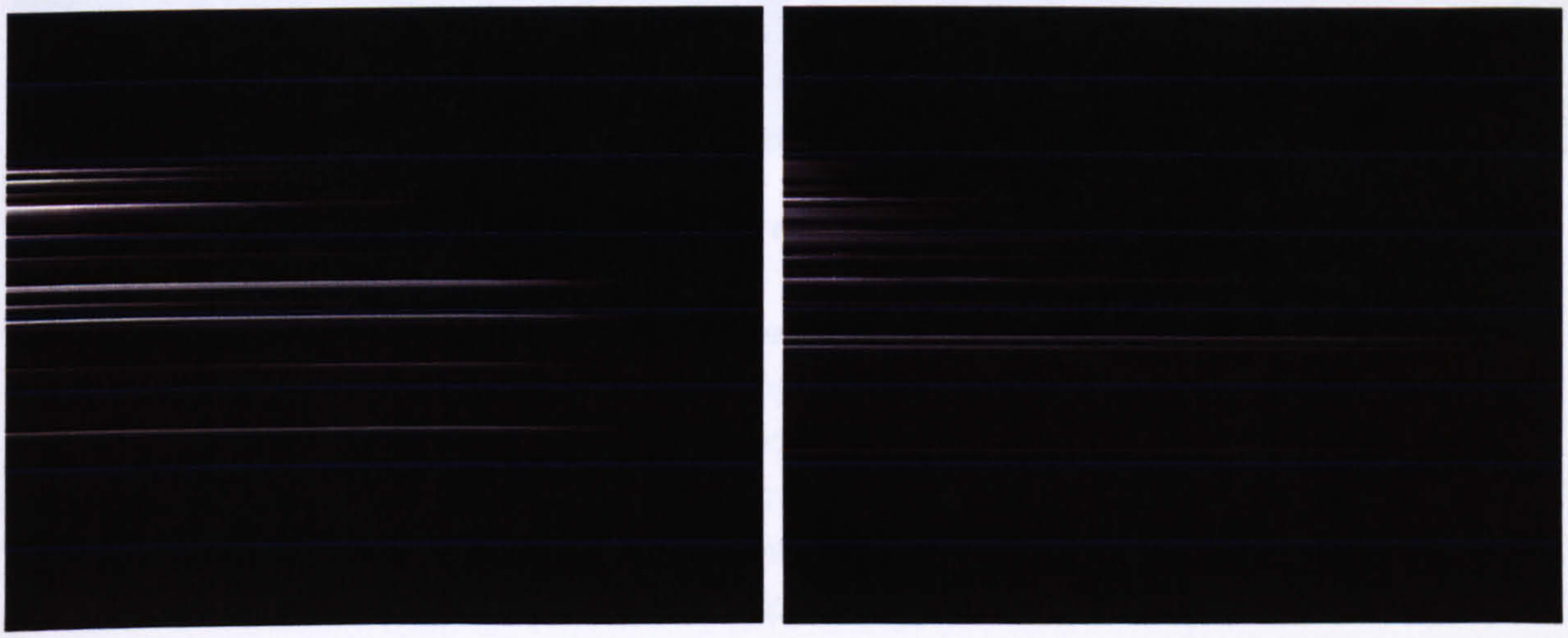

Figure 6. Inharmonic spectra of the two bronze bells used in the piece.

In an attempt to explore different aspects of the instruments chosen, I started to create transitions that would build relationships between temporal and timbral aspects of the material chosen. I was interested to see if the spectral structure of the instruments could also work as a temporal framework for developing rhythmic sequences that would help me to structure the piece. I therefore used an image synthesiser that links the spectra of a specific sound, like the ones in figure 6, with a specific sample to create a sequence in which the sample is modulated in time and frequency according to the energy components of the original spectrum. This allows the user to make use of the spectrum as a variable temporal framework that can be compressed

or stretched in time using the samples as raw material. Using this tool I was able to develop synthesised sequences based on different samples of bells and triangles, and by stretching the spectra of specific sounds, I was thus able to relate each generated sequence to a particular tempo. On the one hand this allowed me to create timbral and pitch relationships in the sequences based on the type of sample chosen and, on the other hand, to have a temporal reference for each sequence. This would allow me later to create temporal relationships with the sequences in the mix at different levels, as done in the pieces *Clangor* and *Showtime!* Figure 7 shows two examples of stretched spectra used to synthesise sequences of sound with various tempos. The first spectrum corresponds to the spectrum of a short excerpt of speech and the second one is the sound of a gong beaten.

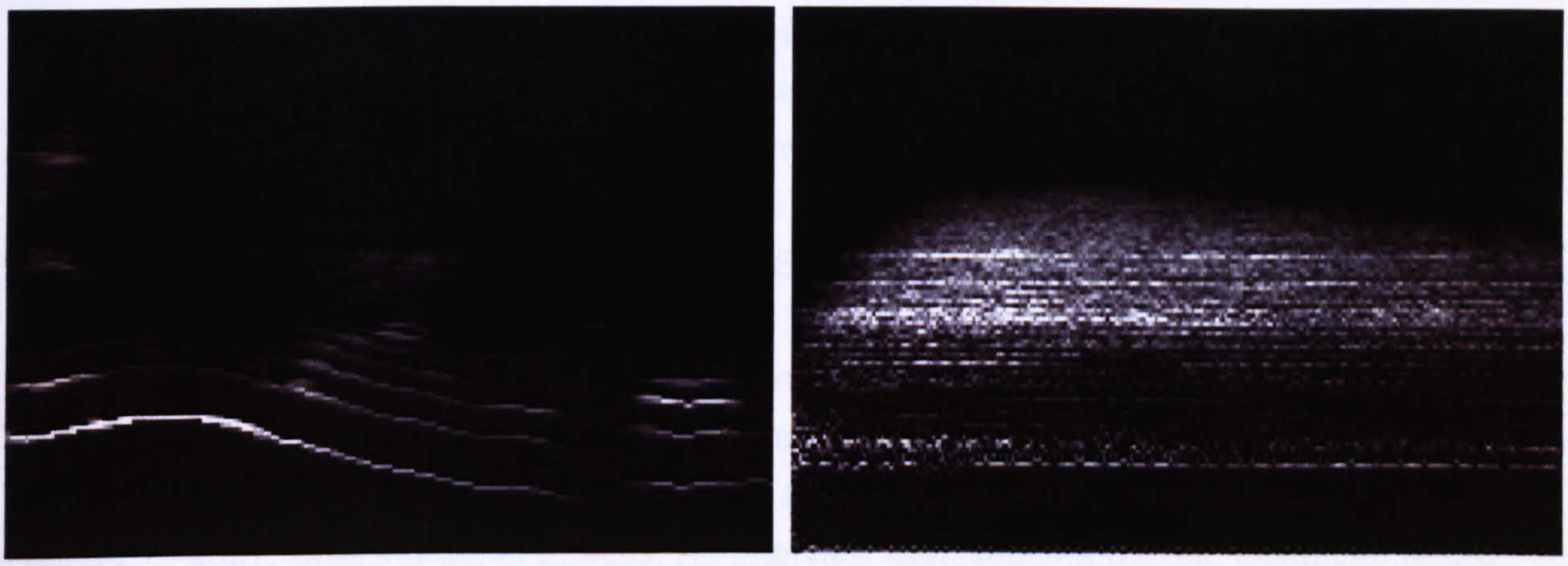

Figure 7. Spectra of a short excerpt of speech (left) and the sound of a gong (right) used in *Ciguri*.

In order to develop continuous contrasting material suitable for timbral developments in the piece, a similar approach to the one used for rhythmic sequences was employed. This time, the approach was based on the spectra of the samples previously used as raw material in the rhythmic sequences. The spectra of bells and triangles, like the ones shown in figure 6, were used as a reference to synthesise long and continuous sounds using a spectrum synthesiser. Like the image synthesiser, this tool uses the spectrum as a framework for the synthesis process, but employs oscillators instead of samples as a basis to create the synthesised sequences. This gives the sequences a more synthetic and timbral character, allowing the user to work in detail with the harmonic content of the sound, emphasising or diminishing specific harmonics of the sound. This proved to be a powerful tool to create sonorities based on the inharmonic character of the instruments chosen, which could be contrasted with the rhythmic sequences as a way to explore the relationship between the rhythmic and timbral characteristics of the spectra of bells and triangles.

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APPENDICES

Introduction to the Appendices

The following appendices are articles published during my PhD studies. These articles aimed to develop and articulate ideas explored in the musical works submitted in this portfolio, focusing mainly on the topic of spatialisation of sound. The two articles published in conference proceedings, *Some Considerations for Spatial Design and Concert Projection with Surround 5.1* and *Shaping Sounds in York Minster,* relate directly to the compositions *Plastiches* and, respectively, *Clangor.* The peer-reviewed articles *Creating Sonic Spaces: An Interview with Natasha Barrett* and *Contemporary Trends in the Use of Space in Electroacoustic Music* are a more general reflection on the advantages and limitations of technological tools for spatial design from the perspective of practitioners in the field of electroacoustic music.

SOME CONSIDERATIONS FOR SPATIAL DESIGN AND CONCERT PROJECTION WITH SURROUND 5.1

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ABSTRACT

This article describes the process of composing an electroacoustic music piece using a 5.1 surround sound system for studio monitoring and diffusion in a concert hall. Specific spatial ideas explored in the composition of the piece are explained in connection to the possibilities offered by this system, as well as to its limitations. Considerations are outlined regarding the quality of the spatial performance of the system in a concert hall as compared to its performance in a studio in the compositional process. Some conclusions are drawn as regards limitations and advantages of surround 5.1 systems for electroacoustic music composition and some suggestions are made for a more effective concert performance.

Keywords – Spatial design, surround, sound projection, composition, electronic music.

1. INTRODUCTION

There has been an increase in the use of multi-channel systems in the last years due to more accessible equipment prices as well as due to more refined possibilities of working with spatial design which these systems and related software offer [1, 2, 3]. This encouraged many electroacoustic music composers to start working actively with systems such as surround 5.1 as a way to expand the possibilities for the use of space in their music. But, when working with systems that offer more tools for spatial design such as surround 5.1, do we really obtain a complete control of the spatialisation or do we put more limitations than advantages to the compositional process? And what are the good and the bad attributes of 5.1-channel systems for music creative purposes that a composer should be aware of when playing a piece in a concert hall? Considering these questions as a motivation, the first goal of this work was to study the limitations and advantages of the surround 5.1 through the compositional process of a piece of electroacoustic music, with some specific ideas for the spatial design in mind. A second goal of this study was to try to understand the limitations of the diffusion of electroacoustic pieces in surround 5.1 in concerts as compared to the original studio spatial design.

2. SPATIAL DESIGN OF THE PIECE

2.1. Inspiration

The piece *Plastiches* was conceived as an exploration of different approaches to space, using sonorities of plastic sources and foams recorded in an anechoic chamber. Two types of sounds were used for the piece: natural impulsive sounds from the mentioned sources and convolved continuous sounds obtained from the same sources. These two types of sounds were used as a basis for the design of the two very distinctive parts of the piece. The spatial design was conceived from the start in surround 5.1, trying to achieve particular goals and giving it an active role in the compositional process.

An initial inspiration for the use of space in the piece were ideas developed by the composer Trevor Wishart while working with quadraphonic systems, exemplified in his book *On sonic art* [4]. It was interesting to test some of the ideas designed for symmetrical quadraphonic systems in the surround 5.1 format and see how they could be developed. Ideas related to the use of space in different forms such as motions, trajectories, frame rotations, temporal developments and interactions were considered as a basis for the composition of the piece in terms of spatial and timbral evolutions.

A second source of inspiration for the spatial design of the piece were the possibilities for spatial allusion brought about by the quality of the sound material used in the piece, in this case anechoic recordings. The diversity and the dry quality of these recordings led to a particular approach to the use of space. By manipulating the dynamics and also the positioning of sound it was intended to create perceived spaces with some relation to particular situations that could be perceived as allusions.

2.2. Use of space in the piece

Space was approached in the piece from different perspectives, trying to work with it structurally as well as organically. The piece is structured in two parts, following the idea of a timbral and a spatial counterpoint between sounds originated from plastic

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sources and foam sounds. Different types of spatialisation techniques were developed throughout the piece according to the type of material used, trying as much as possible to bond timbral and spatial gestures with a detailed use of the automation of the surround parameters in the mix. The first main idea for spatialisation to be developed in the piece was that of motion and spatial interaction of elements in a defined sonic space, the space created by the surround 5.1. Trajectories of particular sounds in the horizontal plane were designed and automated following fusions and contrasts in timbre of particular sounds. This was done assuming, as with quadraphonic systems, a discrete space with the listener in the middle where different possibilities for movements and interactions could be designed in detail in a kind of grid [4]. Figure 1 shows the grid with spatial positions as seen in the software for the automation of the surround.

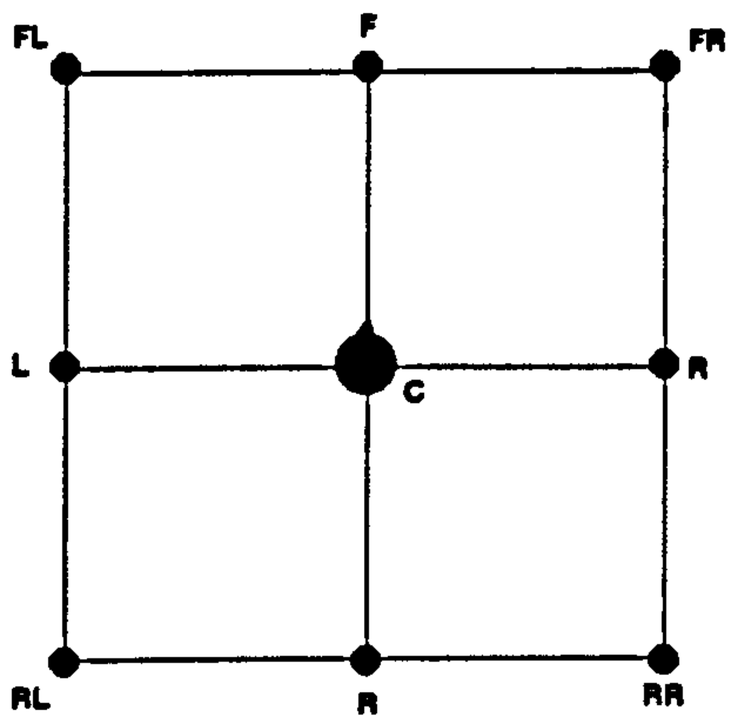

Figure 1. Grid with spatial positions (F: front, FL: front-left, FR: front-right, C: centre, L: left, R: right, R: rear, RL: rear-left and RR: rear-right).

The second main idea to be developed was to try to create non-conventional evolutions of the use of space by employing speakers as discrete sources that could help to break the spatial perspective in multiple images and would make the listener loose the sense of a purely stereo focused composition. This approach, well know by composers who work with the multi-channel format, allows a great deal of flexibility and lets the space play a more active role in a non-conventional manner [5]. Some of these spatial developments were obtained by the rotation the listeners' axis in relation to the speakers, by spatial counterpoint through the alternation of distinctive sound material between speakers, by rhythmic associations of timbre and space, and by developments of long continuous convolved sounds played by particular pairs of speakers.

3. COMPOSING USING THE 5.1-CHANNEL SYSTEM

3.1. The 5.1 surround system

The 5.1 surround systems was developed for cinema applications as a front-orientated sound stage with stereo effects or room ambience [6, 7]. The system consists of a conventional stereo pair in the front, with a central speaker in the middle, two speakers at the back and a subwoofer. This system can also be considered as a 3-2 stereo configuration, with a stereo pair in the front and a stereo pair at the back. The subwoofer speaker is normally located in the front, close to the central speaker. Figure 2 shows the positioning of loudspeakers in the surround 5.1-channel system [7].

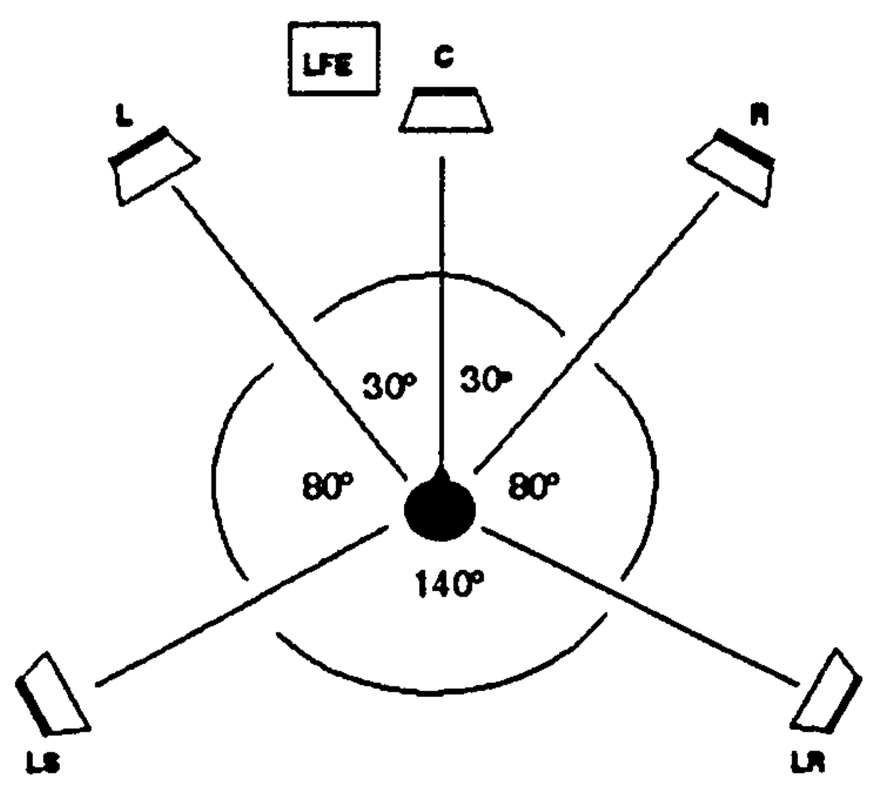

Figure 2. Disposition of loudspeakers in a 5.1-channel surround system.

3.2. Pros and cons for musical spatial design

As a way to ensure an effective use of space in the piece with the possibilities of the 5.1-channel surround system it became important to understand the advantages and the limitations the system poses for the development of the ideas previously mentioned. As to the positive aspects of the surround 5.1 system, it can be stated that the system offers a number of tools to expand the possibilities for musical spatial design such as the possibility of creating very stable stereo images with the support of the central loudspeaker, very rich and advanced possibilities of automation for the spatialisation of the sound image, as well as the possibility of creating a very effective sense of surround in the listener with the help of the rear speakers. Another advantage of 5.1-channel systems, less exploited for musical purposes, is that a carefully adjusted mix can facilitate an aesthetical approach towards spatialisation by combining the stereo and multi-channel techniques as mentioned previously. This means that for some purposes one can work with a conventional stereo image reinforced with the sound of the rear speakers and for others one can treat all the speakers of the systems as discrete sources that can be used to create contrapunctual and independent spatial developments, not necessarily based on a stereo image but on a number of discrete independent sources. To achieve good results from the combination of both techniques a considerable amount of time needs to be spent in order to understand perceptually how the system works in terms of spatial distribution as well

how one can develop interesting contrasts and fusions of the two techniques

Once the advantages of surround systems have been presented, it is also important to mention that 5.1 surround poses serious limitations to a spatial design for musical purposes where the space is to be integrated effectively in the composition. The first clear disadvantage of surround 5.1 systems encountered in the process of composing the piece was the extreme focalisation and timbral colouration of sound in front of the listener produced by the contributions of the central speaker. This makes the mix brighter than usual and creates a different perspective for the spatial developments in the frontal axis, making the stereo mix more focused in the centre with fewer possibilities for movements to the extremes. A second disadvantage, less obvious when monitoring in the studio as it will be explained later, is the spatial discontinuity at the sides of the system between the three frontal speakers and the two rear speakers. It becomes clear after spending some time monitoring the system that it is quite hard to create an integrated convincing spatial design which breaks the disposition of the two stereo systems (3+2) with holes at the sides of the listener. Cinemas have also experienced this problem with multi-channel systems. As a result, multiple speakers are used at the sides of the hall and also at the back in order to reinforce the sound of the two rear channels [8].

At a macro level, besides the above mentioned disadvantages clearly related to the architecture of the 5.1 surround system, a recurrent problem encountered while designing the piece with different software was the imprecise correspondence between the visual movements of the sound image shown on the spatialisation automation screen and the actual perceived movement of sound inside the speaker configuration. This paradox creates a peculiar illusion of movements that do not really sound positioned as it is shown visually, which implies re-adjusting the mix following one's aural perception rather than the movement of the sound image provided by the software used for spatial design. In this context the discrete space shown in Figure 1 (which is the one shown on the software screen) becomes just a vague reference that does not really correspond in detail to the way we listen to the sound located in the geometrical space. After a considerable amount of practice with the system it became clear that it is important to define certain limits for the movement of the sound image, with movements and positioning occurring within the grid, in order to get an integrated sound and not sounds that focus on the speakers. By carefully listening to the movements of the sound image some limits of the discrete space mentioned can be set where movements and trajectories can be integrated and developed effectively. Outside these limits the sounds tend to focus on the speakers as point sources and, as a result, the whole stereo image is broken. Figure 3 shows the original discrete space shown in Figure 1 with the limits for the effective spatial integration of sound.

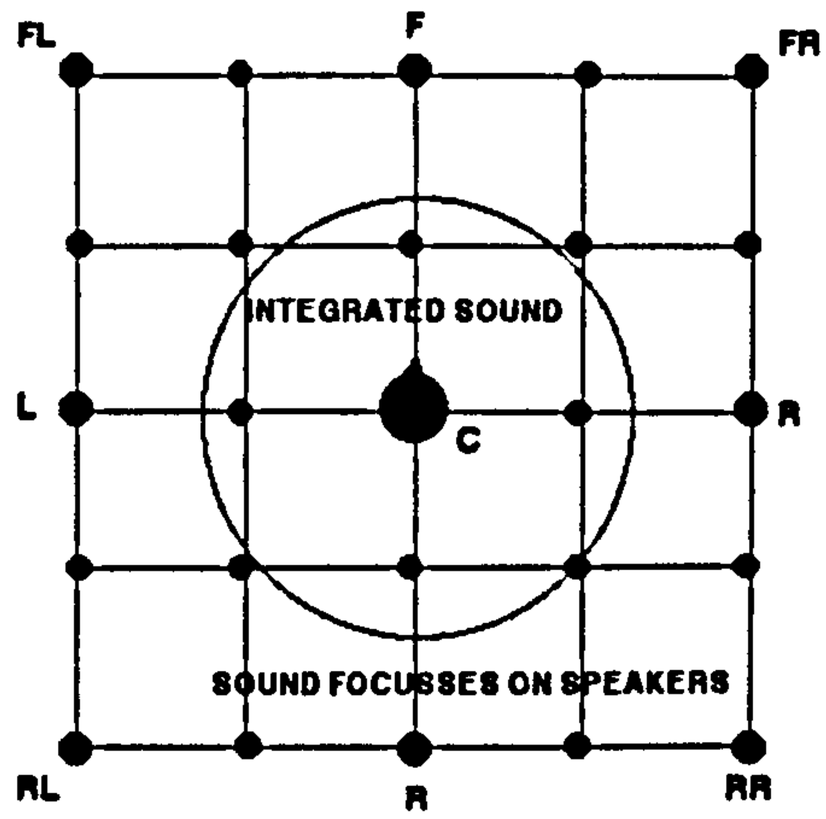

Figure 3. Grid with spatial positions with two areas where there is integration of sound (inner) and where the sound is focused into the speakers (outer).

4. CONSIDERATIONS FOR THE DIFFUSION OF THE PIECE IN A CONCERT HALL

After the spatial design of the piece in the studio was finished the piece was tested and adjusted in the Arthur Sykes Rymer Auditorium at the Music Department of the University of York using a 5.1-channel surround system similar to the one in the studio [9]. The type of loudspeakers used in the concert hall was the same brand as the ones used in the studio, but in larger models.

4.1. Re-mixing the piece in a concert hall

The mix created in the studio was played in the hall and re-mixed by adjusting the automation of the spatialisation through a process of repeated listening. When playing in the hall the mix done in the studio, different issues were identified concerning the quality of the spatialisation and the overall sonic experience. The first impression was that in the hall it became easier to distinguish when sounds integrated together in space in a coherent way and when sounds focused into the speakers, breaking the unity in the spatialisation. The distance between the speakers and, above all, the absence of sound sources at the sides made the spatialisation of the studio mix quite fragmented in the hall, adding a sense of discontinuity to the spatial gestures. It became very obvious to the listener that he/she was confronted with two stereo mixes overlapped, one in the front and one at the back (3+2). It also became clear that the sense of unity in the spatialisation achieved in the studio was lost in many sections of the piece and that impulsive sounds focused more into the speakers when played in the hall.

The second problem encountered while playing in the concert hall the mix done in the studio was that the balance in terms of timbre changed quite dramatically,

especially in the low frequencies where the proportions of the hall now seemed quite large compared to the ones in the studio. This could be compensated easily by boosting the level of the subwoofer channel and also by minor adjustments in equalisation.

4.2. Sound material, spatial approach and dynamics

Throughout the listening and re-mixing process it was very interesting to discover that continuous sounds could easily be spatialised and integrated in the hall with almost no adjustments. Just by balancing correctly the relation of the levels of these sounds in the front and in the back speakers, very convincing and detailed trajectories could be developed, crossing through the room in an almost unexpected and impressive way.

It was also interesting to notice that the possibilities of working with different spatial aesthetics, as mentioned in the previous section, become wider in the concert hall. Contrasts between independent spatial developments using the speakers as discrete sources and stereo images created with all the speakers could be done effectively by carefully adjusting the mix.

Another interesting issue noticed in the concert hall was that dynamic changes in the mix seem to work in a quite different way than in the studio, probably because of the larger dynamic range of the speakers. This implied that some adjustments needed to be done in the balancing of the piece in terms of intensity of the different sections that seemed to sound quite differently in the hall compared to the studio. The success of making a compact and integrated spatialisation of the sounds proved to be very dependent on the global intensity of the piece and its relation to the type of hall. Too high levels impoverish the possibilities for contrasts, making the mix exaggerated in terms of spatial gesture, while very low levels make it difficult to integrate the spatial and timbral details in the hall. A careful adjustment of levels for concert performances seems to be necessary in order to compensate for different types of room acoustics, especially between the front and the rear speakers.

5. CONCLUSIONS

The composition and spatial design of the piece *Plastiches* with a surround 5.1-channel system showed that the system has advantages and disadvantages that need considering in order to create a coherent spatial design in a music piece. It showed the importance of being aware of the limitations of the system, since the positioning of sound on visual interfaces can give an inaccurate perceptual idea of the movement of sound. The spatialisation also proved to be very dependent on the type of sound material played.

5.1-channel surround proved to have a potential for a compositional approach in which the spatial design can combine and integrate a multi-channel discrete source spatialisation approach with the single image stereo approach.

Considering the diffusion of the studio-designed piece in a concert hall, one should be aware of the need for adjustments in the level of the piece as a way to preserve to a high extent the spatial design. One very straightforward adjustment is the one of the subwoofer channel as well as the balance between the level of frontal and rear speakers.

6. ACKNOWLEDGEMENTS

The author would like to thank the support of the Digital Music Research Network for presenting this work.

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SHAPING SOUNDS IN YORK MINSTER

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ABSTRACT

This article describes the process of designing and performing an installation at York Minster taking as a point of departure an existing piece of electroacoustic music. The creation of a soundtrack that would relate to the location is described using an asymmetrical disposition of loudspeakers for a flexible method. Strategies for an integrated spatial and temporal evolution over a 12-channel speaker system in the hall are outlined considering a strategy for the movement of sound in relation to the movement of the audience in the hall. Some conclusions are drawn about the approach used to create the soundtrack from the original piece as well as the method used for the implementation. Finally, some suggestions are outlined for an improved version of the installation which could have a longer duration and could happen outside the context of a concert.

Keywords – Minster, installation, composition, music.

1. INTRODUCTION

The idea of an electroacoustic piece of music that would try to capture the body and clarity of the gamelan started as a project for a studio piece. As the work was being composed, the possibility arose to premiere the work as an installation at York Minster in an event where *Gamelan Sekar Petak* of the University of York would perform. This led to a change in the approach of the creative process and new goals were set. These are outlined in this article. The first goal was to devise an effective method which would allow the transition from a studio electroacoustic piece to a soundtrack for an installation in a large location as York Minster. The second goal was to find a flexible and practical way to implement the installation using the available sound-reinforcement audio system.

2. TRANSITION TOWARDS AN INSTALLATION

2.1. Introduction

The studio piece *Clangor* was conceived using sounds recorded from different components of a Javanese gamelan orchestra [1]. The piece explores the timbral possibilities of different instruments in a varying temporal framework that affects the duration and timbre of sequences of sounds [2]. Tempo variations shape the form of the piece allowing contrasts between long continuous sounds with a low tempo and rhythms with a high tempo to occur. This idea was the starting point for developing the transition from the piece of music to the soundtrack of the installation, considering on the one hand an adaptation to the acoustics of the Minster and on the other hand a sense of functionality in the context of the event where the installation would take place.

2.2. Relating sound to the physical space

York Minster is the largest Medieval Gothic church in Northern Europe with a volume of approximately 140000 cubic metres. The floor and walls are made of stone that gives the hall a distinctive reverberation that varies from 3.9 to 4.7 seconds in different parts of the hall [3]. Figure 1 shows the plan of the Minster with its dimensions and different sections: the nave, the south and north transept, the chapter house and the choir [4]. The lines and numbers in the figure will be explained later when the implementation will be described.

During the inspection of the hall and in order to make it work in the acoustics the space, it became clear that changes would have to be done to the original piece to create the soundtrack for the installation. Two very different types of areas in the hall in terms of acoustic materials as well as shape were identified. The first and largest area is that of the nave, the transepts, the corridors and the east end. This area, mostly made of stone and with almost no acoustical absorption, allows the public to walk and explore the architecture of the Minster freely. The second area is the choir, a separated area almost completely made of wood, with seats for the audience, separated from the rest of the hall by walls [5]. These two areas will be referred through the text as the first and second areas.

Give the size and the very particular character of the hall, the idea emerged to relate the soundtrack created to the two mentioned areas: to develop a sense of movement in the first one and to create a more static sonic experience in the second one. The aim was to emphasise the natural contrast in the acoustics with contrasts in timbre and spatialisation. Long slowly evolving sounds would be played in the first area where there is a large reverberation, while rhythmic sequences of short impulsive sounds would be used in the area of

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the choir where the surfaces are mostly wooden and where more clarity and detail in the sound could be achieved.

2.3. Creating the soundtrack from the original piece

With the above in mind, the original piece was re-mixed by enlarging some sections of the overall evolution of events in time as well as changing the approach in the spatialisation of sounds. The temporal evolutions of parts of the piece were expanded, following to some extent the original changes in tempo, allowing the material to develop in time at a slower pace than in the musical piece.

The new pace was designed by taking into account the role of the installation in the context of the event, as explained below. This installation would take place between performances of the gamelan group *Gamelan Sekar Petak* in an event called *Echoes* organised by the Music Department of the University of York. The idea was to encourage people to move from the nave of the Minster, where they would be at the time of the end of the performance of the gamelan group, to the other parts of the hall during the duration of the installation. People should be allowed to explore the hall through a sonic experience in a reasonable period of time, following a strategy that will be explained later when the use of live diffusion will be introduced.

The spatialisation of the original piece was also modified to a large extent in order to make it work for the desired purpose of the installation.

Initially all reverberation or delays were eliminated from the original piece in order to allow the acoustics of the hall to be the only reverberant field perceived by listeners. The panning of the sounds of the original piece was adapted, with a very different disposition from the symmetrical speaker array of a concert situation. Because of the large volume of the hall and the long distances between speakers that would have to be used to create a reasonable coverage of the hall, a more flexible approach to the movement of sound between speakers was adopted as used in a previous work [6]. As well multiple speaker pairs were used that could be related to the original panning in a stereo source as it is shown in figure 1 where odd number loudspeakers are related to one channel of the soundtrack and even number loudspeakers related to the other. This allowed an open and flexible approach to the spatialisation with the possibility of multiple axes of movement in the panning of sound between speakers by just controlling levels in a mixer with multiple independent stereo outputs. In this way multiple relationships in different axes of movement could be created between pairs of speakers, as shown in the figure 1 where sounds could be panned between speakers 5 and 4, 5 and 6, 3 and 4, 3 and 6, as well as 3 and 2.

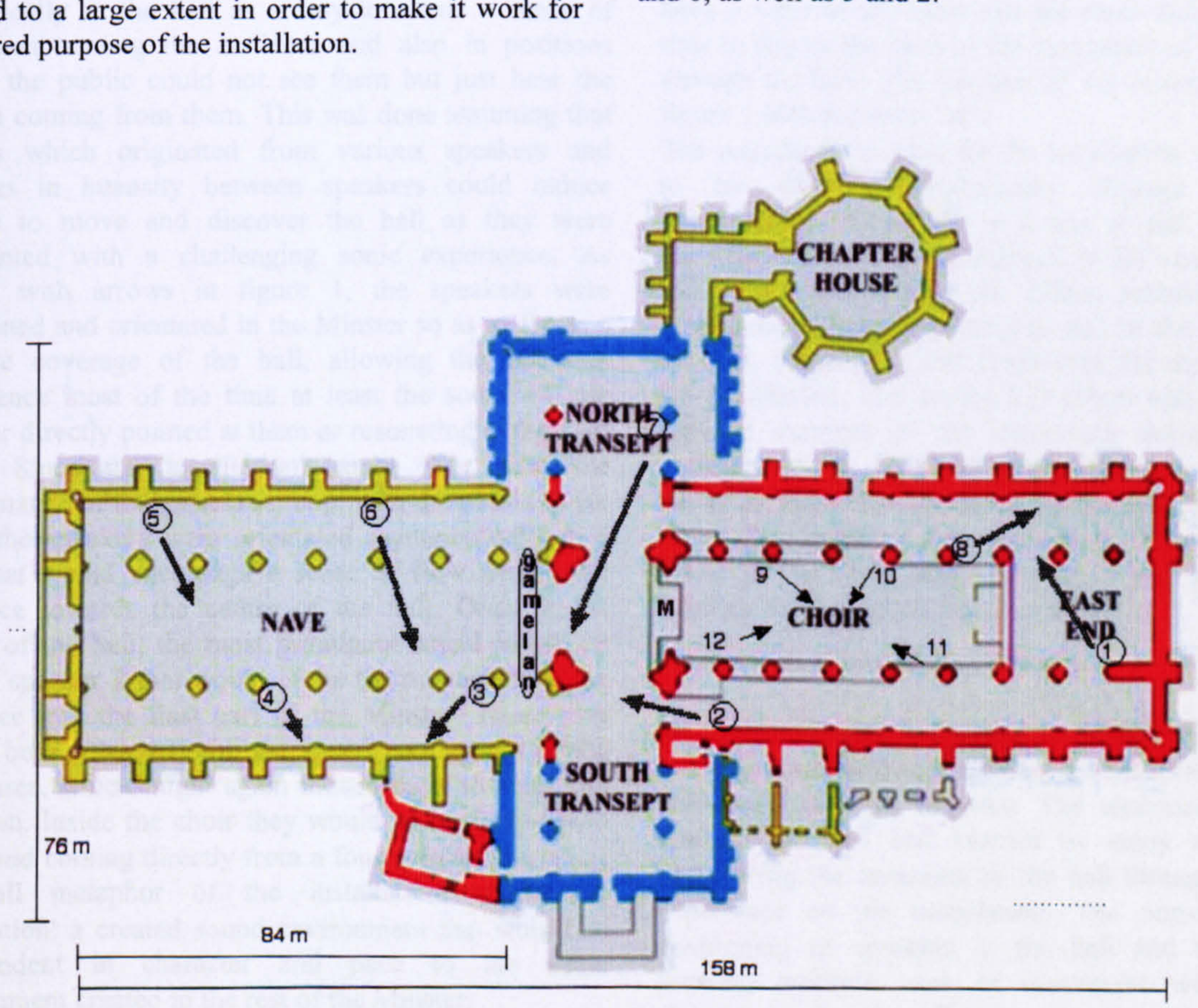

Figure 1. York Minster plan with loudspeakers positioning.

3. STRATEGIES FOR THE IMPLEMENTATION OF THE INSTALLATION

3.1. Introduction

A multi-speaker system playing the stereo soundtrack created for the installation had to be designed bearing in mind the shape and acoustics of the Minster as well as the idea of an audience walking in the hall. In this section some of the strategies used for the implementation of the installation will be explained as well as the response of the audience to the installation.

3.2. Speaker positioning

Once the soundtrack for the installation was created considering aspects of the hall and the practicalities of the event, the next step was to find the best speaker positioning that would allow an integrated performance in the hall. Two main options were considered for the location of the loudspeakers. The first was to try to cover the hall as much as possible with an available 12-speaker system. Considering the event during which the installation would take place, it became clear that it would be difficult to break the 'concert position' of the audience in the nave when the soundtrack of the installation would start after the performance of the gamelan group. Therefore the speakers were set strategically in the hall as a way to create a sense of movement among the audience and also in positions where the public could not see them but just hear the sounds coming from them. This was done assuming that sounds which originated from various speakers and changes in intensity between speakers could induce people to move and discover the hall as they were confronted with a challenging sonic experience. As shown with arrows in figure 1, the speakers were positioned and orientated in the Minster so as to create a discrete coverage of the hall, allowing the audience experience most of the time at least the sound of one speaker directly pointed at them or resonating in the near walls. Since the installation would start after the performance of the gamelan group, with the public in the nave, the speakers were orientated asymmetrically in a way that would encourage a sense of flow among the audience towards the centre of the hall. Once in the centre of the hall, the most prominent sound would be that of speaker 2 that would invite the movement of the audience into the East part of the Minster. There they would be confronted with the sound coming out of the choir area, which might again induce them to enter and sit down. Inside the choir they would be presented with the sound coming directly from a four-speaker system as a small metaphor of the installation within the installation: a created sound environment that would be independent in character and pace to the sonic environment created in the rest of the Minster.

3.3. The role of active diffusion

Active diffusion in the installation was conceived as a tool to adjust the individual intensity of loudspeakers in the hall as well as to increase the contrasting character of the acoustics of the choir area and the rest of the hall. Since it was not possible to make any tests in the Minster before the day of the event, it was also important to use a flexible alternative that would allow to adjust the performance to the venue. By adjusting the sound levels with active diffusion it was easy to calibrate the intensity of the soundtrack in different parts of the hall and test the possibilities of spatialisation in such a large space. A plan for the active diffusion throughout the duration of the installation was designed where the ideas mentioned above of temporal and spatial relations of the soundtrack, were linked to changes in the intensity of loudspeakers in particular areas of the hall. The intention was to generate a sense of movement of the long continuous sounds in the nave and create a transition to rhythmic layers of sounds in the chorus where the acoustic environment allowed the sound to be more detailed.

3.4. The use of independent sources

Active diffusion was carried out using a mixing desk with multiple independent outputs and two CD players as inputs. The mixing desk was positioned at the entrance of the choir, which allowed the people in the mixing desk to have a view of the nave and the choir and at the same time to follow the pace of the movement of the audience through the hall. The location of the mixer is shown in figure 1 with the letter 'M'.

The soundtrack created for the installation was designed to be played independently through two non-synchronised CD players as a way to add flexibility to the adjustment of the soundtrack to the venue. The first CD player would play the fifteen minute soundtrack continuously from beginning to end in the first area of the hall, creating a fixed framework for the duration of the installation. The second CD player was used to play selected excerpts of the soundtrack through the four speakers in the choir area, alternating between more rhythmic sections of the piece and gaps of silence during which the sound of the speakers in the hall could be heard in the choir area. This was done as a way to emphasise the contrast mentioned before.

3.5. The response of the audience

Most of the strategies devised to create a more flexible and functional approach towards the performance of the installation seemed to work The audience wandered through the hall and seemed to enjoy the idea of discovering the acoustics of the hall through the sonic experience of the installation. The non-symmetrical positioning of speakers in the hall and the idea of creating multiple axes of movement with panning showed to be an effective way to encourage the movement of the audience. The idea of creating an

internal space in the choir where people could perceive a more clear and distinctive acoustics in the hall seemed only to be appreciated by a few people who walked into this area and experienced the desired contrasting effect relating sound and the physical space. The response of the large majority of the audience seemed to be more focused on walking continuously through the open spaces of the hall rather than staying in a particular location in a situation similar to the one they experienced in the concert just before the installation. A longer duration of the installation in a less time restricting situation, outside the context of a concert would have probably benefited the installation as it would have allowed people to spend more time in different parts of the hall.

4. CONCLUSIONS

The result of the transition from a studio piece towards the soundtrack for an installation showed that a careful planning of the temporal evolution and the spatialisation of the soundtrack effectively helped to adapt sounds to the acoustics of York Minster. A functional spatialisation approach using a non-symmetrical positioning of speakers led to a simple and effective method of projecting sound in space by defining axes of movement between multiple pairs of speakers in the hall. The decision to use live diffusion for the implementation of the installation proved to be a functional way of adapting sounds to the shape and acoustics of the hall and adding a sense of flow that could be related to the audience.
Further developments of the strategies used for this installation could consider an extended time frame independent of the context of a concert in order to allow a more ambitious use of the possibilities of the acoustics of the hall and also a better understanding of how we can relate basic sound characteristics to the behaviour of a walking audience.

5. ACKNOWLEDGEMENTS

The author would like to thank Judith Ring for her help with the active diffusion and technical support during the installation.

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Creating Sonic Spaces: An Interview with Natasha Barrett

Natasha Barrett is a freelance composer who currently lives in Norway. Her compositional output consists of works for instruments and live electronics, sound installations, dance, theatre, and animation projects, but all her energy seems to stem from her acousmatic composition. In 2006, she received the Nordic Council Music Prize—the most prestigious recognition for a Nordic composer. She has also received awards from the Bourges International Electroacoustic Music Competition (1995, 1998, 2004), Concurso Internacional de Música Electroacústica de São Paulo (2001), the International Rostrum for Electroacoustic Music (2002), and the Noroit Electroacoustic Music Competition in France (1998, 2002), among others. Barrett's projects are frequently commissioned by international organizations, and her music is available on the Empreintes DIGITALes, Cultures electroniques/Mnemosyne Musique Media, Centaur, Computer Music Journal Sound Anthology, Prix Noroit, and Aurora labels.

Her studies include a master's degree at Birmingham University with Jonty Harrison and a doctoral degree supervised by Denis Smalley at City University, London. Table 1 provides a list of her compositions.

This interview took place at the International Computer Music Conference in Barcelona, Spain, on 8 September 2005, and was focused primarily on the composer's thoughts on spatialization. Since this interview took place, the transcription has been augmented with additional information in subsequent communication with Ms. Barrett.

The Listening Space

Felipe Otondo: You have been dealing with spatial design for quite some time. What is your approach toward the use of space in electroacoustic music?

Natasha Barrett: It depends on your listening space. If for now you think about space away from the context of the listener—for example, if you are alone in the studio—I think you can compose a three-dimensional impression of space, even when you manipulate phantom images with two loudspeakers. In stereo, you can then create a great deal of depth—you can work with many degrees of middle-, fore-, and background. This sense of space is often captured through a careful recording technique. But then, of course, as soon as you leave that private listening space, your composed space may collapse because you are no longer in control of your environment. At this point, I find that spatial information suggesting simple room acoustics can be quite stable, whereas other types of spatial information that create, for example, a sense of perspective, occupation, or embodiment, are fragile.

So then you need to think, "How is my space going to function?"—and you might like to try alternative spatialization techniques. Furthermore, you need to decide whether you are aiming at home or concert listeners, in which case I think you need to approach these situations in different ways. One way in which I have found common ground for concert and home listening has been with surround and ambisonics spatialization.

Otondo: Don't you see a contradiction there—a problem that many people don't seem to be aware of—a conflict between this space you can create in the studio and this open space in a concert?

Barrett: Well, as soon as you take your stereo work into a concert, you can make it sound multichannel and occupy the room. I expect other people you have interviewed have said the same thing. Often, when I talk to someone outside our field, they ask how many channels I have in the source. They don't believe me when I say it is stereo. If the loudspeakers are set up correctly, if you have the right space and you know what you are doing, then you can

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Table 1. Compositions by Natasha Barrett

Title	*Instrumentation/Medium*	*Year*
Crack Process	Percussion, trumpet, electric guitar, and computer (ambisonics and conventional multichannel)	2006
Deep Sea Creatures	Acousmatic (stereo, 5.1, 12-ch, or 16-ch) (ambisonics and conventional multichannel)	2006
Mobilis in Mobili	Acousmatic (stereo, 5.1, 12-ch, or 16-ch) (ambisonics and conventional multichannel)	2006
Trade Winds	Acousmatic (stereo, 5.1, 12-ch, or 16-ch) (ambisonics and conventional multichannel)	2006
Hommage à Parmerud	Acousmatic (stereo and 5.1)	2005
Abemolpas (Avoid being eaten by mimicking other less palatable species)	Acousmatic (5.1, ambisonics, and conventional multichannel)	2004
Where shadows pass for bodies stand	Classical guitar and computer (stereo)	2004
Exploratio Invisibilis	Acousmatic (ambisonics and stereo)	2003
Symbiosis	Cello and computer (stereo)	2002
Prince Prospero's Party	Acousmatic (ambisonics and stereo)	2002
Angels & Devils	Acousmatic (stereo)	2002
. . . fetters of a dream . . . (Fetters)	Acousmatic (stereo and 5.1)	2002
Agora	Electroacoustic Theatre (16-ch acousmatic, sound-making installation, and soprano)	2002
Push-me-Pull-me	Cello, violin and computer (stereo)	2001
Industrial Revelations	Acousmatic (stereo)	2001
Displaced : Replaced	Installation (ambisonics cubic array)	2000
Rain Forest Cycle	Installation (triangular pyramid array)	2000
RAS	Percussion quartet and computer (stereo)	2000
Utility of Space	Acousmatic (ambisonics and stereo)	2000
Liquid Crystal	Clarinet and computer (stereo and multichannel)	2000
Three Fictions	Acousmatic (stereo)	2000
Circadian Cycles	Sinfonietta and computer (stereo and multichannel)	1999
Viva la Selva!	Acousmatic (stereo)	1999
Diabolus	Percussion, voice, computer (stereo)	1999
Outspan	Acousmatic (stereo)	1999
Mimetic Dynamics	Installation (quadraphonic)	1999
Microclimate II: Red Snow	Acousmatic (stereo)	1998
Microclimate I: Snow & Instability	Double bass, alto flute, percussion, and computer (stereo)	1998
Buoyant Charm	Acousmatic (stereo)	1997/2001
Little Animals	Acousmatic (stereo)	1997
Surf	For two classical guitars and computer (stereo)	1997
St Paul's Descending into the Autumn mist	Acousmatic (stereo)	1997
Racing Unseen	Acousmatic (stereo)	1996
Racing Through, Racing Unseen	Acousmatic (stereo)	1996
Earth Haze	Acousmatic (stereo)	1995
Swaying to See	Acousmatic (stereo)	1995
Imago	Clarinets and computer (stereo)	1995
Puzzle Wood	Acousmatic (stereo)	1994

make a good diffusion performance sound extremely multichannel and multilayered.

Otondo: You are good at diffusion performance.

Barrett: I started in Birmingham during a master's degree supervised by Jonty Harrison and have been practicing ever since. I can play okay—I enjoy it and I know that I can project the right thing in the music.

Otondo: But it was not enough for you? Why did you feel you needed more?

Barrett: There are some limits to sound diffusion in the concert. Yet there are also some advantages. Sound diffusion is a performance practice involving interpretation, and you can tailor the spatialization to work within the space of the concert hall. Some compositions demand a specific diffusion performance for the musical structure to be clear. Other music gives the performer a greater degree of interpretation. But whatever the intentions from the compositional side, you cannot project the simultaneous spatialization of different sound streams, do things that are impossible to do with one pair of hands, work with the idea of spatialization as a structuring method reliant on details a performer may miss, and so forth.

The last point is maybe most important for me. If the diffusion interpretation does not convey the composed spatial intentions, then you could say that the spatial musical structure becomes a bit less accurate and takes a direction other than that intended. Not surprisingly, I have experienced this scenario mostly at events where diffusion as a performance practice is a rarity, even though the performer may have an understanding of the music. However, with ambisonics, because you can accurately compose the spatial information, you gain tighter control over the spatial musical structure and therefore allow it to play a more important role. With sound diffusion performance, you really have to accept some chance.

Otondo: And then the performer plays a big part in it, giving a unique interpretation of the piece with whatever style or assumption is desired.

Barrett: Exactly, and this performance can make a "not-so-good" piece sound fantastic, but it can destroy a great piece if it goes against the spatial musical structure present in the music. So when you want to go further than spatial generalizations—if you want to work with spatial hierarchy where tiny movements in space and spatial relationships contribute to sound identity—you need a technique that is not going to break in performance. This is the point where I started to move into ambisonics. Ambisonics can also result in a concert disaster, but that is a technical rather than a performance interpretation issue. It has, however, meant that since my sudden burst of ambisonics compositions in 2000–2003, I am now more selective when I choose to use the technique.

Otondo: Can you explain a little more about ambisonics?

Barrett: I'll try to give an easy introduction. At the moment there are two main ways to create and manipulate a virtual three-dimensional sound field, or a sound field that mimics the properties of our real acoustic sound field: ambisonics and wavefield synthesis. Each involves quite different methods, but in a perfect world would produce the same result. To capture or encode the spatial information in the first place, we have two choices: either we can attempt to capture the real sound field via recording, such as by using a Soundfield microphone, or we can synthesize the spatial information using the math of either ambisonics or wavefield synthesis. With ambisonics, higher-order representations present a more accurate description, where each order corresponds to an order of spherical harmonics.

Otondo: Can you explain a little more about the higher-order representations?

Barrett: You can make a comparison to spectral representation, where if you try to represent a complex sound with one sine tone you don't get very far. But the more harmonics you add, the closer your representation will be to the original. The same goes for capturing the three-dimensionality of sound using spherical harmonics. The Soundfield microphone can capture a first-order representation, otherwise known as B-format. This is not a very accurate description of the sound field compared to higher-order representations. Therefore I choose to work more with the latter.

Figure 1. Natasha Barrett.

Otondo: So once you have captured or encoded the spatial information, what next?

Barrett: Then we need to reproduce, or decode, the soundfield information over our chosen speaker arrangements. It is here that more compromise is needed. The higher the order of the encoding, the more loudspeakers we need in the decoding. But a nice compromise is to use a third-order encoding, which in the horizontal axis requires a minimum of eight loudspeakers and fits quite nicely into a small concert situation.

Working practically with compromise is the nice thing about ambisonics over wavefield synthesis. For wavefield synthesis to recreate a soundfield, little compromise is possible, and large numbers of adjacent loudspeakers are required. Other compromises involve considering our perceptual interpretation. How much accuracy of spatial information is perceptually relevant? How can we treat the sound material to enhance the perception of spatial cues through filtering, loudness, and pitch changes? In many situations I begin with stereo sources and then relocate the sound image within my composed ambisonics soundfield. This sometimes involves splitting the sound into different frequency layers, each located in a slightly different spatial position.

Creating Spaces

Otondo: Listening to your music, one gets the feeling that you are quite concerned with the issue of creating spaces. You are very good at making the listener perceive both tiny and large spaces; sometimes with small objects you can create a huge space. Is this related to the idea of allusion that you wrote about in articles (Barrett 1999, 2002), working with the material as a way to create space?

Barrett: Creating spaces is strongly connected to the experience of our surroundings, and in this respect, spatial mimicry made possible with ambisonics can be a useful approach. But you are correct, it is also very much connected with the idea of allusion. When you consider very tiny sounds building up an impression of space, then you can begin to imply a space within which these sounds should live. If you use abstract sound material, it can be difficult for the listener to find the spatial context. If you don't want to use reverberation, you don't have a clear spatial context to start off with, either. But gradually, as the sound material unfolds, its behavior, its motion behavior—the relation between many things happening at once—imply space, even though you are not using reverberation or clear sound identities. This is something I find very interesting because I don't like using reverb. When I do, I try to calculate a realistic room model using ambisonics reflections.

Otondo: How does that work?

Barrett: I calculate the early reflections as ambisonics reflections in the virtual space. But, as I said, I try not to use reverberation. I prefer to use convolution in a way that doesn't explicitly say "this is a small room" or "this is a big room." I find normal reverberation distracts too much from something else you might be trying to do.

Otondo: Has this to do with the idea of putting a room inside another room as Dennis Smalley (Austin 2000) suggests?

Barrett: That's one part of it, the problem of combining the listener's space with the space in the music. But I think it also has to do with the fact that a

clear reverberation effect can dominate what you are doing. It blurs spectral detail and "messes up" textural information. It can distract the ear from something more important, such as the indirect implication of space. For me, it is at that moment of implication and ambiguity that music starts to come through. The listeners start to use their imagination and their own experience to find a place in the music.

Ambisonics and the Hybrid Approach

Otondo: Going further into ambisonics, do you think that aside from the advantages of three-dimensional sound, these systems are still restrictive for most composers? They can be complex and quite expensive . . . you need very specific studio software and hardware.

Barrett: First of all, ambisonics is not expensive, and, for the user, it is not technically challenging. Provided you don't want to program the math, it is not technically challenging at all. The software I use is free, and there are in fact quite a few computer music centers working with ambisonics, but maybe not so many full-time composers. There are, however, problems with the stability of the ambisonics sound field that I touched on. Because ambisonics is an encoding and decoding system where you encode the spatial information and decode the result for the locations of your loudspeakers, this means that if you decode in advance, you have to place your speakers in the exact locations for which you decoded. Unless the hall is completely flat and of correct geometry, it is very difficult to place the loudspeakers correctly.

Now, with ambisonics, the nice thing is that you can decode your encoded information for (theoretically) any loudspeaker geometry, and so you might think it would be easy to decode on site. But in practice, that doesn't always work, because the decoding algorithms currently do not cope well with asymmetry in loudspeaker placements and loudspeaker responses. So as soon as you change a circle to an oval—just that compression along one axis—the decoding algorithms will not work as well.

Otondo: What happens then?

Barrett: When loudspeakers are different distances from the central point, you have to think about phase problems throughout the spectrum and volume differences. The sound field will be distorted and will break down. In practice, when listening, this can result in an uneven sound distribution, front–back reversal, or simply a feeling of spatial mono or spatial "meaninglessness." In my successful ambisonics concerts, I've carefully set up the loudspeakers just for this music. However, if you setup a diffusion rig in the standard European diffusion format, such as the BEAST format (Harrison 1998), stereo diffusion will work much better than ambisonics. Currently, I normally only set up an ambisonics concert array if I am playing only ambisonics works, or if the project is an installation where I can exactly locate the equipment. Despite my faith in soundfield recreation techniques, I also need to be realistic about my demands!

Otondo: But it does fit well with 5.1 surround?

Barrett: Yes. Even though 5.1 is asymmetric, the loudspeakers are the same distance from the center point, which makes decoding easier than, for example, for an oval. When composing for a fixed speaker array such as 5.1, I sometimes use normal panning as well. One of the great things about ambisonics is that it is easy to make a feeling of space and to make clear trajectories. But when a sound is stationary, then the location is not quite as clear, and it is better to place the sound in a conventional way. Straightforward 5.1 for home listening is not a problem, but I don't think 5.1 works that well in the concert where the listener is not sitting in the perfect location. In concerts where it has been necessary to play from a 5.1 source, I have used at least two 5.0 configurations—one 5.0 configuration close and one distant or one elevated, and manually diffused between the two with careful control over the subwoofer channel.

Otondo: So you create the piece in ambisonics and then you do the mix again in 5.1?

Barrett: Actually, I first create the piece in quad or stereo while listening in the perfect position. With my first ambisonics piece (*The Utility of Space*), I worked in a second-order, nine-channel ambisonics

format from the beginning, and my computer was not fast enough to do all the multichannel mixing and decoding in real time. I had to encode and then decode out of real time and then mix and listen. It was a big piece that took too long sitting and waiting for the computer to complete the task. Now machines are faster, and software has changed. With many of my ambisonics pieces, I spatialize maybe 20 simultaneous items, which still puts a strain on the computer if also simulating air absorption, the Doppler effect, and maybe a few early reflections.

Otondo: So, what do you do then?

Barrett: Then I use scripting software that allows me to script as many simultaneous objects as I want, but as a non-real-time process. Then we are back to first working in stereo or quad, getting a good sense of potentially three-dimensional information, and—when all other aspects of the composition are correct—implementing spatial ideas that I could only plan or imagine in the earlier stages.

You could say that I render the high-quality version at the end once I've got the composition "right." To some people, it may sound strange that I compose first in stereo or normal quad and then realize the ambisonics version once the materials, the timing, the counterpoint, and the flow are correct. Things do change when you compose the ambisonics field, obviously—when calculating Doppler shifts and filtering, pitch and volume changes! Then you have to go back and change the material—but to do most of the composition first in the more traditional format makes the complete process manageable.

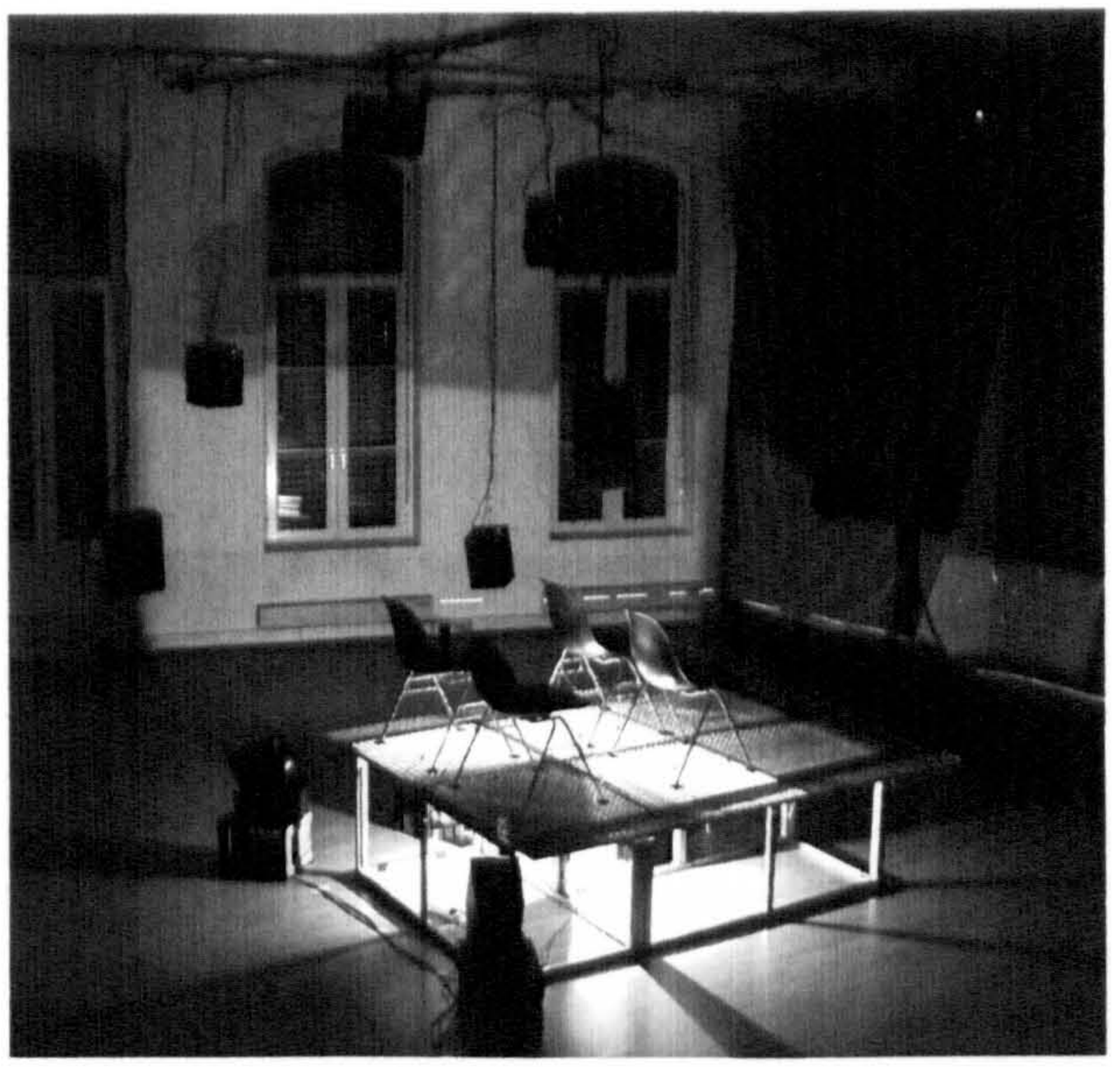
Otondo: So you have developed a sort of hybrid approach . . .

Barrett: Yes, I have from the compositional point of view, because the technical aspects of ambisonics were starting to get in the way of the compositional process.

Otondo: This allows you to work with more traditional spatial formats. I guess you spend some time doing all this.

Barrett: Well, it's quicker now because software is easier to use and more accommodating to multichannel formats.

Figure 2. Dodecahedron setup from the ambisonics version of Exploratio Invisibilis.



Otondo: How do you compensate in ambisonics for the size and the acoustics of the hall?

Barrett: If it is a very reverberant space, you don't use ambisonics. In a large-room acoustic, the music needs care to bring out the detail. In that case, I would go for diffusion, and I would go for the diffusion of stereo rather than multichannel. This is because you can control the piece better and adjust for the changes that happen due to the sound moving in a big acoustic with a strange coloration. In a very reverberant room, the only reason I would use a multichannel version is if the piece were to be divided into layers that I would diffuse simultaneously, and not as, for example, eight fixed channels. You could call it multiple-stereo diffusion.

Multichannel and 5.1 Surround

Otondo: Just about that, what is your opinion about the conventional approach of multichannel diffusion? Have you made pieces that are just multichannel?

Barrett: Not multichannel in a conventional sense. My first multichannel piece was in fact an ambisonics work (*The Utility of Space*), and was later mixed to stereo for practical reasons.

Otondo: Do you think purely multichannel composition is restrictive?

Barrett: It depends how you work. For example, Barry Truax has worked in a way where his compositional approach is partly dependent on the multichannel setup (Truax 1999). So, it depends on the kind of music and the approach that you have, and my approach is not like that. It would therefore be inappropriate for me to start that way.

Otondo: It is very difficult to monitor with eight speakers in a conventional studio.

Barrett: That's right, it is difficult. I think Annette Vande Gorne has a studio where they monitor in eight. I remember it's very nice there. I sometimes monitor in an octagonal setup, but only in the last stages of the composition. If you are not working with speakers as independent voices, then there is less reason to monitor over eight speakers—at least in the horizontal axis. As long as you are sitting in the perfect position, four speakers are enough. In that respect, I have composed directly into quad for some parts of a piece, and then converted the mix to eight channels or multiples thereof, or separate near and far layers, and near and far multichannel mixes.

Otondo: Don't you think one could combine both multichannel techniques? Maybe surround 5.1 is a good example of that.

Barrett: Of course, you can combine any technique—there is no limit. It just depends on the music and your intention. In a way, 5.1 surround is a hybrid combining the idea of the center speaker as a voice with normal phantom images.

Otondo: I have been working a bit with surround 5.1 trying to get an idea of the transition from the living room or studio situation to the concert hall situation, and I have found that it is a very complex transition in terms of spatial experience for the listener (Otondo 2005). What is your approach towards surround 5.1? Do you think it is something fashionable that will disappear in some time?

Barrett: No, I don't think it will disappear at home, because in a way it is a practical setup. Some home-audio consumers don't listen in 5.1—they listen in quad and drop the center channel or pan it center front. But, if I am thinking in a practical way, then I have to understand that most people who buy a 5.1 setup are not audio experts—they have a home cinema system. The 5.1 layout does not fit into all living rooms, but it can, if you reorient furniture and change your life a little bit! But to contradict myself, playing ambisonics goes "out the window" when the 5.1 system consists of three unknown and different types of loudspeakers.

Otondo: But what happens with 5.1 in the concert hall?

Barrett: In the concert hall there are two problems with 5.1—maybe more than two problems, but two main problems. The first problem is that in a large concert hall, the five speakers are far away from the audience, so you loose a sense of intimacy. With diffusion, of course, you place speakers at different distances to the audience, whereas in concert playback of 5.1, because the speakers are far away, the reverberant field blurs the direct source early on, and there is nothing you can do about it.

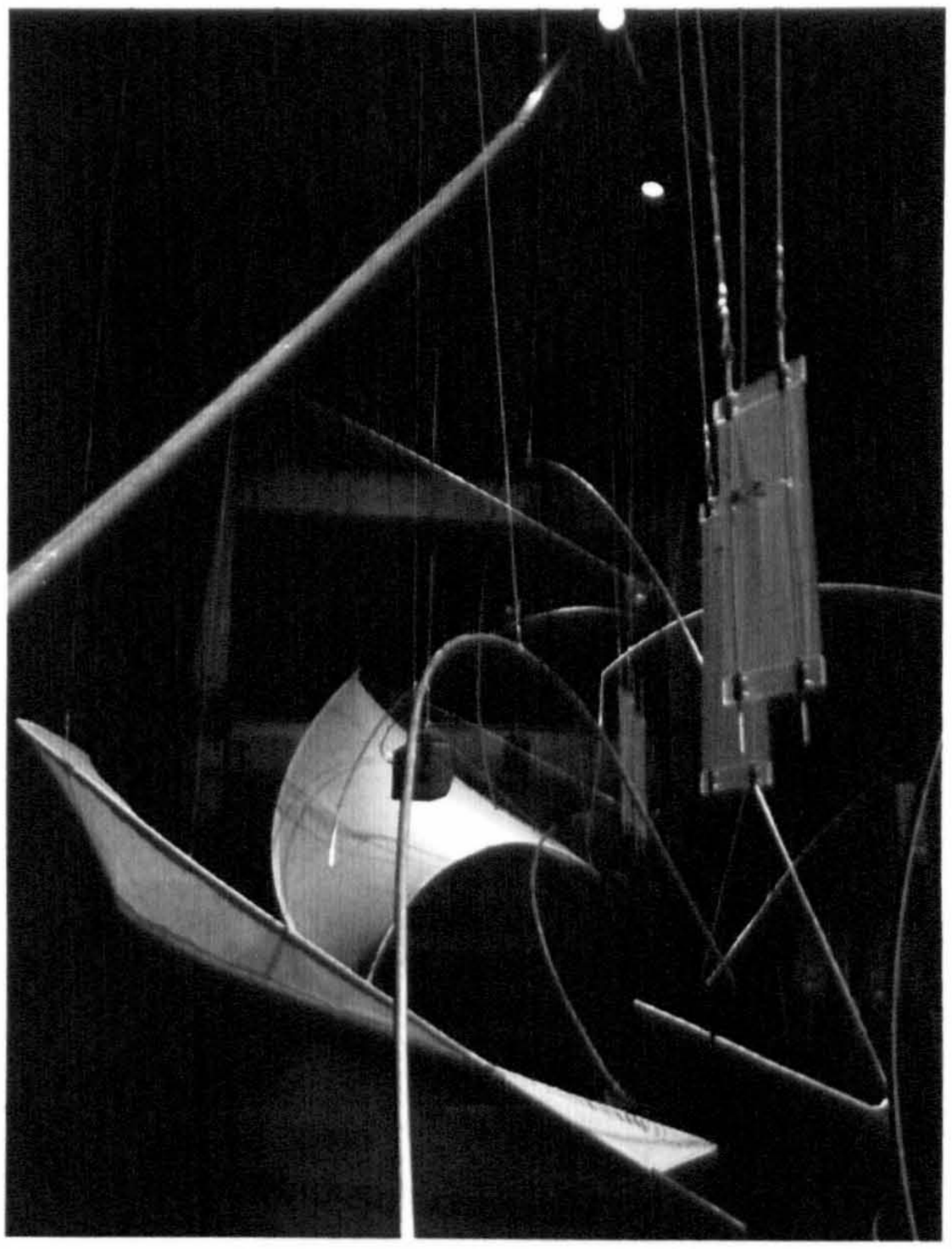
The second problem has simply to do with five speakers not being enough for a large space. If you are not sitting in the center, then you get a biased sound picture, and of course all the big cinemas use more than just five loudspeakers. Often there will be a large array at the front, and then extra loudspeakers at the sides and back. This doesn't solve the loss of intimacy, but as large cinemas are rather dry, reverberation does not cause so much of a problem. As I mentioned earlier, my own solution is to work with multiple 5.0 configurations and diffuse among them.

Otondo: So you also have this problem when you go from ambisonics in a 5.1-channel arrangement in the studio and you play it in a 5.1-channel system in a concert hall?

Barrett: Same problems—interference from reverberation and not enough speakers to fill in the space.

Otondo: Let's pretend I am a millionaire, and I will give you the chance to play your music in a perfect environment. What would you want?

Figure 3. Sound-making elements from the installation part of Barrett's work Agora.



Barrett: Well, then I would tell you to build a concert hall! Well, to be realistic, then I would say to buy some good loudspeakers.

Otondo: How many speakers would you use then?

Barrett: Depends on the size of the space.

Otondo: A normal concert hall.

Barrett: A normal concert hall for ambisonics? Sixteen would be good. Maybe another sixteen for elevation. And then you could probably create a good sound field. But again, you need to have the right kind of speakers.

Otondo: Do you need the same type of speakers?

Barrett: For ambisonics, yes. If not, different speaker colorations and diffusion angles will distort the recreation of the sound field.

Space and Composers

Otondo: Now I'd like to get into something more general. Do you think there has been a change in the approach toward space lately by electroacoustic music composers due to cheaper and more sophisticated equipment?

Barrett: [Laughs] Depends what country you are in.

Otondo: In general.

Barrett: Not as much change as there could have been. The main difference is that composers are using better reverberation effects. But the understanding of spatial issues, at least among composers, is still not so advanced.

Otondo: Don't you think that cheaper sound cards and the spatial possibilities of programs like Max/MSP, pd, Spat, and others have opened new possibilities for spatial design?

Barrett: Well, many people are working with multichannel music. The problem is that some appear unclear as to why they are doing it. Maybe they work with multichannel because it is "the thing to do." I have, however, unfortunately been seated in bad listening positions in many multichannel concerts—stuck on an end with one loudspeaker pointed at my ear. I have experienced stereo diffusion that sounds more "multichannel" than some real multichannel pieces. One assumes that with multichannel you can easily play with independent spatial trajectories, but getting that to function in the concert space is difficult once the music is fixed to maybe eight channels. When the sound just gets stuck at the back due to the room acoustics, speaker characteristics, or inaccurate speaker placement, there is little that can be done. In part I think the spatialization equipment and technology have become readily available, but the users haven't caught up.

Otondo: Why? Because it is difficult?

Barrett: I would not say it is difficult, only that it requires a level of understanding, as all skills do. When you first begin, the temptation to swing sounds around the room is enormous! It feels physi-

cal and immediate. But spatialization is about so much more than that.

Otondo: So new means imply new complexities, but people are not really aware of it, they are just using and abusing this technology?

Barrett: That is what I sometimes hear.

Instrumental Pieces

Otondo: I have listened to your piece *Symbiosis* for cello and live electronics in one of the listening rooms here at the ICMC and wanted to ask you, what is the difference in the spatial approach when you work with instruments compared to those purely electroacoustic works that you mostly write?

Barrett: Well, I think my opinion is the traditional one. When a performer is on stage, the visual aspect means you hear in a different way. And so in *Symbiosis*, you see the cellist on stage. She is not just sitting there playing—she is moving around a little bit and using her voice. It is a dynamic piece, and so her whole physical presence is quite spectacular. What you are seeing ties you down; it provides a constant reference point regardless of whether the sound is moving through the space. One has to take advantage of this fact and not experience it as a problem. Although the electroacoustic part of *Symbiosis* contains some spatially relevant non-cello sound material, the cello is the center of that sound world, and the performer is articulating the structure, visually emphasizing the aural totality. In particular, sound propagates from the performer and away throughout the space.

Otondo: So you take a completely different spatial approach than with the purely electroacoustic pieces—you try to understand things from a performance perspective.

Barrett: The thing is that in reality, when you compose a piece for a performer, normally the performer has commissioned the work and therefore you should write something that is good to be performed, something that takes full advantage of that perfomer's skills. Often you may have a musical agenda that is not the same as the performer's agenda, especially coming from an acousmatic point of view, and you need to balance these agendas and find things that work.

Otondo: You have different goals you want to achieve with the piece?

Barrett: Sometimes. For example, unless I am composing a purely theatrical work, my initial agenda is sound, whereas the performers' primary agenda is performance, and they are not necessarily the same thing. This is, of course, not always the case, but either way we need to integrate the demands of both performance and sound. For example, in *Symbiosis*, there is—toward the end—a stretch of three minutes for solo computer.

Otondo: There are also parts where it is almost purely instrumental.

Barrett: Exactly, and in *Symbiosis*, this is one way in which I balance the elements: to give both parts solos and to have both coming together at important meeting points. In those three minutes of solo computer, the performer has to find a way to "compose" herself. Everybody is looking at her, and she is a performer having to listen. In that section the theater emerges as she demonstrates the act of listening and not just sitting there waiting for the next thing to happen. You see a string quartet play a piece with computer or tape, particularly when they play with a click track, and they look like they are thinking, "When do I come in next? What time is it?"

Otondo: It looks like they are really uncomfortable.

Barrett: That's right, so one trick is to find a way for both parties to feel comfortable when the other is soloing. For me, it is the potential in the sound that makes the integration of the reality of the performance and the reality of the sound possible.

Otondo: When you play a piece like this one live, are you concerned with the issue of the balance of the reproduced sound and the radiated sound from the instrument? I feel that most live-electronics and instrument-plus-tape pieces that I have listened to in concerts have a problem in this respect. The listener gets a very fragmented spatial experience with

the sound radiated from the instrument coming directly from the center and the sound coming from the speakers from the sides. It is hard to integrate everything spatially.

Barrett: Yes—well, integration is a two-fold problem. There is the issue of composition, where you have to consider spectra, gesture, and articulation, and there is the issue of concert loudspeaker setup—placing the equipment correctly in relation to the performer and the space. You could refer to some well-known pieces by Dennis Smalley, and you can say they demonstrate a spectromorphological unity. But then when it comes to the concert, if you use speakers in one part of the hall and place the performers elsewhere, this will result in a detachment of sound sources. There is the practical aspect of setting up the speaker rig so that these two layers of acoustic and electroacoustic elements—of composition and performance—function. For this, it is normal to place a pair of speakers quite close to the performers on stage as the primary projection of the amplified acoustic sound (if this sound is amplified at all), or for the primary projection of live sound transformation.

Over these speakers, we can also balance some of the pre-made electroacoustic sound material. As more speakers are spread around the hall, then I distribute a little of the acoustic or live transformation along with more of the other types of sound—such as non-instrumental sound material or material that if heard toward the back or in the surroundings won't feel detached from the performance. This means we can build a sound world where the instrumental sounds come from the direction of the performers, unless the conceptual aspect of the composition demands otherwise.

Otondo: But don't you think that is the easiest thing to do—most composers detach the transformed sound from the instrument's sound. Like most of the pieces we have listened to here at the ICMC in Barcelona, we have sounds totally detached from the radiated sound of the instruments. Don't you think that the hard thing to do is to try to integrate the sound spatially and at a level of timbre? It is hard to find pieces where it is done properly.

Barrett: I think we are looking at a difference in aesthetic. In performance I often find that the North American style is somewhat different from the European style. Yet on a recording, I suppose it's the luxury of studio editing that maybe blurs these differences in aesthetic.

Otondo: You are quite skeptical about this.

Barrett: Not at all. It's a matter of taste. The style that I hear at this ICMC uses the tape and computer parts as if they were two separate "acoustic" instruments. The electroacoustic part contains articulations and sounds which are strongly instrumental in character. This type of material allows you to spatially detach the electroacoustic from the live part in that the electroacoustic becomes an "invisible acoustic" performer. Whereas a conjunction of textures and sound fields, of articulations and trajectories, I believe, stems from a different aesthetic and a different compositional approach. Although my personal taste is with the latter (probably stemming from my admiration of Varèse), I can definitely appreciate a good piece of music working with the former aesthetic. After all, it's the music that counts.

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Contemporary trends in the use of space in electroacoustic music

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This paper describes a survey of contemporary approaches towards the use of spatial design in electroacoustic music, focusing on the type of spatial systems used by a sample of composers and the way they conceive the use of space in their music. Comparing the results with information gathered from seventeen articles by composers written on the topic in 1997, it is shown that composers nowadays are more used to working with different types of spatialisation systems than before. There is also a considerable increase in the use of surround 5.1 as well as four- and eight-channel systems and a decrease in the use of stereo. The compared results also show that, in general, composers nowadays seem to be less concerned with performance and interpretation issues as well as technical aspects of spatialisation. Further studies could consider a more detailed investigation of how the new spatialisation tools have shaped the aesthetical character of the music composed in recent years.

1. INTRODUCTION

The use of space has been an important aspect of electroacoustic music in its different forms since its early developments. The development of refined technological tools has had an impact on many of the different features of electroacoustic music, including spatialisation. As mentioned by Zvonar, it has thus shaped the aesthetics and character of the music created, allowing composers to develop new ideas with different approaches (Zvonar 2005). In the last decade there has clearly been a change in the availability of tools for spatial design for composers, mostly with cheaper sound cards (Dow 2004), powerful software with automation tools and the availability of standardised multi-channel systems such as 5.1 surround (Barbour 2002; Otondo 2005).

But how much are composers using these new tools and to what extent have these tools changed the way electroacoustic music composers conceive the use of space? With these questions in mind, the goals of this study were to investigate the types of spatialisation systems used and the approaches towards spatial design adopted by a representative group of composers nowadays, and then compare the findings with data collected from articles about this topic written almost a decade ago.

2. SURVEY METHOD AND SAMPLE

In order to determine which spatial systems composers use nowadays and their approaches to spatialisation with the available technology, a simple and direct survey method was designed, as will be explained below.

2.1. Survey method

A short questionnaire was designed consisting of two open questions. These were:

(1) In your last works, in what spatial format have you created your pieces (stereo, surround, multi-channel, other)?
(2) Can you explain some of your decisions about the use of space when you compose a piece of music?

The questionnaire was produced in three languages (English, French and Spanish), in order to allow participants to answer in the one they felt more comfortable with.

2.2. Sample

In order to reach a wide variety of composers, the questionnaire was sent by e-mail to different mailing lists related to electroacoustic music: the Canadian electroacoustic music (CEC) mailing list, the Sonic Arts Network (SAN) mailing list in the United Kingdom, the Dutch Electroacoustic Music mailing list, the Ars Electronica festival mailing list, and also directly to specific composers working in the field of electroacoustic music. Those composers interested in participating in the survey answered voluntarily by e-mail with their answers. The results considered for this study were gathered from replies e-mailed to the author from March 2005 to May 2006.

In total, forty-three composers answered the survey, of which 72% were European, 14% were South American, 12% North American and 2% Asian. The ages of the respondents varied, most of them being composers that had been working actively in the field for at least five years.

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3. RESULTS

In order to facilitate the analysis of the collected data, the topics mentioned by a significant number of composers were identified as categories for analysis. In the case of question (1) the categories refer to spatial systems, and for question (2) these refer to various aspects of electroacoustic music related to sound spatialisation.

3.1. Results for question (1)

With regard to the spatial format in which the composers create their pieces, the results show that many composers nowadays work with more than just one spatial format and that stereo is the most popular. Table 1 shows the results for question (1) of the survey.

3.2. Results for question (2)

When asked to explain their decisions about the use of space, most respondents gave a quite detailed account of their approaches, describing how they conceived the use of spatialisation when composing their music. Some composers mentioned just one or two topics, while others mentioned up to five topics with abundant details. The information provided by the respondents was summarised into twelve main topics that show general tendencies towards the use of space. These topics can be seen in Table 2 in descending order from the more to the less popular.

4. SPATIALISATION TRENDS IN 1997 AND 2006

The original idea of this study was to compare the results obtained conducting the survey with information gathered using a similar procedure a decade ago in a straightforward way. This proved to be difficult due to the fact that there are no similar published studies that the author is aware of. For this reason, a decision was made to compare the results with data gathered from articles written in 1997 by seventeen well-established composers working in the field of electroacoustic music and published by the Institute International de Musique Electroacoustique of Bourges (Barrière and Bennett 1998).

The two different types of samples in terms of age and experience as well as the different methods of obtaining the information could have had implications in the margin of error of the compared results. For this reason the compared results shown below are not treated as definitive, but rather as an indication of some global tendencies in the use of space by composers in the last decade.

Table 1. Results for question (1): In your last works, in what spatial format have you created your pieces (stereo, surround, multi-channel, other)? Note that many composers work with more than one spatial format.

Spatial format	Stereo (%)	8-channel (%)	Surround 5.1 (%)	4-channel (%)	Other (%)
Composers that work or have worked with this format	63	44	26	21	16

Table 2. Summary of topics mentioned for question (2): Can you explain some of your decisions about the use of space when you compose a piece of music?

Topics mentioned in connection to the spatialisation of sound	(%)
Sound material in the composition	37
Movement of sounds	30
Localisation of sounds	28
Clarity of sound material	28
Musical structure	23
Creation of space in the composition	23
Room acoustics	21
Functional or dramatic role in the composition	21
Depth in the stereo mix	14
Technical issues related to software or hardware	12
Performance with live diffusion	9
Interpretation with live diffusion	7

4.1. Comparing the use of spatialisation systems

When comparing the data on the use of spatialisation systems in 1997 and 2006 one can observe that there are some shifts in tendencies, as can be seen in Table 3. Differences between the data obtained in 1997 and 2006 are shown in column 3. As one might have expected, there has been a considerable increase in the use of 5.1 surround systems, which were only starting to be available for composers in 1997. According to the compared data, in the last nine years, 5.1 surround systems have become an important spatial format for a considerable number of composers who have either created works in this format or have used it as a

Table 3. Compared results for spatial formats used by composers in 1997 and 2006.

Spatial format	1997 (%)	2006 (%)	Difference (%)
Surround 5.1	0	26	26
Four-channel	0	21	21
Eight-channel	29	44	15
Other	6	16	10
Multi-channel (>eight channels)	18	9	−8
Stereo	88	63	−25

platform to develop more complex ideas in systems like Ambisonics (Barrett 2002; Otondo 2007). It is not clear if surround 5.1 systems will continue to be popular in the near future; there seems to be a decline already in the popularity of these systems (Richardson 2006; Field 2007).

Looking at the compared results we also find an increase in the use of four-channel systems in the last nine years. This is a slightly surprising result due to the fact that quad systems have been available for quite some time since the first performances of electroacoustic music and have led to very specific aesthetical approaches by composers in the 1970s and 1980s (Wishart 1984; Barbour 2002). This increase in popularity could be linked to the greater availability of cheaper multi-channel soundcards and software that easily allow composers to create four-channel versions of their pieces with minor changes to a stereo mix and play them in a surround 5.1 set-up dropping the central speaker channel (Otondo 2007).

We also note an increase in the use of eight-channel systems. This can be related to the greater possibilities to work with this format in multi-channel studios and concert halls nowadays, in contrast to some years ago when there were few centres that had such facilities (Vande Gorne 2002; Otondo 2007) and composers had to design their own software and hardware to work with eight or sixteen channels (Truax 1999). This increase in the popularity of eight-channel systems has also been linked to the increase in the availability of tools for spatial design by Dow (2004).

Table 3 also shows that other types of spatial systems have increased slightly in popularity, while there seems to be a slight decrease in the use of multi-channel systems with more than eight loudspeakers. The different nature of the data compared in this paper makes it difficult to know how representative of changes in approaches to spatialisation these small differences are.

Finally, we find a decrease of 25% in the use of stereo systems by composers, which could be due to the growing diversity of systems mentioned above. It seems that the new generations of composers are exposed to many more choices for spatial design, as is shown by the 37% of the respondents of the survey who said that they are using some of the other available formats instead of stereo in their recent compositions. One could speculate that the popularity of stereo systems might well increase again considering the growing importance of mp3 players and music heard through headphones over the Internet.

4.2. Comparing approaches to spatialisation

Comparing the approaches to the use of space obtained from the questionnaires with those mentioned in the articles by composers in Bourges in 1997, we can see that there are some similarities, but also substantial differences. Table 4 shows the percentage of composers that mentioned each topic in 1997 and 2006 with the respective difference arranged in descending order. At first glance, the results from the table show a tendency towards a decline in interest by composers nowadays in most of the topics compared, with larger differences at the top and bottom of the table. Due to the fact that these results might have been affected by the different nature of the samples compared, we will concentrate on these larger differences as a way to try to identify some global tendencies.

Looking at the compared results in detail, it can be observed that clarity of sound material is, surprisingly, the only topic that stands out as more important to composers in the survey in 2006 than in the 1997 articles. The details of many responses to the survey seem to indicate that composers in recent years have been using the spatialisation as a way to develop a more coherent internal space in the studio that can help to render the sound materials in the composition clearer. This seemed to be less important in 1997 when automation interface possibilities were less developed and composers had to stick to a less ambitious use of space in the studio, while

Table 4. Compared results of topics related to the use of spatialisation of sound mentioned by composers in 1997 and 2006.

Topics related to spatialisation of sound	1997 (%)	2006 (%)	Difference (%)
Clarity of sound material	6	28	22
Creation of space in the composition	24	23	−1
Functional or dramatic role in the composition	24	21	−3
Sound material	41	37	−4
Localisation of sounds	35	28	−7
Musical structure	35	23	−12
Room acoustics	35	21	−14
Movement of sounds	53	30	−23
Depth in the stereo mix	41	14	−27
Interpretation with live diffusion	47	7	−40
Performance with live diffusion	65	9	−55
Technical issues related to software or hardware	71	12	−59

interested more in the performance possibilities of their pieces with live-diffusion in concerts.

Contrary to the positive difference for clarity of sound material, there is a tendency towards a decline for the rest of the topics compared. This difference becomes substantial, around 20–30% less interest, for topics like movement in the composition and depth in the stereo mix. The decrease in the later topic could be related to the fact that, according to the results of the survey shown above, there are a considerable number of composers who are not working in stereo and that the possibilities of working with depth in more than two channels are still limited.

At the bottom of the table we find the range of large negative differences, between 40 and 59%. The different character of the three topics mentioned in this range as opposed to the rest of the topics compared could be explained by the differences in approaches between composers who worked purely with stereo a decade ago and the large number of composers working with multi-channel systems nowadays. Therefore, the large differences in the case of performance and interpretation through live-diffusion might be indicative of the increased popularity of surround 5.1 and standardised eight-channel systems mentioned above. The responses of many composers to the survey point to the fact that performance through live-diffusion does not seem to be as interesting as it used to be. Many respondents seem to be more interested in reproducing convincingly a spatial design developed in the studio and some feel, like Natasha Barrett, that live-diffusion can be restrictive for more detailed and complex spatial developments (Otondo 2007). Similarly, the idea of a particular interpretation of a piece from the mixing console by the composer or someone else, adding a new dimension to the spatial design done in the studio, as explained extensively by many of the composers in 1997, does not seem to be as important for the respondents in the 2006 sample. The exceptions among the latter are a few composers who have been working in this way for a long time or seem to be sceptical about reproducing in the concert hall the spatial design created in the studio, as explained by Dow (2004).

Finally, we find the largest difference of 59% for the more technical aspects of spatialisation related to hardware and software. The respondents to the survey did not seem to be very interested in technical issues related to spatialisation, but seemed to be keen to approach spatialisation from a very practical perspective, which contrasts with the detailed technical descriptions of some of the 1997 articles. In this case, the different approaches to the use of stereo or multi-channel systems mentioned in the previous section seems to be directly related to the way respondents to the survey conceive the more technical aspects of spatial design as compared to almost a decade ago.

4.3. New tools for spatial design but any new compositional approaches?

The compared results shown above indicate in general terms a change in the approach towards spatialisation of the composers considered for this study, which can be related to the availability of new tools. However, from these results it is not clear whether there has really been an assimilation of the new technological tools leading to new compositional approaches to spatialisation. Compared results show some differences in approaches to spatialisation, but it is hard to see if there are any considerable compositional trends that one can identify. This could be related to the argument by Barrett that despite a considerable development in the technological tools available for the spatialisation of sound, this has not materialised in the electroacoustic music we hear nowadays in concerts and that 'the understanding of spatial issues among composers is still not so advanced' (Otondo 2007). Barrett considers that 'the spatialisation equipment and technology have become readily available, but the users haven't caught up' (Otondo 2007). Along the same line of Barrett's comments, but from a more technical perspective, the engineer and researcher Damian Murphy, in a recent event devoted exclusively to spatial design where commissioned pieces focusing on spatial design were premiered, said that he had been disappointed by most of the proposals received for the open call (SpaceNet 2007). In a discussion panel about spatial design closing the event he said that he identified a very conservative approach in the use of space, arguing that 'the technology is there but there has not been a development in terms of artists pushing the boundaries'.

In general terms, one could make a connection between the remarks above and the results of this study. Results show that tendencies towards the use of spatial systems seem to be much clearer than the approaches towards spatial design. It is therefore hard to see if there has been assimilation of the possibilities offered by the tools for sound space that composers are using nowadays. Further studies could consider investigating in detail to what extent specific changes in the technology for sound spatialisation identified in this study have shaped electroacoustic music aesthetically in recent years by taking specific musical examples and a more detailed survey.

5. CONCLUSIONS

The results of this study show a very rich and diverse picture of the contemporary use of space by a sample of electroacoustic music composers considered for the survey. Comparing the results with information gathered from articles almost a decade ago, one notes that there has been a change in the use of spatialisation systems by composers in recent years: 5.1 surround and eight-channel systems are more popular, while the

interest in the use of stereo systems has declined. The availability of cheaper and more sophisticated spatialisation systems also seems to have affected to some extent the way composers conceive the use of space in their music. Changes in technology have made them more aware of the possibilities of reproducing the spatial design done in the studio in the concert hall and less interested in traditional stereo live diffusion performance practice. By focusing on specific examples, further studies could investigate to what extent these changes have shaped aesthetically electroacoustic music created in recent years.

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PERFORMANCE KIT

TO HAVE DONE WITH THE JUDGMENT OF ARTAUD

FELIPE OTONDO

Performance kit - *To have done with the judgment of Artaud*

Felipe Otondo

Introduction

This performance kit provides some guidelines and the essential elements for the performance of the dance theatre piece *To have done with the judgment of Artaud,* as performed by Base Theatre at the 2007 Edinburgh Fringe Festival. The information and materials in this kit should be used in connection with a video recording of a performance of the work provided on the enclosed DVD and also the original script and recordings of the radio play mentioned in the list of materials in the next section.

The piece *To have done with the judgment of Artaud* was conceived as a devised work and the goal of these guidelines is to provide some guidance for a choreographer or director to create their own version of the piece. The version of the piece performed at the Edinburgh Fringe Festival was conceived and developed for four performers, two dancers and two musicians. However, it should be possible to adapt the piece to a larger number of performers by making small adjustments.

Material needed to prepare and perform the piece

Texts

Original script of the radio play (in French):

Artaud, A. 1976. *Pour en finir avec le jugement de dieu* in *Ouvres Complètes.* Vol 13: 65-104. Paris: Gallimard.

English translation of the original script:

Artaud, A. 1995. *Watchfriends and Rack Screams: Works from the Final Period* (ed. and trans. by C. Eshleman with B. Bador). Boston: Exact Change.

Recordings and videos

Original recordings of the radio play by Artaud and others:

Artaud, A. 2006. *Pour En Finir Avec Le Jugement De Dieu*, Sub Rosa Records, Belgium.

DVD recording of the performance of the piece by Base Theatre at the 2007 Edinburgh Fringe Festival (enclosed).

3 CDs with the composed music for the radio players and theatre's PA system (enclosed).

Equipment

2 portable radios with CD players similar in size and power.

Conventional CD player connected to a PA system.

Percussion instruments

Small drums with soft mallets and shakers.

4 small hand drums.

Sections of the piece

The following is a description of each of the sections of the piece as performed at the Edinburgh Fringe Festival. The following acronyms will be used: P1 (performer 1), P2 (performer 2), P3 (performer 3) and P4 (performer 4), PP1 (portable player 1), PP2 (portable player 2) and PA (stereo track played through PA system).

1. Installation

This section was constructed as an introduction to the piece while the audience is coming into the room. Each performer moves along defined axes in different sections of the room, as shown in figure 1. Two performers carry portable radios playing the tracks roughly synchronised with the PA system's CD player. The texts spoken by each performer are excerpts of the text of the next section. Each performer should choose their excerpts from the following section and deliver it in a sparse fashion, allowing space between each speaker's intervention. The movements should be simple and repetitive, and related to the sparse delivery of the text. The specific movements to be done for each performer should be agreed and prepared in advance with the director or choreographer.

Lighting: the use of dim lights should be considered for this section, though subtle variations for the lighting can be introduced. It is important that there is enough visibility for the audience to walk into the room and find their seats. As the tape part starts to fade out at the end of the track and the performers move gently towards the starting position of the next section, the lights should gently fade away reaching total darkness when the sound has completely faded out.

This section should be treated as a site-specific work and should be adjusted to the amount of performers available as well as to the geometry of the room where the piece will be performed.

MUSIC: PA: track 1; PP1: track 1; PP2: track 1.

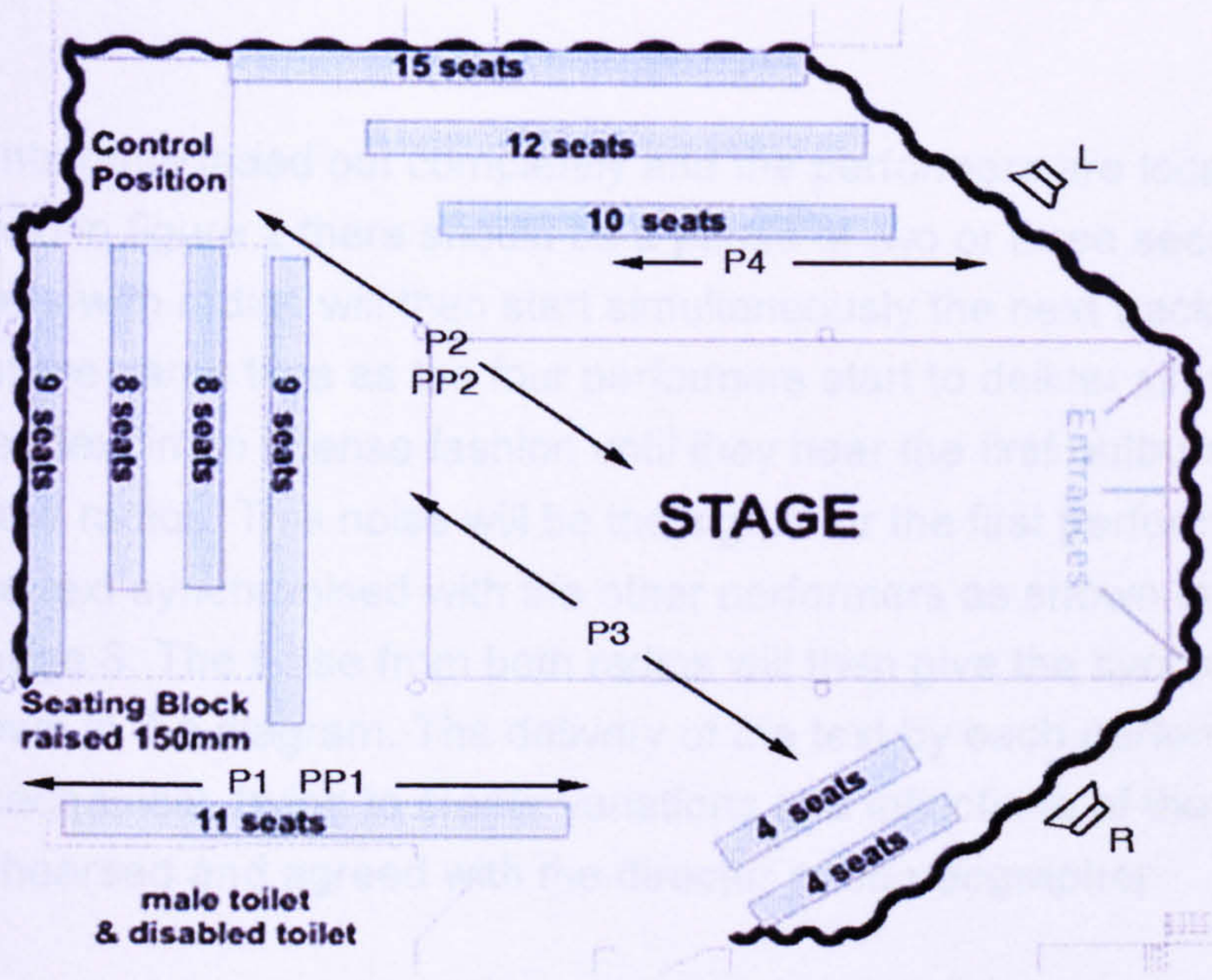


Figure 1. Positions performers and mobile sources in the *Installation* section.

2. Opening

Once the lights have faded out completely and the performers are located in the position shown in figure 2 there should be a pause of two or three seconds. The two performers with radios will then start simultaneously the next track on the radios and at the same time as the four performers start to deliver simultaneously an improvised text in an intense fashion until they hear the first outburst of noise from one of the radios. This noise will be the signal for the first performer to start delivering the text synchronised with the other performers as shown in the diagram of page 8. The noise from both radios will then give the synchronisation cues, as shown in the diagram. The delivery of the text by each performer should be slightly mechanical, trying to create variations and inflections of the voice that should be rehearsed and agreed with the director or choreographer.

As the piece evolves, the sound from the track on the PA system will get louder and louder, masking the voices of the performers until reaching a climax in intensity. At that point the sound from the PA systems will slowly start to fade out and performer 1 will switch to the next track on his/her radio and he/she will start to walk to the front of the stage, improvising vocally on top of the sounds coming from his/her radio. This improvisation should use as a reference the opening text of the original radio play shown below and should be inspired on track 6 of the original recordings of the radio play called *sound effects 3* by Artaud and Roger Blin.

Lighting: a powerful spotlight should be focussed on the four performers during the delivery of the text; this should be synchronised with the beginning of the delivery after the gap of silence at the end of the previous section. When performer 1 walks to the front of the stage, the front lights should be used to direct the attention of the audience to him/her until the end of the improvisation.

kré	Everything	*puc te*
kré	must be arranged	*puk te*
pek	to a hair	*li le*
kre	in a fulminating	*pek ti le*
e	order	*kruk*
pte		

MUSIC: PP1: tracks 2 and 3, PP2: track 2, PA: track 2.

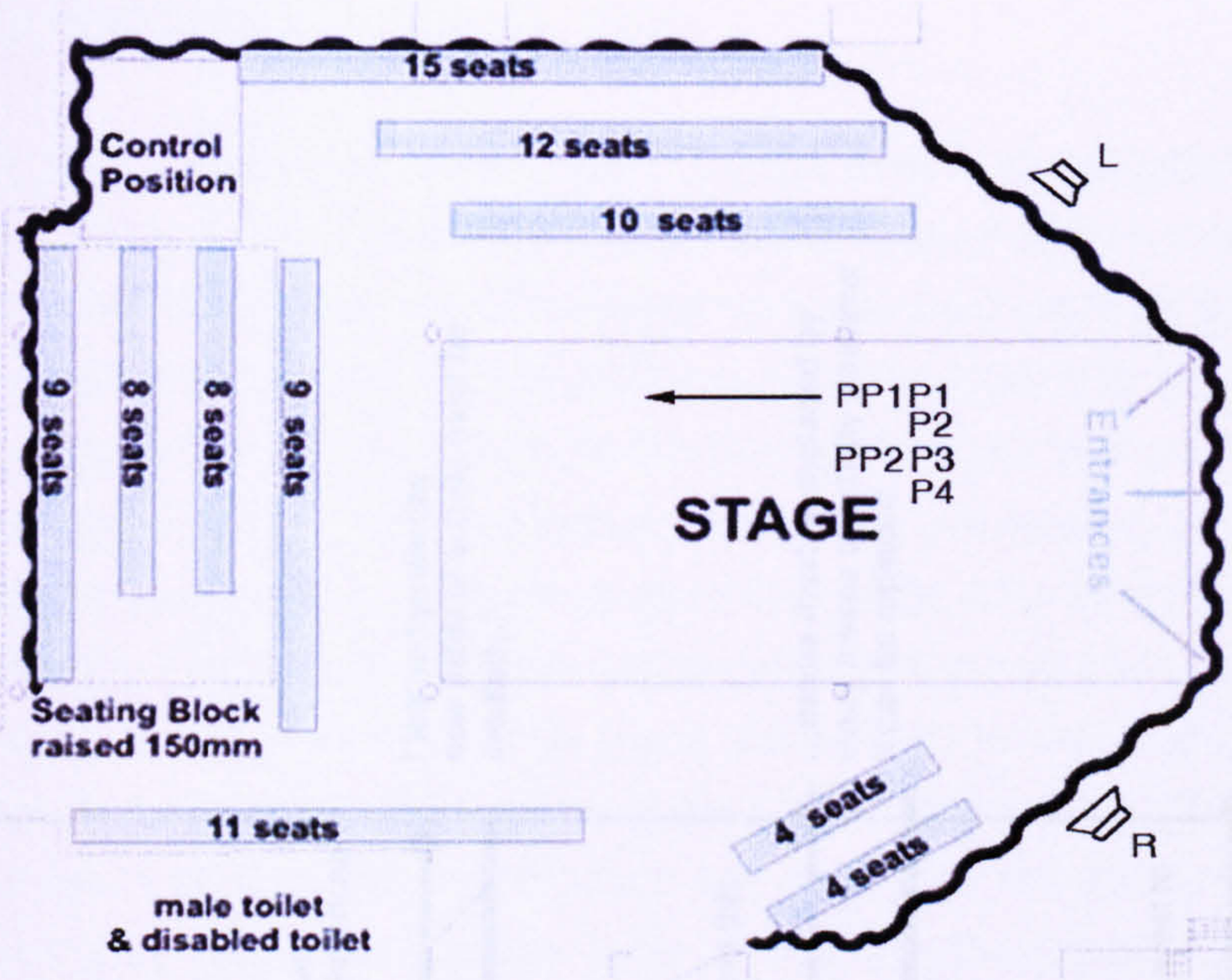
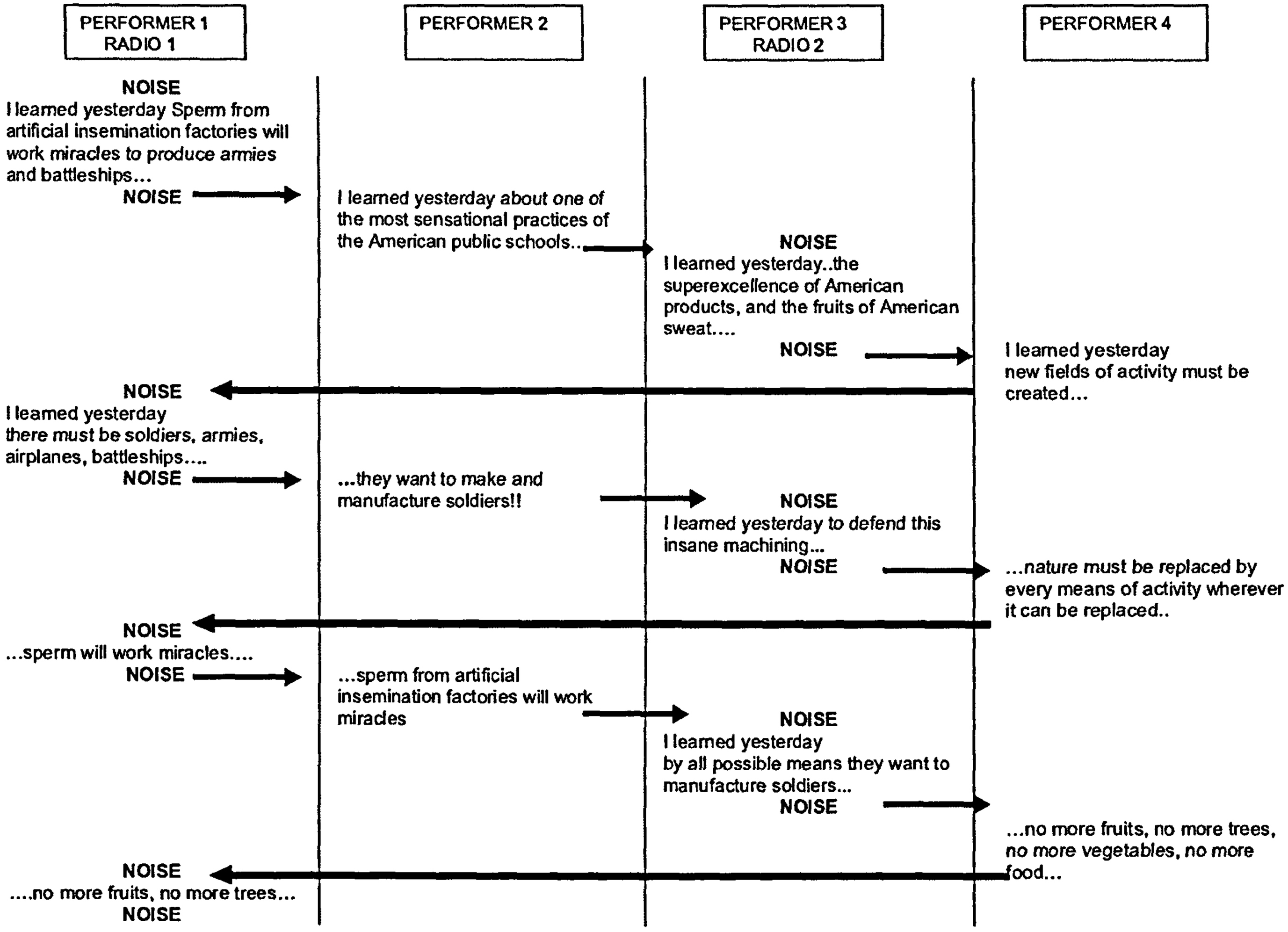


Figure 2. Positions of performers and mobile sources in the *Opening* section.


PERFORMER 1
RADIO 1
PERFORMER 2
PERFORMER 3
RADIO 2
PERFORMER 4
NOISE
I learned yesterday Sperm from artificial insemination factories will work miracles to produce armies and battleships...
NOISE
I learned yesterday about one of the most sensational practices of the American public schools..
NOISE
I learned yesterday..the superexcellence of American products, and the fruits of American sweat....
NOISE
I learned yesterday new fields of activity must be created...
NOISE
I learned yesterday there must be soldiers, armies, airplanes, battleships....
NOISE
...they want to make and manufacture soldiers!!
NOISE
I learned yesterday to defend this insane machining...
NOISE
...nature must be replaced by every means of activity wherever it can be replaced..
NOISE
...sperm will work miracles....
NOISE
...sperm from artificial insemination factories will work miracles
NOISE
I learned yesterday by all possible means they want to manufacture soldiers...
NOISE
...no more fruits, no more trees, no more vegetables, no more food...
NOISE
....no more fruits, no more trees...
NOISE

3. The dance of Tutuguri

At the end of the improvisation, performer 1 should walk to the position shown in figure 3. He/she should then generate vocal sounds related to the noise of the radios and start a short sequence of movements previously devised with the choreographer/director. These sounds and movements should be approximately 10 or 20 seconds, allowing the rest of performers get to their new positions before the tape part starts. Once performer 1 stops the movement, the technician should start the tape part to be played on the PA system. The other three performers will then perform a dance or physical theatre piece previously devised with the choreographer or director. This piece should be devised using as an inspiration the text of the second section of the original radio play (*TUTUGURI - the rite of the black sun)* and the tape music composed for this section. At the end of the tape part, when the sounds starts to fade out, the breathing of the performers should blend with the sounds of the tape played through the PA system. This could lead to a short vocal improvisation of one of the performers as an interlude to the next section, as in the performance at the Edinburgh Fringe Festival shown in the enclosed DVD.

Lighting: the light design for these sections should be done in close collaboration with the choreographer/director trying to emphasise the movement of the devised piece created.

MUSIC: PA: track 3.

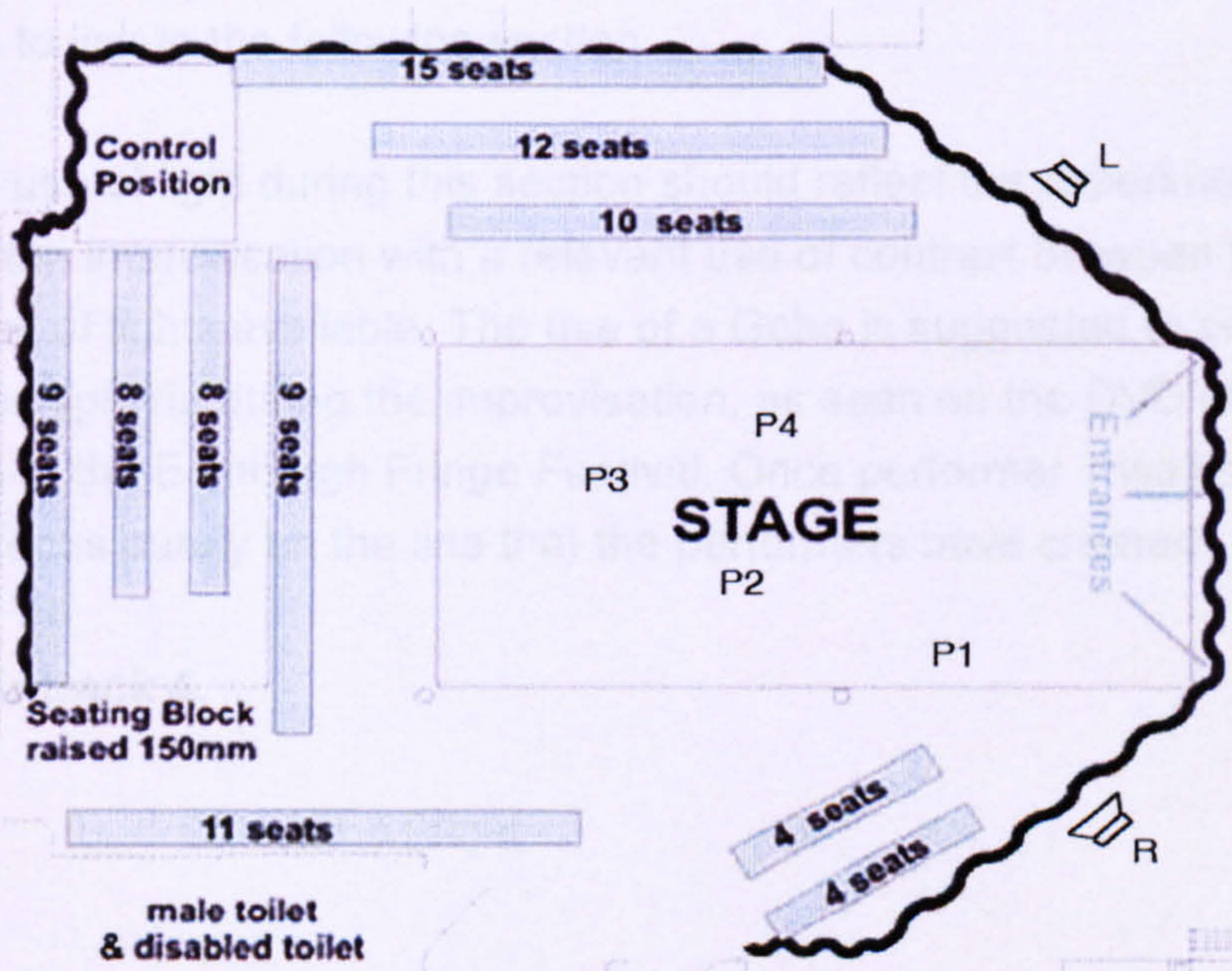


Figure 3. Positions of performers *Tutuguri* section.

4. Research on Fecality

After the interlude performer 1 will leave the stage and the other three performers get in a line as shown in figure 4. The performer in the front will then deliver a selection of the text *Research on Fecality* of the original radio play (position 1 figure 4). This text should be delivered as a monologue, using elements of humour and irony, as done by Roger Blin's in the original recording of the radio play (track 5 of the recordings of the radio play). At the end of monologue the three performers will deliver in unison the following glossolalia text as done by Roger Blin in the recording previously mentioned:

o reche modo
to edire
di za
tau dari
do padera coco.

After delivering the glossolalia text, the three performers will create an improvisation trying to combine movement and sound using the previous text as a framework. This improvisation should be carefully devised with the choreographer/director and rehearsed extensively. At the end of the improvisation performer 1 walks in with a radio playing noise and the four performers get in a line and improvise slow motion movements related to some of the material created during the improvisation without leaving their positions in the line (position 2 in figure 4). At the end of this section a short interlude could be created as a to link to the following section.

Lighting: the use of light during this section should reflect the experimental character of the improvisation with a relevant use of contrast between the different types of lights available. The use of a Gobo is suggested to create contrast in the lighting during the improvisation, as seen on the DVD of the performance at the Edinburgh Fringe Festival. Once performer 1 walks in, the light should focus purely on the line that the performers have created.

MUSIC: PP1: track 4.

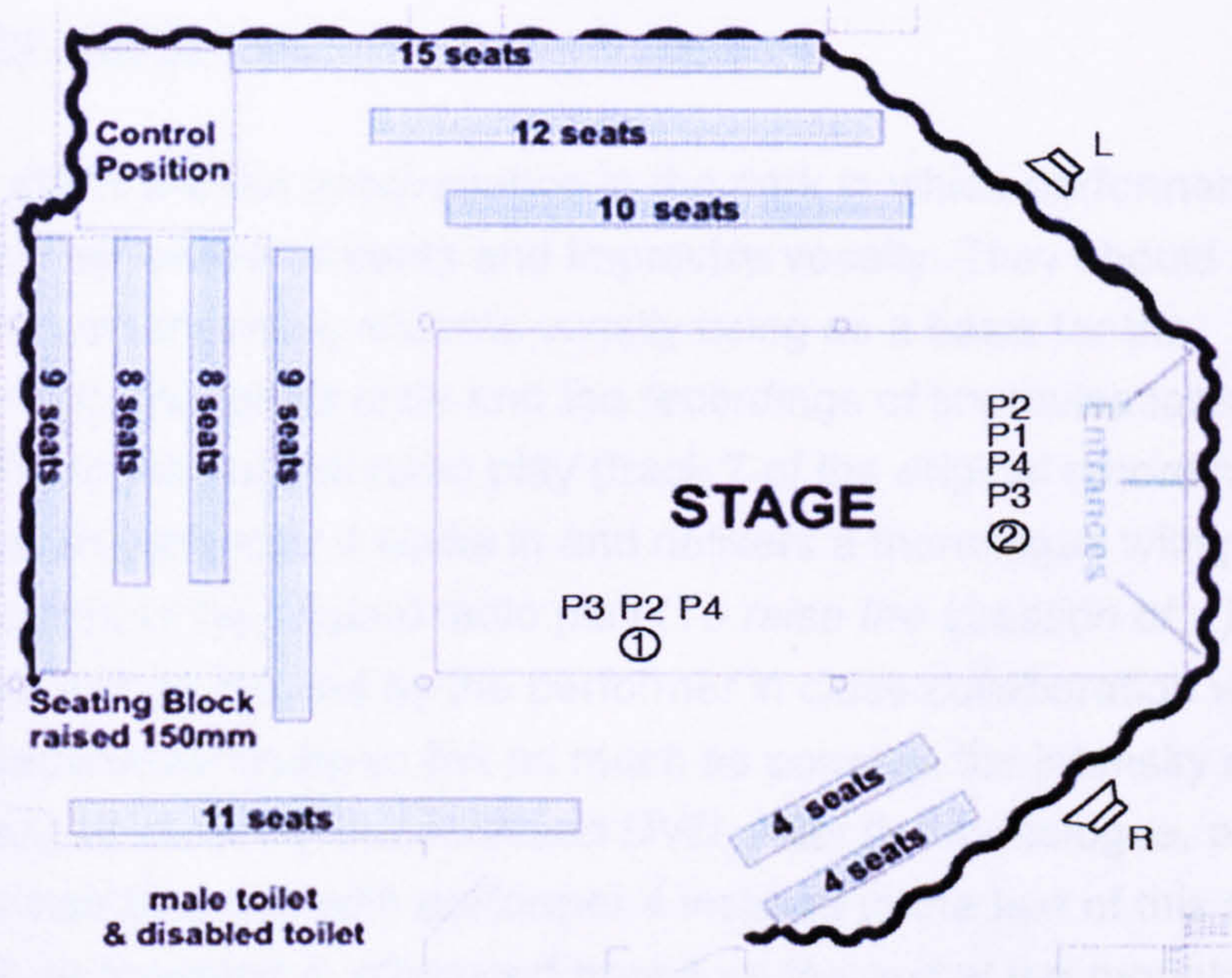


Figure 4. Positions of performers *Research on Fecality* section.

5. To raise the question of...

This section starts with an improvisation in the dark in which performers 1 and 3 play small percussion instruments and improvise vocally. They should created simple rhythms emphasising accents vocally using as a basis for the improvisation the glossolalia texts and the recordings of improvisations by Artaud and Roger Blin in the original radio play (track 7 of the original recordings). After the improvisation performer 4 walks in and delivers a monologue with parts of the text of this section in the original radio play (*To raise the question of…)*. The monologue should be created by the performer in close collaboration with the choreographer/director trying to link as much as possible the intensity of speech and movement as shown in the enclosed DVD. After the monologue, performer 2 walks in and creates a duo with performer 4 inspired in the text of this section which should be prepared in advanced based on the text of the monologue. At the same time, performers 1 and 3 walk in with radios playing different tracks roughly synchronised with the track played through the PA system. They move in different directions at the back and right side of the stage, as shown in the figure 5.

Lighting: after the improvisation in the dark a spotlight should be used to light the position where the performer will stand. Once the performer has delivered the monologue the lighting should be used to link as much as possible the movement of the two performers involved in the duo.

MUSIC: PP1: track 5, PP2: track 3, PA: track 4.

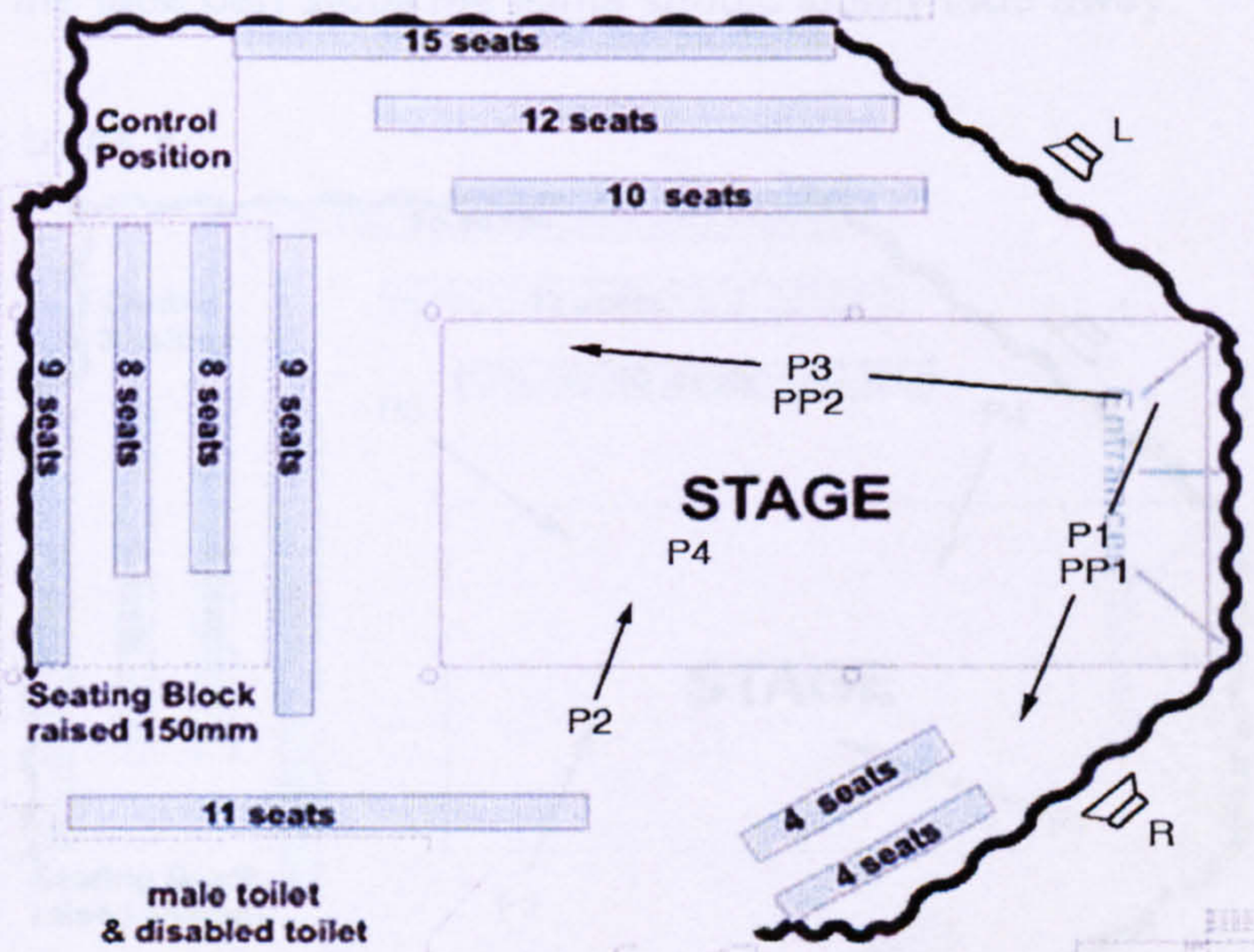


Figure 5. Positions performers and mobile sources *To raise the question of…* section.

6. Conclusion

Once the tracks played through the portable radios and the PA system have stopped, there will be a short pause of 2-3 seconds. Then performer 1 walks in, playing a small hand drum, and starts to deliver a selection of the *Conclusion* section of the original radio play. This text should be delivered as a monologue, playing with the idea of two characters in an interview situation, as done by Artaud in the original recordings of the radio play for this section (*track 9 of the original radio play)*. A hand drum should be used by the performer to build tension in relation to the text as shown in the enclosed DVD. As the intensity of the text builds up, the sound from the PA fades in with a rhythmic piece whose tempo the performer must gradually match with his hand drum. At this stage the rest of the performers come on stage, as show in figure 6, playing their own hand drums and delivering different parts of the text of the *Conclusion* section. The four performers should then move according to a choreographed plan and increase the intensity and speed of movement as the tape part reaches a climax in volume. At this point the rhythmic pattern of the tape part will stop, leaving only the voice of Artaud as lights fade out. When the rhythm stops the performers should remain still in silence until the sound from the PA system fades out completely.

Lighting: a spotlight should be used in the position where performer 1 will deliver his text and as the intensity builds up the use of the lights should be varied, reflecting the sharp movement changes of the performers on stage. When the rhythm from the tape part stops the lights should slowly fade away.

MUSIC: PA: track 5.

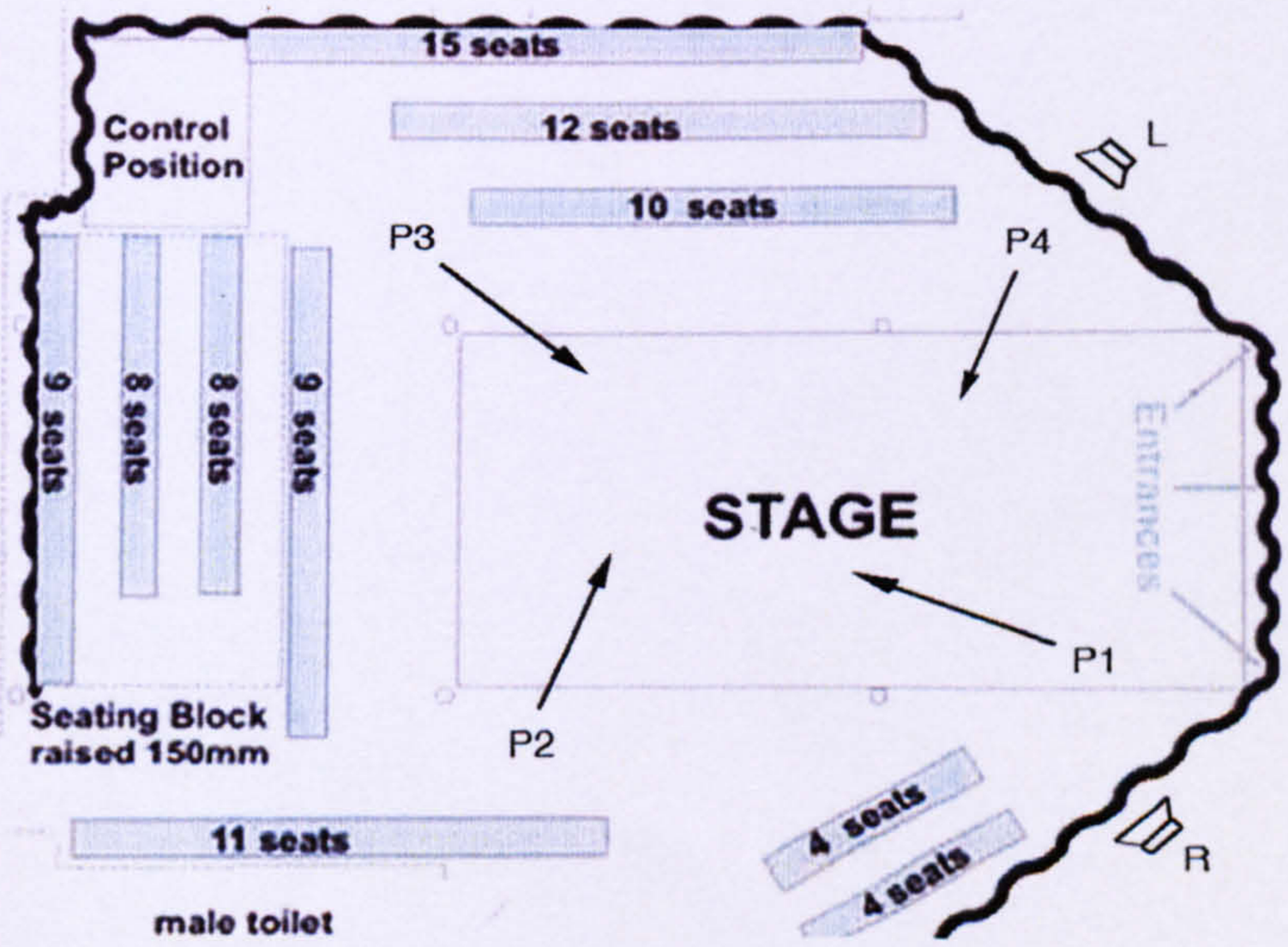


Figure 6. Positions performers *Conclusion* section