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Materialisation of fixed media music

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Materialisation of Fixed Media Music

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door

Siamak Anvaritutunchi

geboren te Tehran, Iran
in 1981

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Prof. dr. Marcel Cobussen

Copromotor
Frank Scheffer Independent filmmaker

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Prof.dr. Erik Viskil (secretaris)

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On the audiovisual component

This dissertation includes an audiovisual part which is complementary and of equal importance to the written component, simultaneously expressing its central ideas and demonstrating them in the form of a multichannel fixed media work for images and sounds which requires performance. The motivation for adopting a 'non-traditional research output' (NTRO - Murray and Rossmanith 2022) arose from encountering difficulties in using words to explain and describe the concert situation of fixed media music, which led to me recording those situations in order to better demonstrate their characteristics. An NTRO is able to incorporate more appropriate methods and tools for artistic investigation and discussion, especially in a realm such as music, which principally embodies tacit knowledge. In *Shaping the Digital Dissertation*, the author Lena Redman explains the benefits of personalised research methods: '[t]he privatization of knowledge tools enables the knower to create their own path in the quest for intellectual expansion in accordance with their individual interests, capacities and personal experiences' (2021, 210). This is perhaps particularly relevant when the artist/researcher is both a creative agent and the subject of investigation, as in my case. Having some prior experience in photography and videography, I found this a unique opportunity to develop such an NTRO and integrate it into my research trajectory. In the course of this endeavour, meeting the Dutch filmmaker Frank Scheffer (whose work I have always admired) played an important role in helping me to find my way among myriad possibilities.

While the initial idea of incorporating video into my research was to *replace* a written dissertation with a lengthy documentary, during the making process I came to the conclusion that the poetic capacities of the audiovisual medium should not be sacrificed for the concreteness of a written dissertation. For that reason, I decided to include a complementary text in order to free the audiovisual part from the responsibility of defining the theoretical ground, and thus to approach it in a more affective and poetic manner. That is why the film sometimes involves a degree of ambiguity which is necessarily absent from the text. Along the way, a symbiosis between the text and the audiovisual component developed as they affected and inspired one another. For instance, some observations through the lens of the camera helped me to better reflect on my practice. On the other hand, the writing process provided me with ideas which could then be explored in and through the audiovisual medium. In other words, the audiovisual medium was utilised both as a research tool and a method for dissemination. Taken as a whole, the audiovisual and the written components aim at establishing a discourse between the interviews, the documentary material and the literature on the one hand, and the self-reflections and my artistic contribution on the other; it is through this coexistence and dialogue that this research is shaped.

In order to gather some first-hand information concerning the practice of fixed media music presentations, I decided to interview some practitioners, including people who work with various styles and approaches to composing and performing this music.[1] This process involved a learning curve for me in both a technical and intellectual sense. The edited interviews which appear in the final version of this audiovisual component are a selection from many hours of conversation with the interviewees. The selection was principally based on the relevance of the content to the overall narrative of the audiovisual part. These conversations also indirectly

[1] My selection was also partly practical, in terms of the availability of the interviewees and myself.

helped me in the writing process by bringing about an understanding of the similarities and differences between the views and approaches of the practitioners.

While this audiovisual part is not intended as a documentary in the traditional sense, in constructing it I was inspired by Scheffer's idea of the *docu-concert,* which combines the experience of a live concert with the documentary form. My aim is to provide an experience of listening to spatial music and *simultaneously* to elaborate on the issues around its presentation, often blurring the boundaries between artwork, poetic reflection and documentation. Hence this component is probably best seen as a contribution to a range of possible forms of artistic research outcomes.

The complete version of the audiovisual component of this research will be *performed* in form of a screening/concert on 24th of June 2024 during the artistic presentation. A reduced version is available online via the link below.

The audiovisual component (reduced version)

https://siamakanvari.com/index.php/audiovisualdissertation
Password: avdmofm

Interviews

Karlheinz Stockhausen 1997, from Frank Scheffer's archive
Daniel Teruggi March 2019, The Hague
Beatriz Ferreyra September 2019, Berlin during *Kontakte* festival
Trevor Wishart October 2021, The Hague, during Sonology concert
Veniero Rizzardi December 2022, The Hague, during *Contemporary Music Heritage* symposium
Jonny Harrison April 2023, The Hague, during *Composing Spaces II* festival
Kees Tazelaar July 2023, The Hague
Giulia Francavilla December 2023, The Hague
Ji Youn Kang June 2024, The Hague

Introduction

0.1. Preamble

In the first journal concerned with concrete music (1948-1949), Pierre Schaeffer described the experience of the first electroacoustic concert organised by the Group de Recherches Musicales of which he was the founder and director. Caught by contradicting feelings, he asks:

> Was I in charge or wasn't I? Should the loudspeaker volume be adjusted once and for all, or, following a vague intuition, should some sort of presence respond to the audience's presence, not leave it alone in front of the turntable, add a level of performance, however minimal, to the automatically produced recording? (Schaeffer 2012, 61)

I have also often found myself entangled in similar concerns and thoughts in connection with the presentation of my fixed media music, questioning my role in the moment of the concert. Towards the end of my Masters studies at the institute of Sonology, having composed multiple multichannel fixed media pieces, I was often confronted with the stark difference between studio and concert hall in the way the music sounded. I will never forget the first performance of my fixed media pieces in a concert hall. After a long time working on the composition in the studio, I was shocked by the realisation that the way that in the concert hall I seemed to be listening to completely different music. Moreover, I realised that when I reduced those pieces to stereo for the purpose of sharing them online or releasing on CDs, they somehow lost their impact, since the spatial dimension of the composition was absent in the stereo version.

The goal of this dissertation is to shed light on the public presentation of fixed media electroacoustic music, and to investigate the performative capacities which are involved in materialising such music and bringing it to sonic reality, in order to deal with the question of why the public presentation of fixed media compositions is often the only way to fully experience this music. In doing so, I will chart the importance of spatial aspects in composing fixed media music, by proposing the concept of *spatial polyphony* where polyphonic textures are created through the organisation of simultaneous musical events in space. The concept of *post-mix* is introduced as a practical and creative strategy for negotiating the various circumstances encountered in fixed media music presentations, offering flexibility and adaptability by composing in a higher number of channels than those to be used in the concert, and mixing them down for each presentation. While an extensive body of literature exists on the *production* of electroacoustic music – such as sound synthesis methods, algorithmic composition and so on – not much attention has been given to its *presentation,* and specifically to the concert situation.

All the endeavours of Pierre Schaeffer's team in Paris to incorporate performative activities for fixed media concerts, as well as Karlheinz Stockhausen's precise design of his music's spatial character, or Iannis Xenakis' site-specific *Polytopes*, reflect different aesthetic approaches to the issue of performing fixed media music. Schaeffer and his colleagues considered spatialisation mainly as a performative aspect of the music, while Stockhausen, Gottfried Michael Koenig and others considered it a compositional or structural aspect. In developing my ideas of spatial polyphonic thinking in the composition of fixed media music, and post-mixing for its performance, I am situating my practice somewhere in between these poles, fusing structural composition with performativity of a sound diffusion practice, an approach which is directed

towards a music-making practice embracing polyphonic complexity while being flexible in allowing the music to take on new shapes from one performance to another.

It is crucial to acknowledge that the production of electroacoustic music was historically limited to a small group of composers with the privilege to access the necessary studio resources, which until recently involved expensive and specialised equipment such as multitrack analogue tape machines and modular synthesisers. Those studios often belonged to institutions such as radio stations (in Europe) and universities (in the USA) whose policies tended to reflect the inequalities and lack of inclusivity of their historical period and the societies in which they were embedded. Upon the advent of personal computers and digital technology, however, the medium gradually became more democratised, and empowered many to make music on their own relatively affordable computers. Multichannel music, nevertheless, is still hardware-dependent, requiring a relatively large number of loudspeakers and a suitable audio interface/mixer for composition and presentation, a setup not readily available to everyone, so that this music remains an exclusive and niche practice. This is something that Azimuth has tried to address by involving a mixed selection of composers from diverse social backgrounds as well as redressing the gender and race inequality which has been historically ingrained in this music.[2]

0.2. What is fixed media electroacoustic music?

Electroacoustic music – as the term clearly implies – is concerned with transformations between electric signals and acoustic energy. These signals are stored on a fixed medium readable by a computer. The term *fixed media*, originally borrowed from computer science, has gradually replaced the term *tape music,* as a result of the extinction of magnetic tape as the main storage (and editing) medium for electroacoustic music.[3] The introduction of digital storage, as well as computer-based editing programs, has enormously accelerated the workflow of composing such music. Fixed media electroacoustic music is composed in a studio and stored digitally on SSD drives, to be heard through loudspeakers.

In Western classical music traditions, a composition often consists of written signs and instructions which require realisation by one or more performers in order to become audible. As the French philosopher Roland Barthes explains, to compose music in this traditional way means 'to give to do' (in Ferguson 1983, 19). In other words, the composer instructs the performer through a written score to turn the musical ideas into 'real' music. In fixed media electroacoustic music, however, the composition and the creation of the sound world occur simultaneously, meaning that the composer fabricates the sounds and structures the material directly on the medium without the need for a performer to produce those sounds later on. According to the American composer Michael Dellaira, 'the ability to affix sounds into physical forms' (by using recording technology) has not only affected the way we listen to music, but also transformed the composition practice in dealing with the creation and arrangement of sounds. He continues that '[m]usic recordings, then, like music notation, provide more than a way to preserve and recreate performance; they also reflect the way we think about music' (1995, 193). And, as John Cage

[2] Azimuth is an organisation for production and performance of electroacoustic music inside the Netherlands, co-founded by the author (see Chapter 3).

[3] According to the SAA (Society of American Archivists) 'fixed media devices are distinguished from those in which the data is stored on a cartridge, disk, or other material that is removable and interchangeable. Hard drives are typically fixed media, with platters sealed inside the drive chassis. Floppy disk and CD-ROM drives are examples of removable media'. https://dictionary.archivists.org/entry/fixed-media.html

states, 'magnetic tape was used not simply to record performances of music but to make a new music that was possible only because of it' (1973, 8). Cage adds that its influence goes beyond electroacoustic music: 'Whether one uses tape or writes for conventional instruments, the present musical situation has changed from what it was before tape came into being' (1973, 11).

The role of the performer, and consequently that of interpretation, are problematised by the direct 'fixation' of the music onto the medium. The music historian Paul Sanden explores Glenn Gould's ideas about using recording technology, stating that 'one of the strengths of electronic sound technology [lies] in its ability to present to composers a permanent record of their own interpretations (in the form of acousmatic works or their own performances) so they would not have to rely on other performers to get it right' (2013 ,54). In the same way, Linda Ferguson, in her article 'Tape Composition', explains that '[t]ape music's significance lies in the fact that tape composition is a sonic commodity which embeds and particularises itself in physical matter in a manner not possible (and likely, not desirable) in performed music' (1983, 22). She believes, therefore, that due to this fixity '[t]he expressive element of performance – interpretation – is not admitted in tape composition, and the expressive content is already present, concretely determined by the composer' (1983, 20). Karlheinz Stockhausen, in a lecture from 1958, states that in 'electronic music […] all sonic events are predetermined down to the smallest details and are fixed by technical criteria', so that '[i]n electronic music, the interpreter no longer has any function' (2017, 642). Many other authors have denied the presence of a performative agency in electroacoustic music. The philosopher Stan Godlovitch, in his book *Musical Performance a Philosophical Study,* states that:

> Computer use thus "liberates" the composer from the performer and the limits of conventional instruments. If, so to speak, the composer is first-person to the work as the player is its third-party, computers rid the composer of all third-party intervention. The result means the elimination of performance as such and its displacement by "pre-cast" or "presented" music; that is, playback which has been utterly and finally set up in advance. (1998,101)

Godlovitch denies interpretation in electroacoustic music, stating that:

> Notated works which tolerated a single type of instance would not be works-for-performance as we know them, but would instead satisfy certain composers who have turned to electronic instantiation precisely to avoid the variety typical of instantiation by so-called "interpreters". (1998, 85)

The composer and sound artist Robin Minard observes:

> [I]n the studio the composer reacts to sounds much in the same way as painters or sculptors normally react to their own physical interaction with materials [...] the results can then be reworked again and again in an intuitive manner until the desired result is obtained [...] There was no more musical interpretation of a work (neither real nor virtual) but rather a work where all phases were finalized by the artist alone. The analogy to the artist's atelier is most appropriate. (2002, 47)

As Minard remarks, fixed media music is often compared to plastic art such as painting, sculpture or cinema. Ferguson even responds to the question 'Is it music?' in a non-affirmative

manner, arguing that tape composition is ontologically different from what had been known traditionally as music (1983, 17). It is true that in creating fixed media music the composer works directly with the 'actual' or concrete sound material instead of abstract signs, similarly to how a sculptor works with wood, stone or metal, or a painter with paint. However, this comparison is not quite accurate. In the case of the plastic arts, the painting or the sculpture constitute the final product in their absolute entirety. Fixed media music, on the other hand, is *not yet* the final product; it is still subject to realisation in order to become audible and hence to become music. The composer Simon Emmerson confirms that acousmatic works 'are studio created yet only "completed in performance" (that is they are not deemed to exist "as art" stored on the shelf or hard disc unheard)' (2007, 31).

Denying the existence of performance (interpretation) in the context of fixed media music implies an assumption that the sound file itself is equivalent to the music and is, in other words, the final product. This is obviously not the case, especially not when the work is composed with the intention of being presented in a concert hall. For instance, in case of a multichannel composition to be heard through more than two channels – which is a common practice in fixed media music – no simple 'playback' is possible. Some deliberate actions (and the right equipment) are required to bring the piece into sonic existence. Tape music, since its inception, has involved performative approaches in its presentation, as when Pierre Schaeffer and Pierre Henry attempted to present their *Symphonie pour un homme seul* in a concert in the École Normale de Musique, Paris, on 18 March 1950. According to the composer and author Peter Manning:

> This event brought the creation and spatial dissemination of electroacoustic music into the concert hall in a highly dramatic fashion, the audience witnessing the synthesis of the work both aurally and visually, the operators being required to run about the stage area starting and stopping the contributing recordings, reproduced via a spatially distributed network of monophonic playback systems, each assigned to a different amplifier and loudspeaker. (2006, 84)

Also remarkable are performative approaches such as using the *potentiomètre d'espace* developed in 1951 by the engineer Jacques Poullin, in order to move monophonic sound sources around in a performance space.[4] These performative ideas were further developed in forms such as 'loudspeaker orchestras', which enabled performers to shape and control the projection of music in the concert venue by using large arrays of loudspeakers of various types and with diverse characteristics and positioning. The *Acousmonium* developed by the Group de Recherches Musicales (GRM) in Paris from 1974 until the present time, and later the Birmingham Electro-Acoustic Sound Theatre (BEAST) from 1982, are examples of such setups.[5]

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[4] Peter Manning explains that, *potentiomètre d'espace* 'consisted of a small hand-held transmitting coil and four wire receiving loops arranged around the performer in a tetrahedron, representing in miniature the location of the loudspeakers in the auditorium. Moving the coil about within the tetrahedron modulated the induction signals in the receiving loops, this information being applied to the electronic amplitude controls regulating the distribution of the sound source between the loudspeakers' (2006, 88).

[5] According to the GRM website: 'Considered as a pioneering unit in electroacoustic, acousmatic and concrete music, the GRM (Group de Recherches Musicales) has been, since 1958, a unique laboratory for sonorous experimentation. Integrated with the INA (Institut National de l'Audiovisuel) since 1975, the GRM has retained a strong involvement in the experimental music field and is still expanding its repertoire every year' https://www.ina.fr/offres-et-services/ina-grm. According to the BEAST website: 'Over the decades since its launch BEAST (Birmingham ElectroAcoustic Sound Theatre) has become established as one of the leading systems for the presentation of electronic music in the world, and as an ongoing catalyst for creation and innovation in the field. BEAST is particularly recognised for its key role in championing the development of acousmatic music – music composed especially for loudspeakers – and live "diffusion", a practice aimed at creating immersive sonic experiences in concert' https://beast.cal.bham.ac.uk/about

According to the musicologist, event director and curator Caleb Stuart, '[t]he performance [in the context of spatial and immersive electroacoustic sound] is not the same from sound system to sound system, venue to venue and audience to audience. Without a good PA-system in a correct setting the work simply cannot exist' (2003, 63). Therefore, the fact that the music is fixed on a digital or analogue medium *does not eliminate the need for an active actualisation of the sounds*. Furthermore, the procedure of bringing the fixed files to sonic reality involves multiple variables and contingencies which all affect the final result. In the absence of a score (or any instruction) an important question is: How should a composition of fixed media music sound? Answering this question is a delicate task which is in fact the responsibility of someone who can be called a performer. This responsibility encompasses not only the audience's experience of the music, but also the artwork and its composer. The performer decides, for instance, on the absolute and relative loudness of the sounds, which might change to a greater or lesser extent as the music unfolds, on the arrangement of the concert situation (the relative positioning of loudspeakers and audience in a particular space), and even on the lighting situation and any other element which affects the experience of the piece; in other words, on everything that constitutes the *atmosphere* within which the piece is experienced (see Chapter 2). Returning to the relationship and contrast between traditional Western art music and fixed media music, we can read in music theoretician Brian Kane's book *Sound Unseen* that:

> Abstract music, which Schaeffer contrasted with *musique concrète*, was music that began with the note, organized its musical thinking in terms of the note, and then draped it in the guise of acoustic or electronic sound. Abstract music gave the ideal note a sonorous body through the realization of scores by performers or engineers. It began silently in the head and ended in the vibrating garment of sound. (2014, 17)

A question that might arise here is to what extent the *process of music making* differs between instrumental and fixed media music. Obviously, in fixed media music, we are not dealing with what Kane terms an 'ideal note' in the form of graphical or textual instructions; but the piece does still 'exist' in the form of sound files which have as yet no 'acoustic guise'. These sound files also need to be brought actively into the realm of acoustic sound waves, which propagate into a performance space, reflect from its surfaces and fill it with their materiality. The composer Henri Pousseur, in a text written in 1962, underlines that electroacoustic music is not a separate domain of music, a particular musical aesthetics, but that

> it should be rather considered as a set of means (instrumental, in the broadest sense) just added to the existing means (human voices and traditional musical instruments) and, while modifying them gradually in a very profound way, tending to join them in order to make as rich as possible the current musical practice. (1970, 81)

Nevertheless, we can distinguish four characteristics which are exclusive to electroacoustic music:

- The prefabricated nature of the composition, concretised on a medium in the process of composing – in comparison to the signs and instructions of a traditional score. The element of time in the composition is fixed, which of course affects the agency of the performer.
- Another peculiarity of electroacoustic music is the vast variety of the musical materials available to the composer, such as instrumental and vocal sounds, environmental sounds which might have undergone various degrees of manipulation and transformations, as well

as abstract and synthesised sounds, and all possible combinations of these. As the percussionist and composer Chris Cutler puts it, '[f]rom the moment of the first recording, the actual performances of musicians on the one hand, and all possible sound on the other, had become the proper matter of music creation' (1993, 141).

- A third characteristic is the extensive and elaborate spatial possibilities for both composition and performance of fixed media music. Of course, spatial considerations have previously involved in music production, as in well-known examples such as the antiphonal music performed by spatially separated instrumental groups (*cori spezzati*) in St Mark's Basilica in Venice around 1600, and twentieth-century instrumental music such as *Gruppen* (1957) by Stockhausen. Nevertheless, in electroacoustic music the technological affordances of spatial sound projection, especially in recent years when digital technology has superseded analogue tape manipulation, have opened up possibilities which were not feasible or perhaps imaginable before.
- Finally, the separation between the source of a sound and a recording of that sound gives rise to an *acousmatic situation*. François Bayle, a composer of electroacoustic music, explains this as 'a situation of pure listening, without attention being distracted or supported by visible or foreseeable instrumental causes' (1993, 179).

Despite these differences, I argue that, ontologically speaking, fixed media music can be usefully described simply as *music where loudspeakers become the sound sources*, instead of instruments and/or voices, and where the agency of a performer/interpreter takes place in a field of activity somewhere between the process of composing and the discipline of performing. This field is the focus of the present research project, which attempts to answer the question of what performing means in fixed media electroacoustic music, and what possible future forms it could take. This question could indeed be turned on its head to provide another possible way of expressing the subject of this research: what does 'fixed media' mean in the context of performing electroacoustic music?

0.3. Structure and format of the dissertation

This dissertation consists of two components: a written part in three chapters, and an audiovisual part consisting of video and multichannel audio. As for the written part: the first chapter contextualises the issues at hand by charting the ontological status of fixed media music and its performance, as well as considering the relevance of liveness in listening to what might seem to be 'recorded music'. The second chapter deals with the concert situation of fixed media music through the lens of *atmosphere,* a concept developed by philosophers Hermann Schmitz and Gernot Böhme among others. The concept of atmosphere as a new aesthetics provides an understanding of the concert situation based on a holistic approach as to how the various elements of the performance environment come together to generate the audience's experience. In the third chapter I discuss my own approach to composing and performing fixed media music, as well as the works of other practitioners in the field. The audiovisual part is itself a fixed media work, consisting of documentary elements such as interviews with some prominent composers in the field discussing how they present their music, together with excerpts of their music. This part also includes some of my own compositions and a documentation of my previous concerts alongside self-reflective autoethnographic elements, as well as abstract and 'atmospheric' material.

Chapter 1

1.1. Actualising fixed media music

In this part, I consider the concepts of the *virtual* and the *actual* (developed by Henri-Louis Bergson, Gilles Deleuze, Pierre Lévy and others), in order to chart in more detail the ontological status of fixed media electroacoustic music and its concert situation. These concepts, I assert, provide a valuable framework to define fixed media music and explain the relationship between its various stages and elements, such as the composition process (in the studio), the sound files (the resultant product) and the concert situation (the final destination).

Actualisation, in the context of fixed media music, may be described as the process of turning the sound files (the virtual) into music (the actual), which often takes place in the form of a public event. As Pierre Lévy explains: 'actualization is an event, in the strongest sense of the term. […] The actual, as the manifestation of an event, arrives, its fundamental operation is occurrence' (*sic*) (1998 ,171-2). The concert situation is, therefore, a moment of becoming, of arriving at a destination, namely the 'here and now' of the public presentation. This process of actualisation is exactly the responsibility of the performer of fixed media music. Actualisation is, however, different from realisation; Levy distinguishes 'realisation (the occurrence of a predetermined possible)' from 'actualization (the invention of a solution required by a problematic complex)' (Levy 1998, 26). More or less similarly, the philosopher Gilles Deleuze explains the difference between realisation and actualisation, and highlights the role of creativity in the latter.

> The possible is that which is ''realized'' . . . for the real is supposed to be in the image of the possible that it realizes. . . . The virtual, on the other hand, does not have to be realized, but rather actualized; and the rules of actualization are not those of resemblance and limitation, but those of difference or divergence and of creation. (1988, 96–97)

That also clarifies why various actualisations of the sound files lead to different sonic results, and are strongly conditioned by the circumstances of the concert situation. According to Lévy, 'the virtual is a kind of problematic complex, the knot of tendencies or forces that accompanies a situation, event, object, or entity, and which invokes a process of resolution: actualization' (1998, 24). The many parameters involved in the presentation of a piece of fixed media music, described in more detail below, determine the process of its actualisation. As in Levy's example of seed and tree (virtual and actual), 'the seed will have to invent the tree, coproduce it together with the circumstances it encounters' (1998, 24). Circumstances are indeed a crucial factor in the actualisation of a piece of fixed media music, and include a wide range of elements and variables, such as the sound reproduction system (including the playback device, processing units, mixing desk, EQ, amplifiers and loudspeakers), the arrangement of the loudspeaker system in the space, the physical characteristics of the space and its acoustical properties, the arrangement of the audience in the venue, the lighting, the atmosphere of the space more generally, and so on. As pianist and artistic researcher Paulo de Assis explains, each actualisation 'is only one ephemeral solution to the problematic field defined by a musical multiplicity' (2018, 41).

On the other hand, according to the philosopher and critic Christoph Cox, '[v]irtualization is a process that involves detachment from the present (the here and now) and movement toward a

general problematic field from which new actual entities are generated as solutions' (2018, 50). The composition process of multichannel fixed media music, then, involves exactly such a virtualisation: the production of the sound files, which are deterritorialised from the here and now (of the studio), and which can be actualised in a concert situation in multiple ways. The virtualisation process (from concrete sounds to sound files), involves an 'interim actualisation' in the form of studio listening to a succession of prototypes, and also takes place in the imagination, whose activity is in turn based on the composer's previous experiences, knowledge and skills of working with spatial sounds, and a conception of a specific atmosphere (see Chapter 2). As Deleuze writes in *Difference and Repetition*:

> While it is thought which must explore the virtual down to the ground of its repetitions, it is imagination which must grasp the process of actualization from the point of view of these echoes or reprises. It is imagination which crosses domains, orders, and levels, knocking down the partitions coextensive with the world, guiding our bodies and inspiring our souls, grasping the unity of mind and nature; a larval consciousness which moves endlessly from science to dream and back again. (1968, 220)

In that light, Levy explains the reciprocal relationship between the virtual and the actual, stating that this relationship 'implies as great a sense of irreversibility in its effects, indeterminacy in its processes, and creativity in its striving, as actualization' (1998, 27). And this clearly explains the reason why *reproducing* the studio experience (interim actualisation) in the concert situation is simply not possible.

The spoken contributions of Veniero Rizzardi (talking about the music of Luigi Nono) and Daniel Teruggi (talking about his own work as a composer) to the audiovisual part of this dissertation take opposing views of the relationship between the studio experience and the live performance of acousmatic music. Teruggi aims to *reproduce* in the concert hall the sound of the music as heard in the studio, while Rizzardi (and Nono) argue that this is impossible. In my opinion, this impossibility gives rise to an opportunity for creativity in the presentation of this music to an audience, which valorises the public presentation of fixed media music, and motivates multiple presentations in various circumstances which can produce new qualities and new experiences. In my own concert presentations, as well as in the present thesis, I have tried to express as clearly and fully as possible these possibilities as I imagine them.

1.1.1. Sound file versus score

To what extent are the sound files of a piece of fixed media music comparable to the score of an instrumental composition? Obviously, they both exist in guises other than the actual sounds – the sounding music. The former exists in the form of written graphical instructions, while the latter are digital representations of the waveforms that, translated into variations in air pressure over time, create the sounds heard by listeners. Unlike the score, sound files include no (explicit) instructions, while scores, on the other hand, incorporate no sonic representation of those signs. Cox explains the ontological status of musical notation according to the conception of the virtual and the actual:

> A virtual entity, the score (a visual, static, inaudible set of marks on paper) does not resemble its actualizations or performances (invisible, dynamic, and audible events or processes), but serves only as a set of instructions for the actualization of music—a

> necessarily incomplete set of instructions ensuring that each actualization will be unique, divergent from all others. (2018, 53)

In a similar way, the sound files of a fixed media piece, which may be visually represented as waveforms on a computer screen but are actually inaudible, static, and digitally stored, are not equivalent to the piece's presentation, which will be spatial and dynamic and will consist of audible events and/or processes. 'Thought is actualized in a text and a text in the act of reading (interpretation)' (Levy 1998, 56). A text thus has a double status, being at the same time virtual and actual. By the same token, the sound files of fixed media music are actual in relation to a composer's ideas and imagination, and at the same time virtual vis-à-vis its concert presentation. Sound files are territorialised in the sense that the durations of all their constituent musical events are fixed, so that the overall structure of the music is not subject to alteration. However, at the same time, they are deterritorialised in the sense that they 'sound' dramatically different in various actualisations, because of the aforementioned contingencies.

1.2. Composer/performer

Chris Cutler, in his book *File Under Popular,* maintains that '[n]otation is a medium which encourages & reinforces a specialising division between Composer & Performer. This is a division which becomes more absolute as its productive potential is unfolded (leading eventually to a destructive contradiction)' (1985, 137). What about fixed media music, in the absence of a notation? Does this specialising division between composer and performer occur here as well? In my experience, in the context of electroacoustic music, an inexpert listener, unfamiliar with the practice (and even sometimes the experts), might find the music making process quite enigmatic. As Dellaira confirms, '[i]t's too hard for the listener to know, much less imagine, just what the composer did exactly; the whole process of getting music from brain to ear back to brain again is invisible to the listener, mediated by machinery and gadgetry' (1995, 202). According to the composer Paulo Chagas, '[v]ocal and instrumental sounds are transparent; they make visible the flow of gestures. […] On the other hand, electroacoustic and digital signals are opaque. They break the transparency of the musical flow' (2006,125). The 'musical flow' is conceived by Chagas as the simple 'mapping' of a visible gesture to an audible sound, which is absent in fixed media music. But when we 'break the transparency' this might create compositional possibilities rather than restrictions. Based on conversations I had with audience members after my concerts, it appears that many of them think that what they just heard was produced by me on the spot on the mixing desk. This is a logical observation, since I was the only one 'in charge' of what was heard during the performance. This is often accentuated by the lighting situation in which the 'music maker' is illuminated under a spotlight as the only agent in action (however minimal) during the performance. Nevertheless, I was of course the one who actually made this music, the only difference being that this happened beforehand and 'outside time'.

Cox discusses Glenn Gould's approach to using recording technology as a performative medium, and states that 'as Gould foresaw in the mid-1960s, the boundaries between the roles of "composer," "performer," and "recording engineer" have become increasingly blurred.' (2018, 59) Similarly, Cutler believes that 'recording places the emphasis firmly on performance, & optimally indeed is a medium of composition for performers' and recording 'strongly favours the reuniting of those two roles' (1985,143). According to Cage, 'a composer is simply someone who tells other people what to do. I find this an unattractive way of getting things done. I'd like

our activities to be more social and anarchically so' (1967, ix). However, a composer of fixed media music is not telling 'someone' (the performer) what to do, but instead doing it themselves. Composing fixed media music is emblematic of a DIY (do-it-yourself) approach to music making. From developing the ideas, executing those ideas by recording or generating the material – which sometimes involves making new instruments or computer programs – to developing, processing, structuring, editing, mixing and mastering: all is usually done by the composer alone. All of these tasks involve using technology and require a certain level of technical skills. It is often the case that the public presentation of the pieces is also undertaken by the composer. Therefore, in fixed media music, we can truly observe the mingling of the roles of composer, performer and 'technical engineer', as Gould suggested above.[6]

In fixed media electroacoustic music, the processes of performing and composing are intertwined. The composer in general 'performs' their own musical materials by generating and structuring them concretely and directly onto the medium. As Cutler confirms, composers of concrete music 'had become performers - & with a new instrument: the media of electronic transformation, recording & reproduction of sound' (1985, 141). On the other hand, the composition continues into the performance phase, by actualising the piece under the circumstances of its public presentation, which often requires taking decisions that could be described as compositional. According to the composer Jonty Harrison, sound diffusion (see below) 'is, in a way, a continuation of the compositional process' (2013, n.p.). In other words, the composition is finished or completed at the moment of its presentation. In Chapter 3, I discuss a way of working that I term *post-mix*, where indeed a composition made in a higher number of channels than those to be used in the concert presentation is adapted to different performance circumstances by extending certain compositional decisions into the presentation itself.

Cutler discusses the ideas and ambitions of electroacoustic music pioneers, stating that '[a]lready in the '20s & '30s Varèse, Eisler, Honegger & others had begun to dream & write about machines which could directly realise their compositions without involving troublesome, inexact musicians at all. *But there is another way of understanding this: at a functional level composers wanted once again to become performers*' (1985, 140, my emphasis). This statement resonates with my personal experience as a composer who simultaneously wants to be a performer. Many years ago, during my music studies (when I was performing casually) I realised that I did not want to be a performer. For me, there was nothing exciting about it, as many performers might claim – it was a rather stressful and draining task. I found being a composer a much more personally appropriate approach; I could stay behind the scenes, be creative, take my time, reflect and make music 'outside time'. Emmerson points to these two different modes of music making (inside and outside time), stating that:

> In the traditional studio a composer's choice might take hours of listening to alternatives, finely tuned variants, including pathways well trodden, yet might still result in a work which is lively, surprising, fresh and unexpected to the listener. (2007, 26)

Similarly, the composer Andrew Lewis observes that composing fixed media music in studio allows for:

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[6] Of course, this does not amount to being 'social' and 'anarchistic' in Cage's sense. However, the medium of electroacoustic composition is in fact open to collaborative approaches, for example when a number of composers contribute material to a collective work. Cage's own electroacoustic composition *Fontana Mix* consisted of a 'score' of instructions to be realised in the studio by someone else who would take a role analogous to that of a traditional performer of a notated score.

> transforming ephemeral, transient detail into permanent, significant detail. Its ability to do this has nothing to do with real-time processing, but arises precisely from the possibility of engaging with sound out of real time. It allows us to ponder our sounds, to reflect on them, to put them under a microscope, to thoughtfully consider their possibilities and to search diligently within them for the inner life they may contain. (2014, n.p.)

In what follows, I will discuss how this outside-time performativity manifests itself in the composing process.

1.2.1. Performativity in the composing process

According to the media artist and writer Joe Milutis, in the case of fixed media music 'the spirituality of the performer, if there was one, was hidden away in the compositional process, and not monkey-suited in the concert hall' (2008, 71). Apart from the fact that this statement once again fails to recognise the performative aspect of the recorded material in the presentation of the music, it accounts nevertheless for a performative agency embedded in the composing process. The performative component of fixed media electroacoustic music can manifest itself in various manners from the earliest phase of composing. For instance, in my own practice, I literally *play* the musical instruments in order to produce the desired sound material for constructing the composition. Of course, many other composers have done that as well. For instance, Iannis Xenakis played a mouth organ (as one of the sound materials) for *Bohor* (1961), and, for *Source Signals 2* (2021), Kees Tazelaar played electric and acoustic guitars as the main sound material for the piece. Comparable performative qualities can also appear in the interactions with analogue or digital equipment which might be utilised in producing (or transforming) sound. Emmerson (2007, 25) discusses Schaeffer's vision and desire for a new instrument in the analogue studio which could be 'played' by the composer. Schaeffer envisaged an organ which was in fact a 'disc-based sampler' controlled by a keyboard: 'an enormous instrument capable not only of replacing all existing instruments, but of every conceivable instrument' (Schaeffer, 1952, 15–16). Emmerson observes that, as such, '[t]he finished work instantiates an idealized *performance* – only one which did not happen at one particular time' (2007, 25). Harrison explains how performativity was part of working in the analogue studio, and the fact that performative gestures continue to manifest themselves in the digital workflow.

> The manipulation of sound materials was, historically, a physical, manual process - it was, in other words, "performing" in the studio. Even though this is now often done via digital surrogates, our aural understanding of the essential "physicality" of performance gestures in shaping musical utterance remains intact. Thus we can assert that elements which we would readily associate with performance were and remain embedded in the composition of musique concrète and its descendants. (1999, 4)

Harrison underlines the amalgamation of composition and performance practices in creating certain musical materials, because of technical limitations:

> Indeed, I'm not entirely sure where composition stops and performance begins. We are now so used to having limitless numbers of audio tracks that we forget that composers

> not so long ago had to do multiple sub-mixes to achieve complex textures and events — and that meant performing those sub-mixes in the studio, in real time, over and over again until they got them right. (2013, n.p.)

In an interview from 1997, Bayle highlights the relationship between his body and the studio, and talks about a period in which he was working while standing and another period while sitting, and that this change had a an effect on his musical output.

> I have now entered a period where I want to hold the hand of the listener. That is to say, I want to make a music in which the listener can feel the body. The body is the instrument now, or more specifically, the gestures of my hands. […] Like a painter, my music is also the product of my hands, ultimately. My spirit selects and saves what my hands do, but it is the hands that perform the work. These imperfect gestures shape the sound's morphology, and serve as signs to the listener. (1997, 17)

Similarly, Manning explains the workflow of using tape machines in analogue studios and the performative qualities which emerge from that process:

> The freedom to start and stop recorders at will, while at the same time dynamically regulating the amplitude levels of these reproduced materials, cultivated an art of performance in the realisation of works which is very remote from any of the practices normally encountered in the highly integrated world of the digital computer studio. (2006, 84)

This performativity might be different when utilising computer-based programs from what Manning describes for analogue equipment. Nevertheless, it is still present in the form of mouse and keyboard interaction, (midi) controllers and so on. In my own composition practice, besides playing instruments and recording them, performative actions can also appear in the form of controlling the parameters of the Max/MSP patches (with certain gestures) via knobs, buttons and faders, in a similar fashion to an analogue studio.[7] Of course, the design of computer-based environments is influenced by the same ergonomics as were previously realised in 'concrete' form in the analogue studio. Karlheinz Stockhausen believed that the composer is already acting as an interpreter in the case of fixed media music:

> The attitude toward making music is in the case of prefabricated music radically different. One writes as a composer and interprets as an interpreter, because of wanting to produce something that should remain valid once and for all and is not repeatable. So, you make a tape, like a sculptor or like a painter ... You worry to high heaven out of concern for the sonic reality. (1996, 91)

However, Stockhausen does not acknowledge how dramatically this 'sonic reality' changes in various circumstances when the music is presented in public. Manning discusses (2006, 90) the case of 'reproducing' Stockhausen's *Studie II* from the score (without the composer's collaboration) at Elektronmusikstudion (EMS) in Stockholm (1971), in order to supposedly create a 'better' version, which Stockhausen rejected as 'awful, a farce to say the least' (Tannenbaum

[7] Max/MSP is a visual programming language for music and multimedia developed and maintained by software company Cycling '74. It is a common tool for electroacoustic musicians to generate and manipulate sound for live and studio purposes. https://cycling74.com/products/max

1987, 22).[8] Manning discusses the possible reasons for this, and underlines the importance of tiny variations in cutting and splicing which determine the composer's relationship to the material. He continues that '[s]imilarly, the manual control of amplitudes introduced subtleties of interpretation unique to the composer, which cannot be deduced from the score' (2006, 90). In the early years of electronic music, the composer would often provide a 'recipe' to be realised by studio technicians. However, by the end of the 1950s this practice was already abandoned, which may indicate a greater importance of the details of the production process than was apparent at first.

Chagas describes Stockhausen's approach in working with the equipment in the WDR studio, and specifically mentions Stockhausen's insistence on controlling the mixing desk himself. Chagas concludes that:

> This gestural approach of electronic music production is an essential aspect of his aesthetics; the composer plays with the machinery of the studio in dialogue with the technicians and assistants. […] The electronic studio was for him [Stockhausen] a model of a performance situation; the listening experience has to be constantly actualized in order to adapt the compositional ideas to the production conditions in studio including technique and space. […] He envisioned the production of an electronic music work in studio as the result of a live performance with musicians and technicians playing with musical apparatuses. (2014, 190-2)

Also, in the case of *Octophony* (1991), Stockhausen discussed the process of spatialisation where '[c]omplicated motions were separately regulated by hand, stored in a computer, and recalled in rhythm for the recording' (1993, 152).

Examining in detail all these various manifestations of performative agency in fixed media music composition requires a thorough investigation, and is beyond the scope of this research. Nevertheless, through the examples outlined above, I underscore how performative agency can already be embedded in the composition process. I do not conclude that the studio is like a musical instrument to be 'played'. What I am trying to highlight here is the performative qualities which emerge during the process of composing fixed media music, in interaction with the equipment in the studio; in other words, traces of the composer's (bodily) presence in the work. Such qualities are consequently reflected and captured in the recorded material and, most likely, will be perceived by the audience as well. As such, a performative agency in the context of fixed media music, can be considered to be embedded in the composition. This suggests that we can understand performativity as a flux between the composition and the presentation stage.

1.2.2. The performer in fixed media music

Applying the term performer in the context of presenting fixed media music has been controversial given the prerecorded nature of the music. It is no secret that the performer of fixed media music is not producing the music on the spot, and there is also no reason to try to pretend otherwise. Questions might arise as to the appropriateness of the term 'performer' in

[8] The score of *Studie II* (1954) is in fact a precise instruction of how to (re)create the piece in the studio.

this case, or whether the term may be broadened in order to accommodate new forms of agency. Can the definition of performer be opened up to embrace new forms of musicking? It is true that performing in the context of music is traditionally associated with 'primary (or direct) causation' (Godlovitch 1998,97) which involves manual dexterity in generating sound, like what an (acoustic) instrumentalist does. In the history of new music, as discussed by Auslander (2023, 114), pieces such as *4'33''* by Cage already challenged the role of performer (and even the definition of music). Electroacoustic music, however, brings still newer challenges to the notion of the performer, by offering new ways of producing sound. Electronic instruments and computers used in live performance give rise to a secondary causation (Godlovitch 1998,97), in the sense that the sound is produced indirectly via controlling the interface of a synthesizer, or a computer program, which results in sounds coming out of loudspeakers. Emmerson maintains that a live performer can also be the one 'who does not mechanically cause the sound, yet who may cause, form or influence it through electronically mediated interfaces under their immediate control' (2007, 90). Many studies have been carried out on the agency of electroacoustic music performers and the concept of instrumentality where the input effort and gestures of the performer and the resultant sonic output are not always correlated in a one-to-one correspondence (d'Escriván 2006). The composer Julio d'Escriván argues that the generation familiar with these new technologies, is not necessarily tethered to the 'efforted-input paradigm':

> Those who have been brought up with personal computers and video games could be more open towards effortless performances […] What is certain is that our appreciation of performing skills has widened to accept all kinds of live music-making as valid […] If the music captures our imagination, it does not really matter whether the laptop musician is sweating. (1996, 188-190)

The composition process in fixed media music also involves secondary (and even primary) causation to produce the sound materials, but when it comes to its presentation, the agency of the performer is yet different from that of live electronic performers. Here, the 'labour of sound production', as John Croft puts it (2007, 60), is eliminated from the act of performing, and this situation is fundamentally different from that of the primary or secondary causation mentioned above, since there is simply no sound production taking place, either direct or indirect.

Regarding technological advances and emergent new aesthetics in music making, Auslander (2023) suggests a new paradigm of musicianship which transcends the traditional instrumentality. He concludes that:

> it is not necessary to produce sound through direct physical agency in the manner of a traditional instrumentalist or even a turntablist to be considered a musician. The category of musician can also encompass those who in some way manipulate or manage sounds they did not create or possibly did not even select. (2023, 114)

Such a definition of a performer who manipulates and manages sound without being its creator closely resembles the role of a fixed media music performer who works directly with the sound files and gives these materials what they find to be the 'proper' sonic actualisation. Oliver Bown, Renick Bell and Adam Parkinson (2014) discuss the role of performers in the context of laptop musicians, and propose a paradigm shift in our understanding of performance by the

introduction of computers in performances. As such, they foreground the importance of the bodily presence of the performer, stating that:

> Even if doing nothing or even faking, the essence of their performance lies in the fact that they stand on stage, in control, and with all eyes on them, and thus avail themselves to an analysis of performativity. (2014,14)

This view highlights the accountability of the performer – regardless of what kind of activity they do – as the one being *in control* and *responsible* for the musical experience of the audience. Following that line, what a performer of fixed media music does can perhaps be compared to a conductor, who shapes and controls the sounds of an 'orchestra of loudspeakers', and is in charge of the emergent musical result and the manner of its unfolding. A conductor and a performer of fixed media music are both 'silent musicians' in the sense that they do not produce any sound themselves at the concert. Until the mid-19th century, the fundamental task of a conductor was to keep time, like a metronome (Neuman 2021, 4), although in fixed media music, ironically, timing is one of the most rigid musical elements of the composition and is out of the performer's control. Of course, the role of conductor has evolved since the 19th century, and goes far beyond being a 'timekeeper'. Nowadays, it encompasses a wide range of diverse activities, from programming and learning the score to auditioning and management. In his book *The Silent Musician* (2018) the conductor Mark Wigglesworth discusses the role of a conductor and the intricate relationships they have to maintain in regard to the composer, the score, the orchestra as an organisation, the musicians as individuals and of course the audience. Eventually, this comes down to the conductor being responsible for the emergent musical experience, and for establishing the *right atmosphere*. This is quite similar to what a performer of fixed media music is supposed to do; *to make sure that the audience has the best possible experience of the music*. Performing fixed media music is not as established a role as conducting. Nevertheless, like a conductor, besides balancing and shaping the sound of the 'loudspeaker orchestra', a great deal of their activity takes place far in advance, prior to the concert moment, in form of planning, practicing, preparation and rehearsal. They need to study the music in order to realise what it demands musically and technically. Accordingly, they need to design a sound system in relation to the venue and the music (and perhaps the audience). For instance, even deciding about the concert venue, or deciding on how to arrange the audience area, is an artistic/musical/interpretative choice. In my experience this is sometimes a matter of compromise. The available choices – with respect to the space and the equipment – are sometimes not as broad as one might like. With creativity, the performer should try to make the best out of the available resources, in order to achieve the ultimate goal: creating a meaningful experience for the audience. When I perform my own pieces, I do feel as if I am 'conducting' – specifically, the extensive presence of instrumental material in my compositions literally evokes such a feeling. I believe that conducting offers a useful analogy to explain what a performer of fixed media music does.

While being a 'silent musician', physical skills can still be relevant. A conductor is required to learn certain skills, for instance how to hold the baton and move their hands (and body) (Wigglesworth 2018, 29-30). Similarly, a fixed media music performer needs to have the required skills in managing all the inputs and outputs on the mixing desk during the concert, which can be quite demanding (specifically regarding works with a higher numbers of channels), and they should be able to react instantly as the music unfolds. Given that manual dexterity in performing fixed media music is not at the same level as that of an instrumentalist,

what is the relevance of virtuosity? Apart from the fact that sound diffusion can become a virtuosic act (see below), the composer and researcher Gerriet K. Sharma (2017) looks at it from a different angle, and suggests a definition of virtuosity beyond the physical dexterity of a performer on an instrument. He explains that virtuosity, in fact, indicates transcending the instrumental difficulties and techniques, in other words, making seemingly impossible things possible. According to this view, moving sounds in the space, which is the result of technological and artistic capacities, can be considered a virtuosic act.

> Virtuosity has then shifted from bodily effort to the knowledge and spatial practice of a deepened interdisciplinary scientist-artist collaboration as an act of mutual translation of different languages, technical abilities and spatialisation before the actual performance, digitally stored to be later performed within the "virtuous" interplay of loudspeaker arrays projecting sound and the conditions of the listening space. (2017, 6)

Similarly, Dellaira considers the technological advances in music as a virtuosic attribute.

> One thing is certain: the driving force behind each and every technological advancement was to make a wider range of sound available – more pitches, greater dynamics, richer timbres – with easier effort. And that meant greater range [sic] could be explored and exploited by instrumentalist and composer alike in the creation of more intense illusions. Technology thus collaborated with the composer in defining the virtuoso as the one who could bring off these illusions. In a sense, then, the history of music technology parallels the history of virtuosity. (1995, 202)

Perhaps we can also consider a listening virtuosity, again like a conductor (or better, like all musicians): the ability to listening to all the nuances of the music while unfolding in the space and reacting to them if necessary requires what could be called a listening virtuosity.

1.2.3. The art of sound diffusion[9]

'Sound diffusion', used as an idiomatic term, denotes a particular practice in the tradition of presenting fixed media music where the 'sound diffusionist' projects a stereo signal over a larger number of loudspeakers (usually of different types and differently positioned) in the hall, as a performative act. As François Bayle explains, the Acousmonium was inspired by a symphonic orchestra 'with its standardised ordering, arranged for the best acoustic effects by groupings of instruments and levels of intensity (strings, woodwinds, brasses, percussion).' (2007, 242). This practice partially stems from the limitations of the sound technology in the past, such as the limited dynamic range of magnetic tape, which necessitated a compensational act during its performance by making the loud parts louder and the soft parts softer (Harrison, 2013, n.p.). According to the composer Denis Smalley '[s]ound diffusion is the projection and the spreading of sound in an acoustic space for a group of listeners – as opposed to listening in a personal space (living room, office, or studio). Another definition would be the "sonorizing" of the acoustic space and the enhancing of sound-shapes and structure in order to create a rewarding listening experience' (Austin & Smalley 2000,10). Harrison describes sound diffusion as an

[9] The term *projection* is also common in this context. Bayle indicates the analogy between the sound *projection* and stereo *image* in our technological age (2007, 243) On the other hand, Harrison argues that the term 'diffusion' is more appropriate in view of the physicality of sound and how it propagates (diffuses) in space (1999, 125).

'active intervention to enhance the sound image(s) on the storage medium and to render those images more "readable" in a space' (Harrison, 2013, n.p.).

Preserving and enhancing the 'stereo image' is therefore one of the main motivations for sound diffusion. As Smalley explains '[o]ne reason why an art of diffusion emerged was the need to expand the stereo image and to project it effectively in a large space' (2007, 12). The stereo image refers to the virtual sound field constructed between the two loudspeakers, based on interaural time differences (ITDs) and interaural level differences (ILDs). This image is best perceivable at the 'sweet spot', which is normally thought of as the third apex of an equilateral triangle formed by the two loudspeakers and the listener. According to Harrison '[e]ven on a good hi-fi system, with the listener in the sweet spot, the stability of the stereo image is notoriously fickle — turning or inclining the head, or moving to left or right by just a few inches, can cause all kinds of involuntary shifts in the image' (Harrison 2013, n.p.). In other words, these movements disturb the integrity of the sound field by altering the ITDs and ILDs from the values which have been incorporated into the music at the time of composition. As such, with only one pair of loudspeakers in a large concert hall, at best only a limited number of audience members in the centre of the hall perceive the 'correct image'. To address this issue, multiple loudspeaker pairs were added to cover more of the audience area. Accordingly, in the case of BEAST, mentioned earlier in this chapter, each pair is described in terms of its positioning and the resultant sound quality, such as Main, Wide, Distant, Punch, and so on (Harrison 2013, n.p.) Moreover, the application of various types of loudspeakers gives rise to different 'characters' which can be used as yet another interpretational tool.[10] This approach results in a multichannel sound system controlled via a mixing desk, so that the stereo signal may be sent dynamically to any of the loudspeaker pairs.

Such a multichannel sound system is therefore utilised to project and maintain the stereo image, firstly in order to cover the whole listening area (so that most of the audience can perceive that image correctly), and secondly in order to enhance, exaggerate and manipulate this image as a performative/interpretative act. In other words, such practice involves *corrective* and *expressive* agential acts (Stansbie 2013, 46) In this context, the *lower* channel number of the source (often stereo) gives *more* flexibility in the sound diffusion performance, and hence more latitude for interpretation. It is important to note that the approach of such a multichannel sound system is essentially quite different from a multichannel sound system which is meant for *composing* multichannel music, where the source material itself consists of multiple sound files, and the positioning and character of those loudspeakers are taken into account at the composition stage, or as a compositional strategy (see Chapter 3). As such, sound diffusion perhaps could be considered as 'performed orchestration', as opposed to 'composed orchestration' where the music has been composed in more than two channels in the studio. Such 'gesture enhancing' actions on the mixer are in fact very limited in comparison to what can be composed in a multichannel format.

I clearly recall my first experience of attending the Acousmonium concert during the Composing Spaces symposium (2013) in The Hague, where 'sound diffusers' were performing pieces from the GRM repertoire. Some of them in fact had been trained as sound-diffusion performers only.

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[10] According to Simon Emmerson, '[w]e may try to describe this in terms of technical quality – scientifically measurable parameters of frequency response, dynamic range, transient handling, directionality and so forth. Alternatively we may resort to a range of verbal attributes which are much less easy to define, such as 'punch' ,'colour' ,'clarity' ,'warmth' even 'honesty' which seem to convey something of this character' (2007, 147).

After a couple of performances (regardless of the musical content), the limitations of such diffusion practice became apparent, in terms of a limited number of movements and gestures that can be made with a stereo signal. The fact that only ten faders can be controlled simultaneously is a natural limitation – assuming that each finger can operate independently. And of course the input source consisting of only two channels is another limitation. At times, a disjunction between the musical content and the performative acts was noticeable: more or less similar gestures and strategies were applied to various pieces, which would sometimes overshadow the music and turn it into an acrobatic act. For instance, repeating the gesture of moving the stereo image from front to back and vice versa in the concert venue ('washing over the audience' so to speak) rapidly became a cliché. Nevertheless, attending the premiere of *Huellas Entreveradas* by Beatriz Ferreyra in Berlin (2019), where she performed her stereo piece over a 10-channel sound system, I could not believe that I was listening to a stereo piece. Here the sound diffusion seemed to be serving the unfolding of the music in the space, displacing various musical elements at different moments, rather than just moving sound in the space. However, as she explains in the audiovisual dissertation, she did not consider it herself as 'a performance', and she did improvise it rather than preparing it in advance, having spent a great deal of time during the soundcheck walking through the venue and listening from various positions to have an understanding of how the music sounds in the space, which of course is also informed by her extensive experience in working with different sound systems in different spaces. As the various contributions to the audiovisual part of this dissertation show, there is no consensus as to how to conceive and describe the act of sound diffusion and how it relates to the concept of performance.

The practice of sound diffusion often demands a high degree of physical skill. In fact, watching a sound diffuser while performing can be quite fascinating. The dexterity in moving fingers on the faders (almost like a piano player) brings sound diffusion practice back to the realm of traditional instrumentalism and virtuosity. Here, the physical skills of the performers have a direct and huge effect on the musical results. As such, the agency of a sound diffuser might fulfil a nostalgia for traditional skill-based performativity. As John Croft remarks, 'the demand for a connection between bodily effort and acoustic output is a form of nostalgia for a traditional form of musical performance' (2007, 63). On the other hand, the composers associated with this tradition are accustomed to taking into account, during the composition process, the kind of performative/interpretative actions that the performer might wish to execute. For instance, a sustained drone-like sound is an invitation for the performer to move it around the space. Or a sound object with a 'distant quality' (lacking high frequencies) might be placed on the 'distant pair' of loudspeakers to further exaggerate this effect. Or, similarly, energetic and active musical materials might suggest rapid movements in the space. Smalley explains that when he is composing, he is constantly considering the possibilities of the art of diffusion in terms of dramatising gestures, clarity of image and so on.

> For example, if I have a texture that's bustling around, I might try and make it bustle more by changing its perspective, possibly using sets of frontal loudspeakers so that the image might expand or contract and maybe also play with a little distancing depending on the nature of the texture. (Smalley 2007, 17)

Sound diffusion can be done in an improvised manner (like Ferreyra), or it can be fully 'composed' where the composer (or sometimes the performer) makes a so-called 'diffusion score' to indicate what has to happen in terms of diffusing the sounds in space as well as giving

instructions for controlling the dynamics. Examples of such diffusion scores are Trevor Wishart's *Red Bird* (1978) and Smalley's *Valley Flow* (1991).

Sound diffusion systems (such as Acousmonium and BEAST) nowadays also include multichannel arrays, but the approach stays more or less the same, and the influence of the stereo approach remains dominant. Harrison considers multichannel composition limiting in comparison to the flexibility of stereo diffusion, and does not regard it as an advancement. He asserts that if such a multichannel system is used for multichannel composition, then:

> The flexibility offered by stereo diffusion to deliver images that are close, intimate, diffuse, distant, high, etc., by using multiple pairs of loudspeakers is, ironically, sacrificed in the name of progress. (2013, n.p.)

He explains what he considers to be the problem with multichannel composition (specifically 8-channel) in relation to the 'image', and asserts that multichannel pieces require a particular configuration, which is according to him a restriction:

> The sonic images [in multichannel compositions] I discussed earlier are composed with that specific speaker set-up in mind, and any other configuration creates an immediate distortion of the images, or even their complete destruction. (2013, n.p.)

In the case of Jonty Harrison's music this is the case, in contrast to other composers including myself. It greatly depends on the material and the composition strategies. If, for instance, the goal is to move a virtual sound source precisely in a certain trajectory within the multichannel setup, indeed most probably the 'image' (or that trajectory) is distorted (or destroyed) when projected through a different loudspeaker arrangement. But in many other cases, the result would be a variation of that 'image', or better, a different musical quality which is not necessarily inferior. It becomes a different actualisation, and that difference can be turned into an interesting musical element to work with. This is exactly what makes the adaptation of a composition for a new arrangement interesting, and gives rise to new actualisations, which is where, as mentioned above, the roles of performer and composer blur. Moreover, in the same way that a piece for string quartet requires four string players, and a symphony requires an orchestra, a multichannel composition requires a certain sound system for its presentation. Nevertheless, a string quartet or orchestra might be differently arranged on stage in different performances: for example, some conductors prefer to seat the second violins of an orchestra behind the first violins, while others place them to the right side of the stage opposite the first violins. The same kinds of considerations apply to the placement of loudspeakers in a performing space.

BEAST's approach to addressing this issue was to add multiple arrays of eight channels each (a similar approach to adding more stereo pairs), in order to form and shape the image and foreground the gestural behaviours of the music. Emmerson explains Iannis Xenakis' approach to using loudspeakers by stating that they were 'a key building block in Xenakis's increasingly complex polytopes – an absolute point in space from which an individual soundstream would contribute to the statistical whole' (2007, 160). Such an approach is in line with his instrumental music, where individual instruments (as points in space) are frequently used to create a dense polyphonic texture – for instance, in *Terretektorh* (1966) where 88 orchestral musicians are distributed throughout the performing space. Similarly, in his electroacoustic pieces 'the loudspeaker becomes an agent in a mass of agents, its character subsumed into the essential

group activity. This engages perfectly with Xenakis's interest in granular synthesis: the loudspeaker here acts not as a virtual source of a "stereo image" but as an individual source within a mass of sources' (Emmerson 2007, 160). Obviously, the approach taken towards utilising loudspeakers depends to a crucial extent on the composer's musical intentions. In Chapter 3 I discuss my own approach to composing for multichannel setups, and I explain why the latter approach (such as that of Xenakis) offers greater possibilities in composing and performing fixed media music.

While the practice of sound diffusion attempts to foreground performativity by bringing the role of the sound diffuser closer to that of a traditional instrumentalist with their extensive interpretative skills, it is at the same time compositionally limiting in the sense that the affordances of the multichannel setup in the composition are sacrificed in the name of the flexibility of a stereo image. For instance, *spatial polyphonic* possibilities are greatly reduced when only two channels are used. It is important to note that many of the activities and approaches mentioned above are not specific to the 'art of sound diffusion'. For instance, actively controlling the dynamics as the piece unfolds, or extending the dynamic range if necessary, as well as utilising loudspeakers with various characters and positioning, are all common tools for presenting multichannel music as well. What I describe here as 'sound diffusion' is the historical approach (as seen in many sound diffusion systems) which is centred on the notion of a stereo image, and the fact that such an image requires 'spatialisation' as a performative/interpretative act rather than just being played back in its original form. Sound diffusion might even be said to have given rise to different identifiable styles, for example 'the Montreal school, which often relies on front-rear movements' (Boutard 2019, 105). There also exist events where sound diffusion artists compete for a prize, indicating the extent to which this practice has become a tradition with its own identity and rules.[11]

As discussed in the beginning of this chapter, the necessity and urgency of active control when presenting 'recorded' music for an audience was present from the very beginning of the history of electroacoustic music, and the art of sound diffusion was born naturally out of that necessity. As the composer and former director of the GRM Daniel Teruggi underlines, the Acousmonium is a long-term development of the concept that 'music should be controlled when presented to an audience, thus creating a performance situation' (2007, 218). While such concerns are still absolutely reasonable and valid when presenting fixed media music to an audience, the performance practice of fixed media music – or the agency of the performer – might be better considered in a much broader sense, especially because many of the technological limitations in sound reproduction systems of the past have been eliminated, and multichannel sound technology is much more widely available and affordable. Furthermore, the understanding of performativity by audiences has evolved in the meantime, and is no longer limited to that of traditional instrumentalism.

[11] For example 'the spatialized interpretation competition' at the L'Espace du Son festival (https://www.lespaceduson.be) which takes place annually in Belgium and is focused specifically on the practice of sound diffusion, and includes a sound diffusion (interpretation) competition where 'sound projectionists' compete in presenting the best interpretation.

1.2.4. Composing for the Acousmonium

In 2013 I had the opportunity to take part in a workshop on the Acousmonium, and I composed a piece (*Gereh II*) for it, which was presented using that system some months later during the Next Generation festival at ZKM (Zentrum für Kunst und Medien) in Karlsruhe.[12] When I first listened to all those various loudspeakers with different characters and positioning, I thought of actually composing a (multichannel) piece which integrates all of them (not necessarily at the same time), instead of making a 'performed orchestration' by moving (or duplicating) a stereo image during the performance. Eventually, I made a compromise and composed the piece for eight channels. Despite the fact that the Acousmonium had eight-channel rings in the system, such a multichannel approach proved not to be convenient, since the arrangement of the Acousmonium is mainly in terms of left and right pairs, which complicates the process of working with 8-channel pieces.

I aimed for an idea whereby I could explore or integrate sound diffusion within the composition itself, since this approach was suggested by the nature and history of the Acousmonium. My idea for the piece was to repeat similar musical material (a dense texture consisting of short percussive sounds) multiple times, and in each iteration to *diffuse* the material onto a different group of loudspeakers. In this way, I intended to foreground the different characters of the loudspeakers and to delineate how those characteristics affect the same sound material. I left a little bit of silence in between each iteration, in order to isolate them more clearly. These silences had another practical function, which was to create a moment to move the sound (faders) to the next group. This is a clear example of how the use of a particular sound system affects a compositional strategy. And, conversely, how the composition takes into account the performative strategies (in this case, by leaving a moment of silence for moving the faders). In practice, though, the fact that most of the Acousmonium's loudspeakers were situated on the stage had the effect of limiting the articulation of the differences between the loudspeaker groups.

In retrospect I would say that, although my diffusion strategy was working well, and although I was indeed performing an important proportion of the compositional ideas through sound diffusion during the concert, I could have achieved much more elaborate textures and intricate relationships if I had had the possibility to compose for all the loudspeakers with separate inputs. This approach, however, is discouraged by guardians of the Acousmonium aesthetic who tend to regard it as going against the intentions of its designers, as I found in the course of attending a workshop on this system. Later on, I made some changes to the piece to make it more suitable for 8-channel configurations. However, I left the silences intact since they also served aesthetic purposes. I performed this piece in many other occasions with various sound systems and arrangements, and in the end I was more content with the final 8-channel version because of its more elaborate *spatial polyphony* which is concerned with simultaneous musical events taking place in various points in space (see Chapter 3). Nevertheless, I tried to utilise various loudspeakers with diverse characters whenever these were available, in order to highlight the compositional ideas I had originally intended.

[12] https://zkm.de/en/about-zkm

1.3. Public presentation of fixed media music

> A concert is a communal event, and the connections that a great performance weave through all who hear it are its most valued purpose. (Wigglesworth 2018, 194)

One of the crucial aspects distinguishing fixed media music from other recorded music is its public presentation in the form of a live event, which aims to encourage a dedicated and focused listening experience. While most recorded music is tailored to the purpose of individual listening – for instance, by bringing something like a concert hall experience to private spaces such as a living room, car or headphone space (which can coexist with any other space) – in the case of fixed media music the audience comes together in a concert venue to experience this 'fixed' (recorded) music in a 'live' (concert) event.[13] This gives the public presentation of fixed media music a peculiar character compared with more traditional concert forms and with most other experiences of recorded music. Fixed media music is often composed with the intention to be experienced in a live setting – in the here and now of the concert situation. Therefore, this collective listening ritual, in turn, inspires and affects the composition process, by causing the composer to be aware and deliberate in thinking about how their music is going to be presented in a concert setting. Such questions are probably more consciously addressed by the composer of fixed media music than by the composer of traditional instrumental and vocal music, who might more often take for granted the circumstances under which their music will be heard by an audience, that is to say on a stage in a concert hall of a certain size, shape and acoustic, as if these circumstances are neutral and transparent, which of course they are not.

One of the reasons for a public presentation of fixed media music is the application of a space as a musical parameter, either as a compositional or a performative aspect of the music, or both. As a result, the physical space becomes an integral part of the presentation of the music, since the spatial characteristics incorporated in the music need to be manifested as clearly as possible in the actual space. As the musicologist Gascia Ouzounian explains, in the context of spatial music, such 'awareness [of utilising space] compelled compositional methodologies that accounted for many individual listeners instead of a single "body" of listeners' (2013, 76). Each of these individual listeners has their own perspective on the music, which is one of the most interesting aspects of listening to multichannel music, and which will almost inevitably be a strong influence on a composer's conception of the music. For example, the notion of a 'sweet spot' is no longer relevant – each sitting position in the venue offers a unique and specific 'mix' of various sound sources. This highlights the importance of the listening experience of a piece of fixed media music in the concert hall. According to Ouzounian, '[t]his was an important step towards locating the value of a musical work not only within the abstracted medium of the score [or in our case the sound files], but in the *actual*, experiential dimensions of listening' (2013, 77, my emphasis). While most vocal/instrumental music will be experienced as emanating from a stage in front of the audience, it is frequently the case that the audience for a piece of multichannel fixed media music will hear sounds from either side, from behind and even from above, and their experience will be of occupying a particular individual position *within* the music rather than a more generalised position outside it. Similarly, the composer Emma-Kate Matthews (2019) in her article 'Activating Audiences: How spatial music can help us to listen', explores the relationship between architecture and music, and compares the more conventional frontal 'stagebound' setting in concert halls to a spatial one where the audience 'inhabits' the music.

[13] This can be any type of space, traditional or nontraditional (a warehouse, an old factory, and so on) concert venues.

She observes that '[s]patial music reminds the listening audience that they are implicit in the act of listening. The audience are occupying the space and they are occupying the sound' (2019, 299). Matthews argues that listening in such a situation demands a higher degree of involvement and thus gives the audience a more active agency. Connected to his idea, the American composer Charles Ives maintained already decades before Matthews that in music which simultaneously consists of various 'rhythmic, melodic, harmonic schemes, the hearer has a rather active part to play':

> the listener may choose which of these two rhythms he wishes to hold in his mind as primal.... As the eye, in looking at a view, may focus on the sky, clouds, or distant outlines, yet sense the color and form of the foreground, and then by observing the foreground, may sense the distant outlines and color, so, in some similar way, the listener can choose to arrange in his mind the relation of the rhythmic, harmonic and other material. (Harley 1997, 75)[14]

Spatiality in music can also increase the emotional involvement of the audience. In a thorough experiment on 40 participants listening to various types of electroacoustic music, the composers Federico Schumacher Ratti and Claudio Fuentes Bravo conclude that spatiality is a property of sound that 'seems to play a central role in both cognitive and affective processes of empathy' (2017, 403).

This individual experience takes place within the context of collective listening (the bodily presence of fellow listeners), which, therefore, sits at the heart of fixed media music-making practice. As the composer Eric Lyon explains,

> Music for large numbers of speakers also commands a social presence that stereo music does not require, since spatial electroacoustic music must be performed in special venues with appropriate multichannel sound systems, whereas much stereo electroacoustic music could be fairly appreciated at home on a good stereo system. (Lyon 2014, 2)

Compositional/performative strategies such as *spatial polyphony* or *post-mix* (discussed in Chapter 3) are emblematic of such approaches. This reciprocal impact of the listening situation and the musical intentions embodied in a composition gives rise to a *performance practice* in fixed media music.

1.3.1. Corporeality in fixed media music

In their article 'Analyzing from the Body', musicologists George Fisher and Judy Lochhead observe that '[r]ather than conceiving of meaning as a mental construct shaped entirely by linguistic concepts, many thinkers [such as Maurice Merleau-Ponty and Michael Foucault] have focused on the body as a central focus for the constitution of meaning and understanding' (2002, 38). In the context of musical performance, this embodiment can be considered in two forms, the corporeality of expression (of the performer) and the corporeality of the perception (of the audience). According to Fisher and Lochhead, 'the performer's body moves when

[14] This remark relates to Ives' approach to spatial separation of the instrumental groups and how he created a polyphonic texture, which will be discussed in Chapter 3.

making music, and those movements provide a strong visual cue to how individuals carry out a performative enactment of musical meaning' (2002, 46). However, the bodily presence of the performer in fixed media music is of a different nature (as discussed above). Here, the performer is *not* producing the sounds as they would be in vocal and instrumental music; their bodily presence is reduced to sitting (or standing) behind the mixer, generally with a minimum of actions. As such, the bodily expressions of the performer are mostly absent (or extremely minimal). Fisher and Lochhead explain that in such acousmatic situations,

> when listeners apprehend musical sound through the non-visual medium of recordings, performative enactment of musical meaning relies on a prior backdrop of experience that allows listeners to imaginatively engage the physical activities that went into its production. (2002, 47)

If I relate their remarks to fixed media music, listening becomes an intense imaginative engagement, whether those physical activities of sound production are based on actual movements and gestures or abstract ones. On the other hand, the bodily perception of the audience is fully at work, specifically within the immersive and complex sound world which results from the way the sound of the music fills the space. In other words, the corporeality of the audience can become a more prominent factor in fixed media music concert situations, so that listeners might concentrate not so much on the corporeality of live performers but on their own.

In any kind of musical presentation, as Godlovitch observes, '[l]isteners … have a central role. In our musical culture, attentive listeners contribute meaning and purpose to much otherwise free-floating musical activity' (1998, 45). Perhaps this could be said even more strongly of fixed media musical presentations. Corporeality manifests itself also in the way the body is situated in a concert venue, which gives a specific vantage point to that body in experiencing spatial music. As the music theorist Karolina Dąbek explains, in such a situation the body becomes the point of reference and the centre:

> It is only in the various variants of spatial music that the centre of gravity has shifted onto the listeners, their own perspective, as well as onto the body in relation to which they perceive and experience the music. (2020,187)

It is clear that bodily presence determines and affects the perception of the music. While perceiving spatial audio, bodily movements can manifest themselves specifically in the form of head movements (which are indeed observable in the audiovisual part of this dissertation). These (micro) movements change the perspective and the spatial cues, and result in a richer perception and localisation of the musical events in the space, specifically in experiencing spatial polyphony (see Chapter 3). According to the composer and writer Gary S. Kendall, '[i]n directional hearing, the front–back distinction is very dependent on the dynamic movement of the head, which clarifies what is in front from what is behind' (2010, 230). Similarly, the music theorist Erik Clarke, in his contribution to the book *Music, Sound and Space*, explains how head movements aid the localisation of lower frequency sounds which are by nature difficult to discern.

> Because low frequency sounds are diffracted ("bent") around the head, reducing the shadow effect, intensity-based discrimination is poor or non-existent below about 500–800 Hz; and phase differences become ambiguous above about 1,500 Hz – although in

> both cases acuity improves with the dynamic cues that come from moving sources and listeners' own head movements. (2013, 93)

This phenomenon has implications for how the different frequency areas of spatial music might be composed and/or diffused. Jens Blauert, in his seminal book *Spatial Hearing* (1997, 178-201) discusses 'motional theories' which are '[t]heories of spatial hearing that describe relationships between the position of the auditory event and the changes to the ear input signals during head movements' (1997, 178). By analysing numerous experiments on various head movements (such as rotating, tipping, pivoting and their combinations) in relation to varying positioning of the sound sources (in the horizontal and vertical planes), he concludes that 'head movements improve the ability to determine the direction of sound incidence' (1997, 190). Rotating movements proved to be more effective than others, while the combination of various head movements gives an even more accurate localisation (1997, 183). According to Blauert, besides the shape of the head and pinna, the vestibular organs and even the receptors in the neck muscles play a role in how head movements help in sound localisation (1997, 190). Again, such considerations are essential to bear in mind when composing and/or diffusing music in which the spatial location or movement of sounds is an important factor.

Fisher and Lochhead claim that 'hearing entails a bodily enactment of musical meaning that links listeners, performers, and creators in the same musical enterprise' (2002, 46). Accordingly, they suggest that 'all hearing is performative', adapting the concept of performativity developed by Peggy Phelan (1993), who states that 'all seeing is performative' (2002, 46). During his residency at the Studio di Fonologia Musicale, Milan in 1957, the composer Marc Wilkinson realised for the first time the importance of body positioning and movement in perception (or, as he puts it, interpretation) of spatial music, which was a novel experience at that time.

> The listener can [perform] the act of hearing. In good conditions, surrounded by a stereophony of sound projectors, his mind will automatically concentrate on different sets of projectors in turn. Each "performance" of the work will bring new visions, for the mind will almost certainly rearrange the sequence of its concentration in space; for that matter, the listener can "interpret" the music by moving about within the confines of the stereophony during performance, thereby consciously creating states of imbalance between the component constructions in sounds simultaneously projected from the different spatial origins. (1958, 48 in Manning 2006, 85)

Wilkinson's discovery of the interpretative potential of moving around within the sound field created by multiple loudspeakers puts the bodily presence of the listener at the heart of the experience of spatial music. Taking Wilkinson's thoughts a bit further, Caleb Stuart suggests a concept of 'aural performativity' which takes place in a mediated, intense and immersive sonic environment where 'causal relationship between what we hear coming out of the loudspeakers and the body of the performer is broken'. As such 'the performer is also a listener. This is especially clear in psychoacoustic experimental music as the bodies of all individuals in the space are receiving different aural information based on their position'. As a result, '[t]he performativity of the music is to be found in the act of listening and the performance of the audience in relationship to the sound they hear' (2010, 64). Although these considerations do not directly apply to music presented to a seated audience, as opposed to a sound installation

where listeners are able to move around, even to static listeners the spatial experience of the music is strongly (if usually unconsciously) influenced by their head movements.[15]

In the course of making a series of compositions based on carpet designs, I drew a comparison between observing (experiencing) a carpet with all its intricate patterns and listening to a complex spatial music where the audience could 'wander' through this complexity and discover its various polyphonic relationships.[16] The idea was based on the fact that Persian carpet designs are in fact representing gardens. As such, a piece of music can also be thought of as a garden — a place in which the listener can be immersed and whose diverse spatial locations and pathways they are encouraged to explore.

> This large cosmos of diverse sounds creates a situation where each listener can explore its various corners and discover the similarities and differences of this sonic symmetric space [see chapter 3], as one would do in observing a carpet, exploring different parts and their relationships. In this way, [in the words of Salvatore Sciarrino,] "what you see becomes less important than how you see". (Anvari 2020, 55)

Here I am not talking about physically moving through the space, but rather – as in Ives's remark – about listeners directing their attention and focus to one or another aspect of what they hear.

1.3.2. Liveness in fixed media music

Being physically present in the concert situation of fixed media music brings about a quality of *liveness* – despite the fact that it is often considered as the opposite of 'live music'. Liveness has often been associated with the presence of human bodies. According to Auslander, the term *live* first appeared in the context of radio production (in the separation of the auditory and the visual) in order to 'distinguish live performances from the playback of recordings heard over the air' (2023, 81). Paul Sanden explains that '[l]iveness is not a fixed ontological state that exists in the absence of electronic mediation, but rather a dynamically performed assertion of human presence within a technological network of communication'. He considers liveness as a quality of perception, and explains that 'liveness is intrinsically linked with perception and therefore highly dependent on the one perceiving the musical performance' (2013 ,115). That is to say, liveness is a quality brought to the music by the listener rather than by any performer. Similarly, the improvising musician and philosopher Gary Peters discusses various ideas of liveness, and concludes that the essence of liveness is *presence:* '[W]hether what is experienced in the live moment is produced or re-produced, embodied or disembodied it is nevertheless valorised as a presence, "now"' (2016, 164). As I argued above, in the context of fixed media music, the corporeality of the audience is highly conspicuous. For me, the presence of the audience always brings excitement to the concert moment, an excitement of experiencing something together, a ritual. This shared experience shapes the atmosphere (see Chapter 2) of the performance, especially when the audience is seated in a circular formation rather than in a more traditional setting where everyone is looking in the same direction; listeners become more aware of the collective nature of the event, rather than only observing the performer's actions. The concept of aural performativity is paralleled in the composer Dugal McKinnon's comment that

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[15] Similarly, in relation to the developments of new aesthetics in experimental music, Auslander suggests a displacement of 'the ideas of performance and liveness from the relationship between the performer and the sound they produce to the relationship between the listeners and the sound they hear' (2023, 114).

[16] 'Composing Music Based on Carpet' (Master Thesis), Institute of Sonology, Royal Conservatoire The Hague, 2014

'[l]oudspeaker music shifts the centre of gravity away from the performer and towards the listener, reconstituting liveness as listener-determined' (2016, 269). McKinnon also underlines the link between spatiality in music and the active involvement of the audience:

> The liveness of loudspeaker music, particularly in immersive sonic environments, emerges in the interaction of sound, space and the somatic, affective, and interpretative activity of the listener […] This can happen only in the absence of performer and performance, and in the presence of the loudspeaker. Such liveness is both singular and radical, particularly within a contemporary cultural context dominated by multimedia, whether spectacular or mundane. (2016, 267)

However, unlike McKinnon, I don't think that in presenting fixed media music we are dealing with an absolute 'absence of a performer'. What is at stake in fixed media music, as discussed above, is the presence of a *different kind of performer*, who is co-responsible for the musical experience of the audience during the concert.

As I have argued above, experiencing (spatial) fixed media music in a concert venue is an activity which transcends mere 'listening to a recording'. Bodily involvement and the collective presence of audience and performer in the here and now of the concert gives rise to a quality that could be considered as liveness. This is in line with Auslander, who nominates 'the audience's experience rather than the properties of the thing experienced as the locus of liveness' (2012, 6). This quality, as well as many of the other issues considered in the present chapter, will be more precisely defined and discussed using Gernot Böhme's concept of *atmosphere*, which is the subject of the following chapter.

Chapter 2

2.1. Understanding the concert situation through atmosphere

> Music doesn't fix itself like poetry does, but precisely this means that it has all the more open and varied ways of helping human beings to appreciate their lot: to be exposed in space and time, and able to be involved. (Schmitz 2020, 68)

This chapter revisits the concert situation of fixed media electroacoustic music through the concept of *atmosphere*. This term, originating in meteorology, has been used colloquially and metaphorically since the eighteenth century (Böhme 2019, 259). Subsequently it gradually entered into philosophy, and has become an important concept in some recent philosophical discourses and aesthetics (Schmitz 2016; Böhme 2017; Griffero et al. 2019; Riedel et al. 2020). I propose that this concept provides a fertile ground for understanding (and appreciating the importance of) the concert situation of fixed media electroacoustic music as a collective, situational, holistic and ephemeral experience – 'the experience of the presence of humans, objects, and environments' (Böhme 2017, 17). I will draw mainly on the work of German philosopher Gernot Böhme as one of the most prominent philosophers whose work centres on the subject and implications of atmosphere. Böhme's work is a further development of the ideas of pioneers in the field such as Hermann Schmitz, and presents atmosphere as the point of departure for a new aesthetic (2017, 13). Böhme and Schmitz specifically discuss music in their writings, and chart its relationship to atmosphere. Böhme indeed considers music as 'the fundamental atmospheric art' (2017, 127). I will argue that the idiosyncratic features specifically of *electroacoustic* music bring it even closer to the aesthetics of atmosphere, namely its use of space and the acousmatic situation. According to this understanding, the ultimate goal of a performer of fixed media music can be considered as *creating an atmosphere* in which the music can be fully materialised or actualised, and thus experienced. Atmospheric thinking resonates with my own aesthetic approach to composition and art in general, where the emotive, sensuous and immediate encounter with an artwork plays a more crucial role in its perception than, for example, a more analytical response which reduces reflection on the artwork to that which can be encapsulated in language. As Böhme aptly notes, '[t]he centrality of judgement in aesthetics and its orientation towards communication has led to a dominance of language' (2017, 15). Such an approach to aesthetics (which involves interpretation) might skip over and subvert a sensuous experience of the art work, and this is what the new aesthetics attempts to address by introducing atmospheric thinking. As Susan Sontag already explained in 1966, interpretation – which attempts to reduce the art work to its content – 'takes the sensory experience of the work of art for granted, and proceeds from there. This cannot be taken for granted, now' (1966, 104). While giving a comprehensive account of the concept of atmosphere is beyond the scope of this research project, I will nevertheless discuss some of the ideas of atmospheric thinking, and their connection and significance to the public presentation of fixed media music.

2.2. What is atmosphere?

> There is an energy in a concert hall or opera house that everyone breathes in. (Wigglesworth 2018, 194)

My first encounter with the concept of atmosphere was a revelation. I felt that I could finally understand the particular sensations that I was (am) experiencing in the moment of a concert. These sensations involve what might be described as a pervasive weight of the presence in the air of a unifying affective force, which valorises each concert situation as a unique and ephemeral happening (something different from individual listening in the studio, for instance), an experience of shared emotive power that connects the audience. Atmosphere by nature is something vague and nebulous, and hence difficult to define. According to Böhme:

> Atmospheres are indeterminate above all as regards their ontological status. We are not sure whether we should attribute them to the objects or environments from which they proceed or to the subjects who experience them. We are also unsure where they are. They seem to fill the space with a certain tone or feeling like a haze. (1993, 114)

For Böhme, atmosphere is neither a subjective and psychological phenomenon, nor a completely objective quality of things and the environment. In-betweenness, therefore, is a prominent characteristic of atmospheres, and this, according to Böhme, gives rise to a new aesthetic that 'is concerned with the relationship between environmental qualities and human states. This *And*, this in-between, through which environmental qualities and human states are related, is atmosphere' (2017, 14). Such an intermediary status might foster a sense of vagueness and indeterminacy, but at the same time it enables us to consider phenomena outside the duality of subject/object, and in the context of their environment.

Atmospheres can be sensed in various situations and constellations, for instance, when entering a new and unfamiliar place, when observing clouds forming an ever-changing mass in the sky, when noticing the movements of colourful leaves in a canal, or when experiencing the quietness of an alley in the evening, the smells in the air, the presence of a group of people, the silence of an empty concert hall, and last but not least, when hearing sounds, specifically when listening to music. I have always been sensitive to these atmospheres without having had a precise formulation to describe them. Nevertheless, it is still quite difficult to talk about atmospheres and to describe their 'character'. We can often find a few explanatory words, but then find it difficult to proceed further. Böhme, in enumerating the available vocabulary to talk about atmospheres, states on the contrary that 'we obviously have a rich vocabulary at our disposal to characterize atmospheres, that is, as serene, melancholy, depressing, uplifting, imposing, inviting, and erotic' (2017, 14). For example, 'one speaks of the serene atmosphere of a spring morning or the ominous atmosphere of a stormy sky […] the delightful atmosphere of a valley or the homely atmosphere of a garden' (2017, 13). I would argue, on the other hand, that atmospheres are perhaps not so much to be talked about, or described, but rather to be *experienced*. As the ethnomusicologist Andrew McGraw explains, '[a]tmospheric thinking speculates on how it is we can be "in" a particular mood prior to or independent of any linguistic, reflective self-attribution of an emotion' (2016, 136). The philosopher Tonino Griffero also explains the shortcoming of language in talking about atmospheres:

> The relative ineffability of atmospheres only depends on the fact that one has to be "in" them to really feel and understand them, and no list of linguistic characteristics can ever be exhaustive for them. (2019, 23)

Ineffability is thus considered by Griffero as a characteristic of atmosphere, and it could also be regarded as a characteristic of music. According to the media researcher Matthew Reason, '[t]o acknowledge the ineffable is to acknowledge not only that some things escape language, but also that some things are outside of language. These are not so much experiences that we have, but experiences that have us' (2017, 84). Atmospheres also 'have' us, in this sense, and this atmospheric 'grippedness' (Schmitz 2020, 65) is also beyond language – which is why I have used the audiovisual medium to attempt to demonstrate and 'explain' them, and their importance in presenting fixed media music in public.

A related notion is that of *ambiance* (or *ambience*), which has a long history in French research, specifically in the field of architecture (Thibaud 2015, 39). According to the architect Michael Tawa:

> Ambiance is the distinctive assemblage of conditions that characterize a setting—that is, a circumambient milieu or circumstance, together with the affective, dynamic or mobile radiance, or the palpable aura that flows from that assemblage. (2022, 85)

Another is the concept of *Stimmung* or *mood* (which will be discussed below) in German philosophy. Whereas ambiance is often associated with the environment and place, *Stimmung* connects to a personal state of mind. To distinguish them, Bille et al. ask:

> Is one then to understand the difference between terms such as "Stimmung", "mood", "atmosphere" and for instance "ambience" by the level of subjective involvement – moods being primarily oriented toward the subjective, ambience towards the objective, with atmospheres in the in-between? (Bille, Bjerregaard, and Sørensen 2015, 32)

Tawa expresses this distinction in a similar way: '[a]tmosphere is produced between the ambiance of a setting and the mood of a human being who encounters it' (2022, 117). An important motivation for my use of the concept of atmosphere, rather than these ideas, is that it explicitly encompasses both the (objective) setting and the subjective experience of that setting.

2.2.1 Bodily presence

Atmosphere is experienced through the bodily (co-)presence in the here and now. According to Böhme:[17]

> Atmosphere is the shared reality of the perceiver and the perceived. It is the reality of the perceived as the sphere of its presence and the reality of the perceiver insofar as he or she, in sensing the atmosphere, is bodily present in a particular way. (2017, 23)

Similarly, Griffero notes that:

[17] Similarly, for Hermann Schmitz, the space of bodily felt presence is where atmospheres are experienced. (2019, 65)

> "atmosphere" usually means a feeling (relaxed, oppressive, gloomy, etc.) that is not private and internal, but poured out into the perceiver's pericorporeal (lived, pre-dimensional) space, and "tinges" their situation to the point that it felt-bodily influences their attitude, behaviour and (even) thought. (2019, 24)[18]

As discussed in the previous chapter, bodily presence is also the condition for fully experiencing (spatial) fixed media music. The musicologist Friedlind Riedel expands on Schmitz's ideas, proposes the following working definition which also brings in the *multiplicity* of bodies as an important factor:

> "atmosphere" or an "atmospheric situation" describes a "feeling" that fundamentally exceeds an individual body or conscious subject, and instead pertains primarily to the overall situation in which a multiplicity of bodies cohere. (2020, 4)

This definition resonates with the concert situation, in which a multiplicity of bodies (the audience) creates a collective consciousness, and thus a common experience in a specific time and space. Riedel continues that 'to conceive of music and sound as atmosphere in this way would mean no longer to consider musical affect in relation to personalised ears and individualised bodies, but to ask about the "cultural techniques" by which music and sound are (made) environmental and through which they modulate spaces, collectives, situations and relations' (2020, 4). Of course, common experience does not mean that all individuals will have the same experience, as Riedel clarifies:

> With the notion of atmosphere, it hence becomes possible to account for the experienced homogeneity of a (social) situation without confusing it with the actual emotional state of each and every person present or with the social unity of a community. (2020, 17)

Bodily collectiveness (as discussed in Chapter 1) is an integral aspect of presenting music in general and electroacoustic music in particular. This is what essentially distinguishes studio listening from a concert situation. It is often the case that physical presence in the venue is the optimal way to experience an electroacoustic piece, because of the specific arrangements and technical configurations required by most spatial/multichannel pieces. This aspect of listening will also have been incorporated into the composer's thinking and intentions during the composition process. Therefore, it can be argued that a fixed media piece, in fact, exists only in the here and now of the concert situation, in the context of a collective experience – in an atmosphere, which is shaped not merely by the music but also by many other elements such as the space, lighting, the audience and so on. While the sound files of which the piece consists can be viewed on a computer screen, this view cannot be deciphered into potential sound by the viewer (as a score, for example, can), so the only way the music can become 'readable' is through the ears of a listener, not in a vacuum but in an atmosphere shaped by the circumstances of each event.

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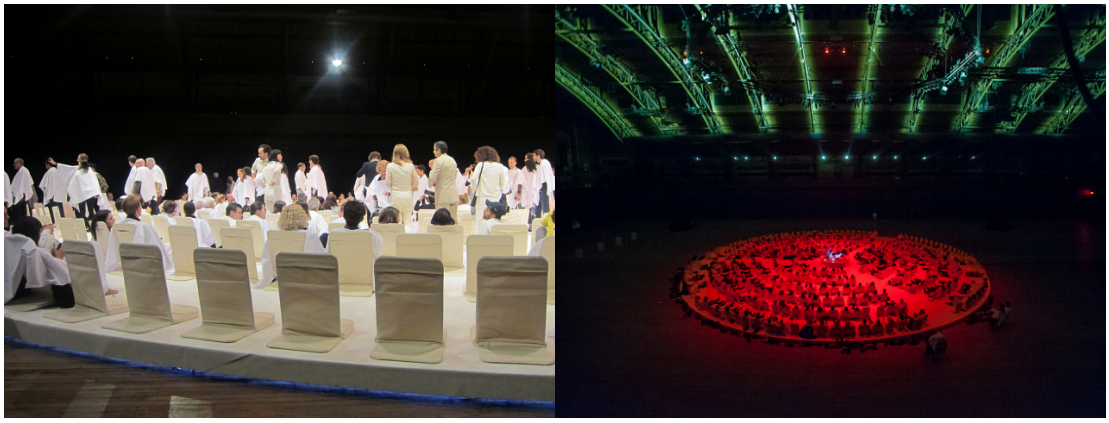
[18] Griffero draws on Merleau-Ponty to explain *predimensional* lived space (the same as atmosphere space): 'besides the physical and geometrical distance which stands between myself and all things, a "lived" distance binds me to things which count and exist for me, and links them to each other. This distance measures the "scope" of my life at every moment' (Merleau-Ponty 2005, 333 in Griffero 2014, 37).

Fixed media pieces often have a beginning, middle and end. In other words, the temporal unfolding of the composition is a crucial aspect of experiencing the music, as opposed to, for instance, sound installations, where the audience can often walk in and out at will, and shape their own experience of the work. Fixed seating is often preferred in fixed media concerts, since it aids focused listening. Moreover, in practical terms, walking around in a concert venue might cause noise and distraction to other audience members, disturbing their concentration and experience. Of course the audience's 'noises' as well as the act of walking in the venue can be integrated in the piece as a compositional choice. There have been numerous approaches to creating a comfortable bodily situation for the audience, specifically for concerts with longer durations, for instance having the audience lying down, or using cushions instead of chairs. For the New York premiere (2013) of Stockhausen's *Oktophonie* (1991) at Park Avenue Armory, the visual artist Rirkrit Tiravanijathe designed an audience situation which was between sitting and lying down. In fact, he created a distinct atmosphere for experiencing *Oktophonie* through set designing and lighting.[19]



Oktophonie at Park Avenue Armory, New York, photography by Allison Meier and Stephanie Berger

2.3. Music, space, atmosphere

The application of the term atmosphere in describing concerts and performances is indeed familiar to musicians and music lovers, who use this term, despite its indeterminate and ineffable nature, to signify a certain quality in a performance or in a piece of music, not referring to a singular element, such as the composition or the performance itself, but rather to the quality that emerges from the *totality* of the situation. For Schmitz, 'acoustic and, in particular, musical forms are among the carriers of atmospheres of feeling' (2020, 66). Riedel elaborates on how Schmitz's 'acoustemological' approach was developed in the light of the prevalence of the notion of space in music since the twentieth century: '[i]t is the "acoustic space" as known to and by early-twentieth-century sound scholarship, that Schmitz elevates as the "primary model" for his notion of atmospheres' (2020, 21). Music and sound have always been integral in atmospheric thinking. As previously mentioned, the German term *Stimmung*, whose literal meaning is the tuning of a musical instrument (*stimmen*, to tune), also refers to mood and feeling. '*Stimmung* also described the state of the instrument after it has been tuned' (Welsh 2012,269). Similarly, Böhme describes atmosphere as *tuned* space (2017, 156, my emphasis). As the philosopher Gerhard Thonhauser (2022) explains in his article 'Beyond Mood and Atmosphere', the roots of the concept of atmosphere are clearly discernible in that of *Stimmung*. For instance, Martin

[19] It is also worth mentioning the peculiar example of Michel Redolfi's underwater concerts (1981 to present), where the audience experience the music while floating in water. The loudspeakers project the sounds underwater, which also affects the manner in which the sounds are propagated and perceived (Roads 2015, 251).

Heidegger, in *Being and Time* (1927), developed the concept of *Stimmung* as an ontological concept: '*Stimmung* attunes being-in-the-world as a whole' (Thonhauser 2022, 1261). Heidegger also highlights the relational and *in-betweenness* (neither quite subjective nor objective) of the character of *Stimmung,* forming another clear connection with atmosphere. Indeed, the distinction between atmosphere and *Stimmung* is not always clear. According to Riedel, Schmitz uses the two terms interchangeably (2020, 7). Moreover, Riedel discusses an essay by Sebastian Klotz in which the use of the term *Stimmung* is traced through the writings of nineteenth-century music scholars, leading to the conclusion that '*Stimmung* referred to precisely those musical dimensions that could not be pinned down or named. Furthermore, it accounted for the contingency and situationality of musical listening' (2020, 8). [20] Stockhausen, discussing his 1968 vocal piece *Stimmung,* explains that the term 'means "tuning," but it really should be translated with many other words because Stimmung incorporates the meanings of the tuning of a piano, the tuning of the voice, the tuning of a group of people, the tuning of the soul. This is all in the German word. Also, when you say: We're in a good Stimmung, you mean a good psychological tuning, being well tuned together' (Cott 1973, 162). All of these possible meanings are in fact also encompassed by atmosphere and its close connection to music, which leads Böhme to conclude that atmospheric thinking is a fundamental paradigm shift in understanding musical experience. He explains that '[b]y contrast with the helpless theories of association, or theories deploying phantasy as an intermediate element, the aesthetics of atmospheres can provide the simple answer that music as such is the modification of bodily felt space' (2017, 127). Similarly, McGraw in his article 'Atmosphere as a Concept for Ethnomusicology' describes atmosphere in relation to music and its spatiality: '[A]tmosphere refers to a shared sense of affective intensity and is described as occupying an immersive, resonant, and spherical spatiality, much like sound itself' (2016, 131).

The central point in all discussions of atmosphere has been *space*, which is yet another connecting point to music in general and electroacoustic music in particular. According to Böhme, 'one might call [atmospheres] quasi-objective feelings that are indeterminately diffused in space' (2017, 125). Similarly, Bille et al. assert that atmosphere 'must be understood as a spatial experience of being attuned in and by a material world' (2015, 36). As such, experiencing atmosphere through the space connects to the fact, discussed in Chapter 1, that (spatial) fixed media music can only be experienced through space. Böhme refers to recent developments in new music, which have resulted in a change of perspective from the traditional consideration of music as a temporal art towards a spatial art. He explains that:

> The fact that music fills spaces and that space, via resonance and reverberation, represents an essential element of its effect, has always been known. Newly discovered were the spatial shapes, that is, form figures and ensembles in space, of the individual tone, the ensemble of tones, and also the succession of tones (or, better, the succession of sounds). These had never before been an issue for music. (2017, 126)

Here, in describing these 'newly discovered … spatial shapes' as a feature of modern music in general and electronic music in particular, Böhme is talking about what is known as sound spatialisation (see Chapter 3), the manner in which sounds can be situated or moved in the space, or, in other words, foregrounding space and spatial arrangements of sounds as a compositional element. For him this 'spatial turn' is what brings music further towards the

[20] Musik Als Artikulation Von Stimmungen: Positionen Vom 19. Jahrhundert Bis in Die Gegenwart.

aesthetics of atmosphere. He explains that '[t]he tendency of music towards spatial art, particularly, has brought it into the realm of an aesthetics of atmospheres' (2017, 127). Similarly, Schmitz emphasises spatiality in music and its connection to atmosphere:

> Music is a temporal art because it takes duration and transience, the two factors responsible for temporality's fate, and integrates and moulds them into unique forms that are presented for listening. It is equally a spatial art, which develops dynamically in the intensive expanse of surface-less sonic space, pouring atmospheres of feeling into it and presenting them, but only as hints, so that listeners can be stirred up (angeregt) or involved by the atmospheres presented without being able to identify them distinctly, just as with the atmospheres of moonlight or a landscape in a storm. (2020, 68)

Spatiality has been a significant aspect of electroacoustic music since its origins (see Chapter 1).[21] Thanks to technological developments in sound reproduction systems, it became possible to integrate space as a musical parameter more than ever before.[22] Böhme acknowledges the affordances of electroacoustic music (specifically spatial sound) in creating 'acoustic formation of spaces' – which he refers to it in the context of sound installations, but which is similarly applicable to fixed media electroacoustic music.

> This genre [sound installation or spatial sound] is explicitly concerned with the spatial movement of tones and the spatial form of sounds, or vice versa; at stake is the acoustic formation of spaces. This development in music was certainly first made possible by the significant twentieth-century advances in electroacoustics. (2017, 136)

Electroacoustic music in particular provides the possibility to mould and shape sounds in space by utilising loudspeakers for projecting the musical material in various manners. Surrounding the audience with loudspeakers, hanging loudspeakers from the ceiling, pointing them upwards, downwards, placing them at different distances, and so on, make it possible to articulate the music in various fashions. All this happens, of course, in relation to the shape and the size of each venue and its acoustical characteristics. As a result, Böhme concludes that this 'exploration of acoustic space has given rise to a new understanding of hearing: as bodily presence in space (2017, 136). As discussed in Chapter 1 and earlier in this chapter, listening to (spatial) fixed media music indeed demands bodily involvement, just as in experiencing atmosphere.

2.4. The atmospheric power of acousmatic situation

One of the characteristics of fixed media music which distinguishes its presentation from that of music performed by instrumentalists and/or singers is the *acousmatic situation*, where the causes of the sounds are occluded, and the sound production activity is not visible during its presentation. The question might arise as to what the consequences of such elimination of the visual aspects of music making might have on the atmospheric qualities of the concert situation of fixed media music. An answer might be traced in the nineteenth-century endeavour to

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[21] To mention some prominent early examples: Karlheinz Stockhausen's *Gesang der Jünglinge* (1955) and *Kontakte* (1960), Edgard Varese's *Poème électronique* (1958) and Iannis Xenakis' *Bohor* (1962).

[22] Check *Space-form and the acousmatic image* by Denis Smalley.

achieve a transcendental experience of music, as explained by Brian Kane in his book *Sound Unseen*:

> Transcendence depends on separation, on the articulation of differences in kind. With its strict separation of the eye and the ear, an especially potent form of this phantasmagoria employs the acousmatic situation to occlude the mechanism of musical production for the sake of musical transcendence. The more the body is hidden, the less the eye sees, and the more grandiose are the claims about music's power. (2014, 108)

Kane discusses here the *concert reform* (*Konzertreform*) movement of the nineteenth century, which attempted to eradicate the visual aspect of music making (2014, 103-8). The underlying idea was that watching the movements and gestures of musicians performing on the stage would distract from and disturb the pure perception of the music and, consequently, prevent a 'transcendental' experience of it. (2014,103) According to Kane, transcendence should be understood as 'the positing of any sphere – whether it be religious, secular, philosophical, ethical, aesthetic, or otherwise – that exists outside the bounds of the mundane world, and that is manifested in this world only at special or singular moments' (2014, 108). This definition resonates strongly with that of atmosphere in Böhme's sense, and I suggest that there is another way of interpreting the concert reform idea: concealing the mundane origins of music, or occluding the audience's view of music-making activities, could also be considered as an attempt to reduce focused vision and thus indeed create an atmosphere in which music could be experienced more profoundly. Various techniques were deployed by the concert reform movement in order to achieve such an acousmatic situation: for instance covering the stage with large curtains, or hiding the musicians in an orchestra pit. These techniques also had a desired acoustical effect on the orchestral sounds, namely diffusing the sound and creating a more omni-directional sound field, avoiding any directionality (visual and sonic), as Cathy van Eck points out in her book *Between Air and Electricity* (2017,10). Richard Wagner's practice at Bayreuth, placing the orchestra pit beneath the stage rather than in front of it as in conventional opera houses, exemplifies such an approach taken to its full potential. Kane quotes a statement from Wagner, who explains that 'when freed of the visual aspects of its mechanical production, "[music] came to the ear in a compact and ethereal sort of unity"' (2014, 102). According to the theater studies scholar Erika Fischer-Lichte:

> Richard Wagner immersed the audience in complete darkness during the 1876 Festival at Bayreuth. These measures aimed at interrupting the feedback loop. Visible and audible – i.e. potentially distracting – audience reactions were to be channeled into "interior" responses that would be sensed intuitively by others but remained without outward expression. (2008, 39)

Kane gives multiple accounts of such situations within concert reform practices, where music-making activities were hidden from sight. These descriptions might be considered as portraying an atmospheric situation in Böhme's sense. Or, conversely, such practice could be seen as 'an attempt to aesthetically shape the listening public, and in turn the social body, by creating the conditions for performances that could properly channel music's transcendent content' (Kane 2014, 103) – in other words, creating an atmosphere through which to experience the music. For instance, in a text from 1826, an anonymous writer describes such a concert situation where musicians are invisible, while even referring to the term atmosphere:

> Imagine a hall in which, first of all, the orchestra with its people and instruments is hidden from the audience's view by a light curtain, this would put a whole crowd of destructive demons in chains, not to mention how much more *atmospheric* music becomes when it resounds unseen. (Kane 2014, 111, my emphasis)

In another account, Wilhelm Mauke, a composer and music critic, describes a concert in a text from 1899:

> The auditorium, whose seats are arranged in the shape of an amphitheater, affords only enough light to permit the audience to read the text of the lieder....[The singer's] voice touches our hearts by being heard through a sea-green web of liana plants. An aroma of Heliotrope passes through the hall when sensuous sultry love songs are sung. Serious lieder are heard with incense that comes from rows of columns that are embraced by the holy groves or cypress. The hymns of summer night rock one to sleep in the midst of large umbellated buds, violet-colored clouds, stars that glitter gently—everything is in mystical darkness. Passionate cries of erotic songs speak to the imagination and to intimate emotions of the audience, which is thrilled with perplexity and pain. (Quoted in Kane 2014, 104)

This is a genuine atmospheric situation described in a poetic way, which demonstrates how various elements participate together in creating such an experience. Unlike Kane, who foregrounds the separation and isolation of the (sonic and visual) senses, the concert described above outlines a multi-sensorial phenomenon which evokes an atmospheric situation. As McGraw confirms, '[a]tmosphere is not experienced as an object or through any single sensory modality. It is registered through a synesthetic envelopment of the felt-body' (2016, 134). In the examples mentioned above, while the mechanism of musical production is made invisible, meticulous attention is given to various (non-musical) sensory elements, which elevate the experience of being in the space, rather than creating a single sensory (sonic) experience. According to these accounts, specific attention was given to the design and the arrangement of the concert hall, the abstract (or pictorial) decorative patterns on the curtains, or the use of real plants, as well as deliberate and subtle lighting, and even the inclusion of scents (from the plants) – hence, a true multi-sensorial experience.

In the field of architecture, Juhani Pallasmaa suggests that 'the biased preferencing of focused visual form is the major reason for the weak atmospheric quality and feeling of interiority in much of modern and contemporary architecture' (2019, 124). According to him, the dominance of vision reduces atmospheric qualities.[23] He asserts that '[t]he condition of omni-directional and immersive hearing created a world of belonging and participation, whereas [focused] vision

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[23] Pallasmaa also explains that the hierarchy of our senses in the past was quite different from that found in modern times, which is dominated by vision. He quotes the historian Lucien Febvre who stated that '[t]he sixteenth century did not see first; it heard and smelled, it sniffed the air and caught sounds' (Pallasmaa 2019, 123). Böhme (2019) names 'olfactory ingredients' as one of the atmosphere generators, and highlights the differences between the vision and the olfactory, explaining that, '[t]he source of the smell may be at a distance, but the smell itself is immediately smelt right here. This experience is quite different from seeing' (Böhme 2019, 262). This aspect of the olfactory is then closer to the mode of listening. Of course smells are always present in concert situations, such as the smell of audience and the venue. 'Olfactory ingredients' can be also intentionally be added in order to shape the atmosphere. Stockhausen's *Düfte-Zeichen* (2003) represents an attempt to delineate the structure of a composition using different scents which are released into the performance space by the performers. However, the way that these scents diffuse slowly and mix together through the air of the space indicates that it is not possible to achieve much variety and subtlety using such techniques within the relatively large volume of a concert or theatre space and with the distances across which the scents need to diffuse.

promotes outsideness, separation, control and solitude' (2019, 123). I suggest therefore an alternative perspective on the concert reform strategies: hiding the sound production activities of the musicians was actually an attempt to reduce focused vision, instead creating and shaping an atmospheric situation. This feature can be further emphasised in the context of presenting fixed media music, where the sound production activities are not even taking place in the same space or time as the audience. The fixed media concert situation - in the absence of focused vision on the one hand, and the omnipresence of music through the space on the other – can thus evoke a more multi-sensorial experience, and hence a more atmospheric situation. Electroacoustic technology has not only replaced the curtain and orchestra pit of the concert reform tradition, but has also revolutionised the composing practice itself, as I have shown in Chapter 1. Nevertheless, aesthetically shaping the concert situation is perhaps something we can still learn from the concert reform movement, for example by designing the concert situation more deliberately, requiring in turn an awareness of the effect and influence of the various elements which might participate in such an experience, for instance lighting, as will be discussed below.

2.5. Lighting in fixed media music presentation

Talking about lighting in the context of acousmatic music might perhaps appear paradoxical. It might be true that a lack of light puts the sense of vision to rest while listening, and prevents any visual distraction. Nevertheless, listening in absolute darkness is not a prerequisite for an 'appropriate' experience of such music. In practice, lighting does play a (subtle) role in fixed media music concert situations; it prompts a sense of presence in the here and now, and, more specifically, engenders an atmosphere, while not necessarily attempting to focus the audience's attention in one particular place or direction. Böhme explains how lighting affects our perception of the world:

> Light as atmosphere endows the things and scenes or environments that appear in a particular light with an emotive character. We feel concerned and moved, we are tuned in a particular way by a particular lighting. (2017, 156)

In her book *Space and Light,* Katherine Sorrell confirms Böhme's opinion by stating that 'light creates atmosphere, highlights and sculpts areas, and opens up spaces, influencing not just how you look at them but also how you feel about them' (2005, 58). Exactly the same could of course be said about the way sound is projected in fixed media music. Böhme considers sound and light in particular as non-objective generators of atmosphere (2017, 92). He states that sound and light 'modulate bodily felt space by creating tightness or expansiveness, orientation, and enclosing or excluding atmospheres' (ibid). According to Böhme, by utilising modern technology in lighting and sound, set designing is not limited to the stage, and it is 'possible for the art of the stage set to leave the stage itself and spill over into the auditorium. The spaces generated by light and sound are no longer something perceived at a distance, but something within which one is enclosed' (2013, 5).

Typically, in a concert hall, lighting is often intended to illuminate the stage where the music making activities take place – hence aiding focused vision, and separating the stage from the audience area. In fixed media music concerts, in the absence of musicians on the stage, and with a sometimes unorthodox arrangement of the audience in the venue, lighting may take a different shape. Various strategies have been practiced within the tradition of presenting fixed

media music in terms of lighting (or lack of it), such as blindfolding the audience as in Francisco López's performances (which of course results in absolute darkness), Karlheinz Stockhausen's approach of projecting a moon high up on the wall of a dark concert hall, or presenting colourful illuminations of loudspeakers as in the case of the GRM's Acousmonium.

2.5.1. The phenomenon of light

Phenomenologically speaking, brightness is the primary character of light according to Böhme, and 'the first effect of light as brightness is to unfurl space' (2017, 148). As a result, it creates 'experiential' space of 'distances and intervals' from the subject. Such a space 'surrounds one as a leeway for free movement' (2017, 149). This is what Böhme calls *cleared space* (*gelichteter Raum*): 'a space in which I am present, and I experience my presence in space in a particular way through brightness' (2017, 150). An illuminated concert venue can be a good example of such a cleared space. Böhme elaborates on our perception of such a cleared space, stating that:

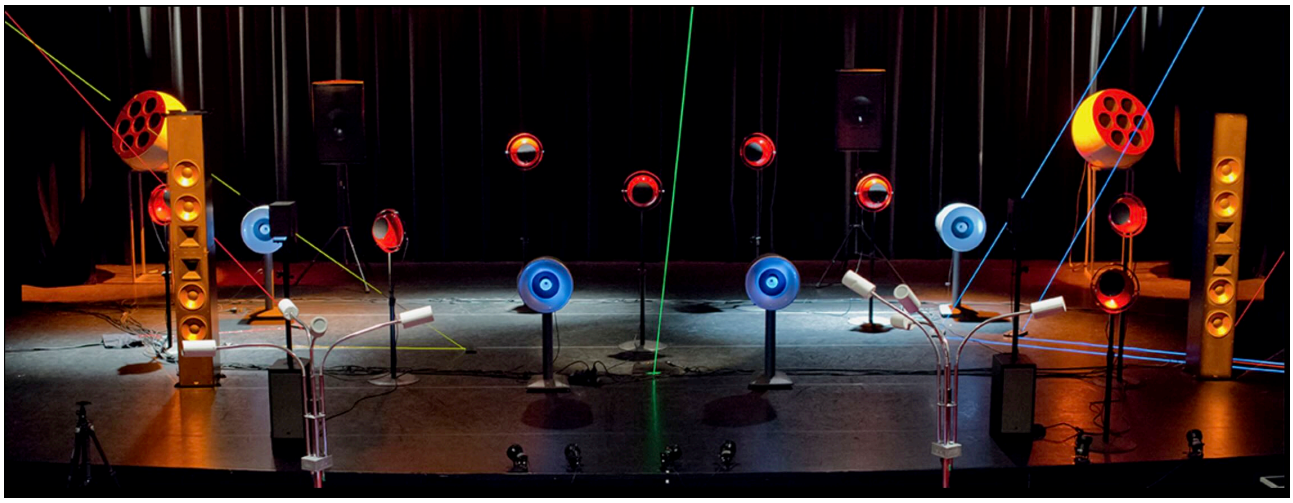
> It is characteristic of space created by light that the possibility of moving within it not only includes that of *de facto* but also of potential movement, that is, of mere eye movement: one can let one's eyes wander within the cleared space […] This possibility of wandering with our eyes in the depth of space may indeed be decisive for our very feeling of being in a space. (2017, 149)

This wandering with the eyes is also a very familiar activity in fixed media music concerts (and is clearly observable in the audiovisual part of this dissertation). Simon Emmerson, in *Living Electronic Music*, confesses that he wishes 'to see clearly the loudspeakers as sound sources as well as the environment in which they are set' (2007, 168). I also find myself often wandering through the space with my eyes during the concert, as if it helps me to better experience the music, and to be in the space. To this, I add the importance of free movement of the head, or more precisely the *ears*, which plays a crucial role in our ability to localise sounds in the space. This is particularly important in the context of spatial music where head movements aid a better perception of the spatial cues (as discussed in Chapter 1). Therefore, the cleared space and the perception of spatiality in music overlap in the experience of the concert situation of fixed media music. Light sources 'unfurl' space through brightness. There is, however, another way that light interacts with space, and this is the phenomenon that Böhme calls 'light in space', of which the 'starry sky' is a prototype (2017, 151). Here, instead of unfurling the space by brightness, light sources like stars structure the space, give it direction and break the infinity of the darkness. 'They take away the pressing aspects of dark space or the indeterminacy in which once can get lost' (Böhme 2017, 152). This type of lighting is also relevant in fixed media music concerts (such as in ZKM's *Kubus*, which will be discussed later). Besides 'space created by light' and 'lights in space', a third phenomenon of lighting, according to Böhme, is 'light on things'. To give an example, in the context of fixed media music presentation, we can consider the Acousmonium's approach in illuminating the loudspeaker orchestra (see below).

The fixed media concert situation is often associated with darkness, which supposedly favours acousmatic listening. Presenting fixed media music without any lighting is a common practice. In reality, however, it is never pitch black in concert venues, partly because the exit lights must always be visible for safety reasons, but also because the performer needs a small amount of light to see their surroundings during the performance. Moreover, some light is also emitted by the equipment in use, such as computer screens, lights on the mixing desk and so on. Therefore,

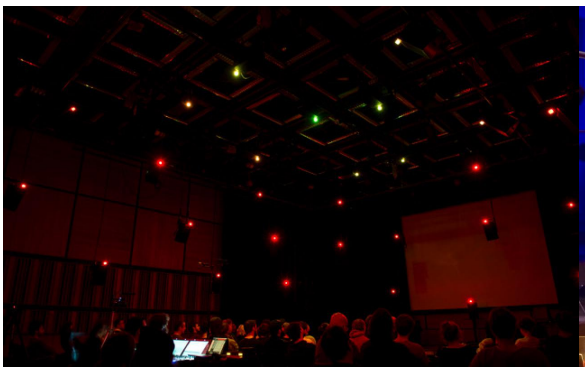
creating absolute darkness in a concert hall requires taking specific measures. Francisco López, for example, addresses this by having the audience (voluntarily) blindfolded for absolute eradication of the sense of vision. He mentions two reasons for this strategy: to avoid distracting them by his activities during the performance, and to ritualise the concert experience. In the GRM's Acousmonium presentations, on the other hand, loudspeakers receive extra attention by the use of lighting. A distinctive arrangement of colourful loudspeakers in various shapes and positioning creates the typical look of an Acousmonium concert. One can even argue that such an arrangement of loudspeakers on stage is as much concerned with creating a visual spectacle as with sound diffusion – perhaps as an attempt to fill in the empty stage and to compensate for the absence of musicians? After all, the Acousmonium and similar setups are often described as 'loudspeaker orchestras'. It is perhaps ironic that one of the oldest organisations involved in developing and promoting *acousmatic* music pays such attention to a strong visual representation – proudly shining spotlights on the loudspeakers as the superstars of the show. In BEAST (Chapter 1), however, while colourful and 'atmospheric lighting' is used, (Harrison 2013, n.p.), illuminating the loudspeakers as sound sources is avoided. As Jonty Harrison explains, by avoiding shining light on the loudspeakers, the designers of BEAST wished to foreground the idea of a 'sound image' which is not tied to the physical presence of the loudspeakers.

> Note that we do not light the individual loudspeakers, as this draws attention to them; what we are aiming for is that the loudspeakers also "disappear" as the sound image is sculpted in the space as an organic entity. (Harrison 2013, n.p.)



Acousmonium, Paris, photography Didier Allard

A more subtle approach is deployed at ZKM's dome-shaped loudspeaker setup, known as *Klangdom*. Each loudspeaker in this 40-channel sound system is equipped with a small LED light. These lights are individually programmable in terms of brightness and colour. Such an arrangement offers an abundance of possibilities in order to create various *lightscapes* (Bille 2007, 265). These lights create the *starry sky* effect as 'light in space'. At the same time, they accentuate the location of the sound sources and their arrangement in relation to the space.



Klangdom at the ZKM, Karlsruhe, photography Tanja Meissner

BEAST in the Elgar Concert Hall, Birmingham

It is worth mentioning the peculiar example of John Cage's last work, *One*[11] (1992), where he 'composes' with light, even if this is not directly connected to the lighting of fixed media concerts. This is essentially a feature-length 'film' in black-and-white which consists entirely of lights and shadows, and according to Richard H. Brown, it is conceived as 'an experience of the effect of light in space' (2019, 176). The piece is created using his accustomed compositional strategies of chance operations, this time applied to light rather than sound. *One*[11] is accompanied by a recording of his orchestral piece *103* (1991), which is experienced 'acousmatically': the orchestra remains unseen. The slowly changing areas of light which appear on the screen are not illuminating particular objects, nor the shape of an architectural space, thus discouraging any kind of focused visual attention on the part of the viewer. Instead they exist in counterpoint to the shifting sonorities produced by the invisible orchestra. This work is thus an example of lighting being used in a purely atmospheric manner, its gradual evolution and indistinct outlines being perhaps comparable with my own use of moving images of clouds in the audiovisual part of this dissertation.

2.5.2. Dim lighting

Brian Kane quotes an anonymous writer from 1826 on this subject:

> Would not the dim light, full of foreboding, compose the souls of those who entered, purifying away the dross of everyday life and setting them into that mood which alone is appropriate for the enjoyment of art? (2014, 111)

In my own artistic presentations, I prefer dim lighting to absolute darkness. Apart from practical reasons such as logistical convenience and avoiding *scotophobia* (for those who might suffer from it), dim lighting engenders atmospheric qualities with its in-between character – also known as 'half-light' which compares to Böhme's reference to atmosphere as a 'half-thing'. In this regard, he states that '[p]erhaps, twilight is even more atmospheric than the night, as it is a peculiar medium of indeterminacy' (1998, 31). Dim lighting has two characteristics which promote an atmospheric quality. On the one hand, it unfurls and 'clears' the space, giving an awareness of one's surroundings and a feeling of presence and belonging in a space. On the other hand, because of its lower intensity, it reduces focused vision and the degree of attention given to a specific point or thing in the space. As discussed above, focused vision creates distance and outsideness, while, in my experience, dim lighting promotes a sense of community when fellow audience members are (dimly) illuminated and peripherally visible. As discussed in the first chapter, with the lack of a focused point of attention like a stage, the audience in a fixed media music concert situation is more attentive towards their own (and the other audience

members') bodily presence, especially when sitting in a circular arrangement where observing each other's presence is easier. This more unfocused or diffused awareness of the others in the space promotes a sense of collectively shared experience of the music. Mikkel Bille and Tim Flohr Sørensen in their article 'An Anthropology Of Luminosity' explain that 'subdued' lighting (created mainly by candles) induces a sense of 'social inclusion', related to the concept of *Hygge* (2007, 276).[24] They explain that:

> The materiality of light has the ability to alter human experiences of space, and to define sensations of intimacy and exclusion. This network between the light, the person or thing shapes the atmosphere, whereby material and social relationships are created or manifested. (2007, 274)

After my research on atmosphere and the role of lighting, I decided to try designing the lighting for my performances more deliberately. For a concert in October 2022, I took the opportunity to experiment with the lighting. Fortunately, in the Conservatoriumzaal of the Royal Conservatoire in The Hague, the possibilities in terms of lighting are extensive. Thanks to the motorised LED fixtures, it is possible to utilise various beam angles, colours and patterns, not only to project onto the stage but also over the whole space; this makes it possible to realise a sophisticated light design with the help of a light technician (see the audiovisual dissertation). Unlike in most acousmatic situations, the hall was dimly lit (in warm orange) so that the audience was able to see their surroundings easily. Patterns in blue which resembled light shining through leaves were projected onto the upper part of the hall. The warm light on the audience was motivated by inducing a sense of *Hygge* (see footnote 24) in utilising candles (also with warm temperature). Blue was chosen to create a contrast while the patterns added texture to the otherwise flat surfaces, with the effect of transforming the rectilinear architecture of the space into an environment which reflects and enhances the complex and irregular textures of the music. After the concert, many audience members commented on this lighting, how it had a strong effect on their perception of the space and enhanced their experience of the music, indicating that this is an area worth exploring further, which I intend to do in future performances.

Lighting can thus not only play a role in experiencing the space and in tuning our presence in a particular way, but can also function to draw attention to the agency of the performer in fixed media music. For instance, casting a spotlight on the person behind the mixer (often in the middle of the audience) markedly assigns performative agency to that person, and creates the expectation of a performative situation on the part of the audience. Conversely, deciding to *not* illuminate the person behind the mixer changes the audience's perspective on the presentation and the agency of the performer. Lighting in the concert situation of fixed media music may have another important and practical function, namely to mark the different moments of the concert, for instance to indicate the beginning and end of pieces, the interval/intermission and the end of the concert, which is especially helpful in the absence of musicians entering and leaving the stage. I would like to make clear that when discussing lighting, I am not talking about audiovisual works such as Iannis Xenakis' *Polytopes,* where the lighting *is* part of the work and is 'composed' alongside it, often with great precision; I refer here to lighting as a constituent of the atmosphere through which the (acousmatic) piece is experienced. Lighting in fixed media music

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[24] According to Bille and Sørensen, *Hygge* 'generally implies a preoccupation with creating an informal, intimate and relaxed ambience with sweets, wine, comfortable seating, pleasant conversation and – in terms of our argument – subdued lighting, preferably, although not exclusively, using candlelight' (2007, 275).

concerts is a delicate task. It should not draw as much attention to the visual as might be the case in an explicitly audiovisual work, but rather be experienced (if at all) as encouraging the audience's dedication to listening. This interconnection between acousmatic listening and lighting is an issue requiring further investigations and experimentation.

2.6. Composing atmospheres

> [A]tmosphere itself is not a thing; it is rather a floating in-between, something between things and the perceiving subjects. The making of atmospheres is therefore confined to setting the conditions in which the atmosphere appears. We refer to these conditions as generators. (Böhme 2013, 4)

Here, Böhme discusses the possibility of *producing* atmospheres, underlining that they are 'emanating from and produced by things, people and their constellations' (2017, 23). An atmosphere may therefore be produced and shaped by preparing the setting and conditions for it to emerge. Sound, light, shapes, smell etc., as I have shown, are among the 'atmosphere generators' which may be integrated into the presentation of fixed media music. François Bayle (1982) discusses the importance of 'staging' fixed media music presentations, a practice which according to him was not given enough attention to in early electroacoustic concerts:

> A theater, an empty stage, unflattering lighting, a few loudspeakers placed sadly in the corners, an accumulation of heterogeneous technical equipment, this is the caricature of an acousmatic concert on a small budget, thrown together hastily the day of the concert. (in Roads 2015, 250)

The development of the Acousmonium by Bayle, beginning in 1974, was therefore an attempt to *stage* the presentation of such music. The choice of venue is also an important decision in creating the atmosphere of a concert: a traditional concert hall, a small theatre, a church, an abandoned factory or an open air location – each of them induces a different atmosphere. Apart from lighting and architecture, sound is of course the principal constituent of the atmosphere in fixed media music concerts. 'Non-musical' or ambient sounds are often absent in such a setting, because concert halls nowadays are sonically well-isolated from (inside and outside) noises. Except for audience noise, the listening experience therefore takes place in a background of (relative) silence.[25] However, I have had multiple experiences in non-concert hall locations where ambient sounds can be an element in shaping the atmosphere. For instance, in one of the Azimuth concerts in the Nutshuis, a monument in the city centre of The Hague, the sounds of the city were constantly present during the concert, specifically in the quiet moments. This resulted in a peculiar effect: 'cross fading' between the musical world in loud and intense moments and the sonic reality of the city during the quieter moments. This affected the audience's awareness and focus in a way that was not necessarily detrimental to their musical experience, particularly bearing in mind John Cage's attempts to erase the distinction between musical and extra-musical sounds.

[25] Heloisa Amaral (2022) in her dissertation 'Mediating from Within' explores the connection between attention and silence in the context of classical concerts, and discusses the possibility of integrating sounds which are 'extraneous to the composition'. She suggest that the co-presence of these non-musical sounds can in turn influence our focus and musical experience, and give rise to a productive mode of engaging with the artwork.

Composing fixed media music often takes place in a studio, an environment quite different from that of the concert venue not only in terms of scale, acoustics and equipment, but also in its atmospheric qualities. The generators of atmosphere discussed above are often absent in the studio. For me, imagining the concert situation functions as a canvas on which musical ideas are put together and develop. Therefore, the composition process begins from its end point, namely its (imagined) presentation, just as a composer of instrumental music might begin from considering the instruments and the players who will perform the eventual composition. This signifies the importance of atmosphere in the act of composing. Imagining the atmosphere in which the piece will sound (or better, will be experienced) – in other words, the (imagined) here and now of the concert situation – guides the composition process, while the atmosphere in which the music is composed (in this case, a studio) plays little or no role in influencing the result.[26] Advance knowledge of the concert location affects the eventual piece in multiple ways. Familiarity with the structure and acoustics of the venue can have a direct effect on the choice of musical material, and the manner of structuring and developing it. A large and reverberant concert hall evokes a different mood compared to a small and cosy venue. This affects not only the audience but also the composer. Again, just as an instrumental composition will change its character somewhat when performed by different people (while at the same time retaining an important part of its identity), a fixed media piece retains its identity in different spaces while reshaping itself (or being reshaped by the process of *actualisation*) to adapt to them.

Atmosphere production can also have a manipulative and negative aspect. For instance, it can serve political propaganda, or have a persuasive effect in marketing and advertising by placing products in the context of a desirable lifestyle, leading to the 'transformation of capitalism into an aesthetic economy' (Böhme 2017, 5). Even so, the consideration of atmosphere as a concept, with its vagueness and ineffability, can open up new perspectives with regard to understanding and working with concert situations, since - like fixed media music in itself - the aesthetics of atmosphere foregrounds spatiality and presence, and emphasises the importance of the experience of an event in a particular time and space, as in the here and now of a concert. These new perspectives suggest the ontological status of a composition as an actualisation which takes place in the context of an atmosphere, rather than being a concrete musical object.

[26] In a parallel example, in the process of architectural design, Pallasmaa explains that 'atmospheric qualities arise unconsciously in an embodied, haptic and emotional manner in the designer's imagination rather than through conscious retinal intentions or cerebral processing. […] the imagined image is felt through the body and it approaches the experience of the real physical thing. […] This vague embodied feeling guides the design as much as any intellectual or visual aesthetic aspirations' (2019, 127).

Chapter 3

3.1. Composing and performing in practice

In this chapter, I discuss the approach to composing and performing fixed media electroacoustic music that I have developed in recent years. I will chart how my artistic practice has informed this research, and how the research findings feed back into that practice. Since embarking on this research, I have composed many multichannel pieces, and performed them on multiple occasions and in diverse venues. Each of these experiences functions as a case study which explores the interconnection between composition process and performance practice. I will explain how working with the electroacoustic medium transformed the role of instruments in my composition process, resulting in what I describe as '(extended) instrumental music for loudspeakers'. The practice of using the sound of instruments as musical material led me to the idea of the *Broken Ensemble* project, in which (broken) instruments themselves, instead of conventional loudspeakers, become the actual sound sources to project electroacoustic music in space. *Broken Ensemble* problematises the acousmatic situation by rendering the sound sources visible (although not 'played' as such). This approach also extends the composition and performance of electroacoustic music beyond the idea of loudspeakers as visually and acoustically transparent and neutral sound sources. I will explain the importance of space as a critical parameter in the composition process, as well as in the performance practice of electroacoustic music. In that light, I will chart the concept of *spatial polyphony* as a compositional strategy, and discuss various approaches to realising this concept in composing for multichannel configurations. Moreover, I will discuss the idea of *post-mix*, which involves composing in a higher number of channels to be mixed down to a lower number in performance according to the circumstances of each concert situation, facilitating the adaptability of multichannel pieces to various situations, and opening up a performative pathway for various actualisations of fixed media pieces. Also in this chapter, I discuss my experience and involvement in the Azimuth organisation, which has allowed me to gain more hands-on experience in presenting fixed media music in public.

3.2. From the sound of instruments to sounding instruments

One of the important conceptions behind *musique concrète* was the idea of opening up music to the sonic potential of 'non-musical' sounds, that is to say sounds not produced by musical instruments or voices, as well as found or specially made recordings of instruments or voices. The term 'concrete' was also used in order to emphasise the material quality of the music, as opposed to music based on the 'abstraction' of traditional notation. As the composer Denis Smalley explains, 'instrumental and vocal resources are a "subset" of the wide-open sound world which is electroacoustic music's territory' (1997, 111). Instrumental and vocal sound sources have always been present in electroacoustic music, such as in Karlheinz Stockhausen's *Gesang der Jünglinge* (1956) in which recorded voices play an important role, or *Hibiki Hana Ma* (1970) composed by Iannis Xenakis, which is based on orchestral sounds. The composer Agostino Di Scipio (2004) discusses what distinguishes electroacoustic pieces such as *Hibiki Hana Ma* from recorded orchestral music. He argues that the electroacoustic techniques such as editing, layering and processing the recorded material, transforms the result into something different

than simply recorded instruments. In other words, the resultant sounds would no longer be reproducible by those instruments or singers.[27]

From the moment I started composing electroacoustic music, instrumental sounds have been the exclusive source of material for my pieces. I have always been fascinated by musical instruments, and was involved in the composition of instrumental music before I developed an interest in shaping and transforming – or, better, *extending* – instrumental sounds by electronic means. I therefore began to record instruments in order to provide myself with musical material, initially with the instruments available to me, in the first instance Persian instruments.[28] This is in distinction to the practice of Stockhausen and Xenakis in the examples mentioned above, where the sounds recorded by the voice and instruments respectively had first been composed and notated, although composers of *musique concrète* often regarded recording their own sounds as a matter of principle. For example, Pierre Schaeffer stated that he was seeking 'instruments' and 'voices' in his recordings of found objects: 'In all this wooden and tin junk and in my bicycle horns I rediscover my violin, my voice. I am seeking direct contact with sound material, without any electrons getting in the way' (2012, 7). In his local environment he found objects he could use as his 'instruments' and recorded them himself although his compositions also make extensive use of sounds he recorded on instruments such as prepared piano.

In a similar way, my own approach has often been to record short segments to be used as musical building blocks. These could include the 'conventional' sounds of the instruments, such as plucked strings, a two- or three-note motif, bowing a string, (pitched and unpitched) tremolo on the strings, and so on, as well as the 'unconventional' sounds of those instruments by using 'extended techniques' such as plucking on (or behind) the bridge of a string instrument, tapping on its body, scratching the skin of a drum; in short, all the sounds I could imagine and find by engaging with the instrument. According to Gernot Böhme

> the specific character of each musical instrument – the horn, the saxophone, and so on – is palpable in its sound. New music has pushed this further by pursuing the material character of musical instruments beyond tones – by blowing, striking, scratching, and so on. In this way, musical instruments were acknowledged, not merely as instruments generating tones as clearly as possible, but now also in the specific character they have as bodies. (2017, 140)

In other words, contemporary composition has added a dimension to acoustic instruments by treating them not only as a means of realising the music of a specific tradition, but also as 'sound objects' which can be made to sound in a variety of ways that emerge from their physical nature rather than from their traditional musical functions. The term 'sound object' here relates to Helmut Lachenmann's description of his work as 'musique concrète instrumentale' (Steenhuisen

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[27] In the case of *Forty part motet* (2001), Janet Cardiff recreates Thomas Tallis's vocal piece *Spem in Alium* (1573) by recording the individual voices and placing each in one of 40 loudspeakers. While no editing or processing is applied to the recordings, the placement of each voice on a loudspeaker in space transforms the experience of listening to the music into something different from traditional vocal performance. Listeners are able to wander through what looks like a small forest of loudspeakers and to stand close to one or other of the single 'voices', which is obviously not possible when listening to the music performed by a physical choir.

[28] While Persian instruments and their timbre have a conspicuous presence and importance in my compositions, this aspect does not play a decisive role in this research. I happened to have them around me and am familiar with their sounds and playing techniques. These works can of course be considered in terms of the cultural significance of incorporating Persian instruments in electroacoustic music, but that is an issue outside the scope of the present research, which I focused on the processes of composition and performance rather than on the initial choice of sound materials.

2003,10). Lachenmann's conception of 'sound object' differs from that of Pierre Schaeffer. As the composer Ming Tsao explains, '*musique concrète instrumentale* refers not to Pierre Schaeffer's sense of an acousmatic music where one forgets about the source of a sound and focuses only on the sound itself, but to the contrary focuses on the concrete musical experience of producing sounds on instruments' (2014, 226). This understanding, however, does resemble Schaeffer's early description of the sound object (*objet sonore*) which originally referred to the object (the physical-material cause) that produces the sound (Kane 2019, 55). In order to bring some clarity to this situation, I will use the term 'sounding object' to refer to the physical objects used to produce sounds, and 'sound objects' to refer to the recorded segments made with them.[29] In this connection it is relevant to recall Gernot Böhme's discussion of the ideas of the German mystic and philosopher Jacob Böhme (1575-1624) in his text *De Signatura Rerum* (1651), where he models things and beings as musical instruments:

> The body is regarded as a sounding board, and its form and materiality as tuning or character (*Stimmung*, called *signatura* by Böhme), which is accountable for the characteristic expression a thing can have. […] like an instrument, each thing has its genuine character (signature) and, when it is struck, its characteristic tone reveals. (2017, 123)

This poetic conception of musical instruments is exemplified in my *Broken Ensemble* project (discussed below), where the bodies of the instruments are caused to vibrate and resonate as sound sources.

When I was studying composition, I would often meet with instrumentalists to try out some sound production ideas and explore extended techniques on their instruments. Such sessions were crucial for me as a composer in order to acquire a better understanding of the possibilities and limitations of those instruments, and they helped me to experience and listen to the sound production techniques that I had already read about in textbooks. Some of these sounds can be consistently produced using a given technique, such as many multiphonics on wind instruments (for which fingering charts and difficulty level indicators are given in textbooks). Some other sounds, on the other hand, are more delicate and unpredictable, so that reproducing them in an exact manner is extremely difficult or in some cases impossible, such as controlling the emergent melodic contour when playing overtones on woodwind instruments. While it is difficult to be specific about such unpredictable sounds when attempting to notate them in a score, recording them and using them in fixed media music presents no such obstacles. The recording sessions for my fixed media music can be considered as a similar kind of process to my learning about extended instrumental techniques from performers and textbooks. Instead of having to use notational symbols to represent these techniques and sounds in a score, I record and store those sounds directly as my actual sound material without feeling any need to make them consistently reproducible through notation. Moreover, in most cases, I play the instrument myself and try to achieve a desired sound; or I explore its sonic possibilities, bringing a performative aspect into the compositional process (see Chapter 1). This is a trial and error process full of serendipity. I am by no means a virtuoso on any of the instruments that I record,

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[29] According to Pierre Schaeffer, '[t]he name sound object refers to every sound phenomenon and event perceived as a whole, a coherent entity'. He compares the sound object to musical notes and explains that, '[*s*]*ound object* and *musical note*: insofar as it is a unit of sound, a "gestalt", which can be made up of several micro-events bound together by a form, the sound object in classical music cannot precisely match each note on the score: a harp arpeggio on the score is a series of notes; but, to the listener, it is a single sound object' (Chion 2009, 33).

but rather a composer who tries to materialise an idea of possible new and interesting sounds which can be obtained with the instrument. This also involves improvisation: exploring the instrument in search of material which might inspire a new composition. These recordings, therefore, become unique and unrepeatable entities, having been captured under certain circumstances and in a certain atmosphere.

The recordings are then subjected to an evaluation and selection stage. This is the moment to select the most interesting sounds and isolate them as 'sound objects', ready to be further processed or otherwise structured in an eventual composition. The selection process might relate to compositional ideas I already had in advance, or to the musical potential suggested by the materials themselves during or after the recording sessions. In other words, the selection procedure is already part of the composition process. In some cases, a certain sound recording prompts the idea of a new piece – a gesture, a certain texture or quality, or what might be described as an atmosphere (see Chapter 2). For instance, in the case of *Gereh II* (2013) for eight channels, the idea of the piece came out of a recording session in which I was improvising on the *setar,* specifically exploring the technique of tremolo. In other cases, the recording process was initiated by a particular preexisting compositional idea. In *Dor* (2012), for the Wave Field Synthesis system, the main idea for the piece was conceived first, and the recording followed consequently. This main idea was based on circular movements, inspired by Sufi dance rituals. Accordingly, the sound recordings were based on a circular trajectory in which I moved the microphone in a circular pattern following the sound source (rubbing the skin of the frame drum). This is exactly how these sounds appear in the piece, moving in circular trajectories; the intended spatialisation of the sounds affected my approach to recording them. In case of *Yekhaft* (2022), recordings of bowed strings suggested the idea of using arc-shaped spatialisation trajectories on the Wave Field Synthesis system.

The recorded segments referred to above can be as short as one second, or as long as two or three minutes. Using brief sound objects allows for more flexibility in combining them to create larger structures. An important role is played by recording techniques in establishing the character of these sound materials. For instance, close-miking, which I often utilise in my recordings, functions as a magnifying glass, accentuating subtle details in the sound.[30] These might not be audible in an acoustic setting where the audience is some meters away from the instruments, so that it is as if one is listening to an instrument in extreme proximity - sometimes even nearly touching the instrument with their ears.[31] Furthermore, such closeness to the sound source isolates the sounds from their usual context, giving them a purer character without external resonances. This, in turn, facilitates their transposition to new contexts, which might involve composing a new acoustic context for them. This kind of recording technique, in combination with the use of brief recorded segments, has the effect of neutralising or reducing any sense of performative agency that might otherwise remain attached to the sound materials, for example if the listener is aware of the space in which the recording took place, or the presence of an instrumental performer executing a particular sequence of sounds. Nevertheless,

[30] Close-miking is a technique which involves placing a microphone very close to a sound source, normally with the intention of maximising the wanted sound and minimising any unwanted sounds from other nearby sound sources or the room acoustics. In classical music circles the technique is more often known as 'Accent Miking'. (https://www.soundonsound.com/glossary/close-miking)

[31] In some cases, I have also placed a miniature microphone (DPA 4060) inside the instrument. This provides a unique sonic perspective, opening up a new sound world, as if the listener is inside the instrument.

these sounds still carry the physical materiality and energy of their source. As the composer and music theorist Andrew Mead remarks:

> We as listeners can understand sound qualities in terms of the actions used to produce them, and [the] dynamic level certainly reflects the amount of energy being expended to create a sound. (1999, 4)

'Dynamic level' here refers to the perceived energy used to produce a sound with a particular sounding object, rather than its loudness when incorporated into a new context. As Smalley puts it, in listening to recorded instrumental sounds, 'spectromorphological' references may provide us with the otherwise absent cues to how the sounds were produced.[32]

> When we hear spectromorphologies we detect the humanity behind them by deducing gestural activity, referring back through gesture to proprioceptive and psychological experience in general. The listener's experience of listening to instruments is a cultural conditioning process based on years of (unconscious) audiovisual training. A knowledge of sounding gesture is therefore culturally very strongly imbedded. This cannot be ignored and denied when we come to electroacoustic music. It is particularly important for acousmatic music where the sources and causes of sound-making become remote or detached from known, directly experienced physical gesture and sounding sources. The process of increasing remoteness I refer to as gestural surrogacy. (1997, 111-112)

Instrumental sounds might be used in their raw form or, more frequently in my work, undergo various processing techniques, ranging from subtle alterations to transformations that render the original instrumental source unrecognisable. These processings can sometimes completely obscure those gestures mentioned by Smalley. For instance, *Sefrhasht* (2016) is based entirely on recorded flute sounds, although recognising these, and recognising the action of flute-playing, is rendered extremely difficult by the extensive transformation applied to the recordings, while the energy and the materiality contained in the sounds are still perceivable.

All possible sounds can potentially serve as material for composing electroacoustic music, but instrumental sounds have a peculiar status. These sounds might be regarded as 'abstract', in the sense that – unlike field recordings and environmental sounds – they do not refer to the outside world or represent an event, place or time; instead, they refer to music and thus to a different kind of listening experience. On the other hand, they are not as abstract as analogue or digitally generated/synthesised sounds. Instrumental sounds embody the physicality and materiality of the instruments, as well as the energy which is put into their production. This physicality and materiality are in turn manifested perceptibly when the sounds are projected in space, specifically on multiple loudspeakers, as if the sounds are being produced by a (transfigured) ensemble or an orchestra.

Lachenmann observes that the merit of new music lies not necessarily in making new sounds, but rather in providing them with new contexts:

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[32] According to Smalley, '[s]pectromorphology is concerned with perceiving and thinking in terms of spectral energies and shapes in space, their behaviour, their motion and growth processes, and their relative functions in a musical context' (1997, 124).

> It is about breaking the old context, by whatever means, to break the sounds, looking into their anatomy. […] Every tremolo or interval or tam-tam noise is as intensive and new as the context you stimulate for it. (Steenhuisen 2003, 10)

As such, electroacoustic techniques applied to instrumental sounds – besides extending their timbres – give those sounds a new dimension, or decontextualise them in Lachenmann's sense, and thus bring about a further renewal of their musical potential, for instance through spatial polyphonic thinking. We could call these electroacoustic pieces 'extended instrumental music' for loudspeakers. For instance, the timbre of instrumental sounds is extended by processing and manipulating them through electroacoustic means. The performative techniques applied to the recorded instruments are extended by making certain passages much faster or slower than they could be played in reality, or by creating complex polyphonic textures which are only possible via montage and editing techniques. Other examples of extension are the magnification of extremely soft and subtle sounds, or the multiplication of instruments into 'ensembles' or even 'orchestras'. The original spatial locations of the instruments when they were recorded are sometimes extended too, by projecting them from various points in the space over a multichannel sound system. Therefore, instead of being situated in one specific location (whether on stage or not), their presence in the space becomes extended to envelop the audience. In all these examples, the role of the original 'performer' of the sounds is hidden by the composition process, so that the instruments and their extensions seem to take on an independent existence.

In what follows, I will explain how my preoccupation with instruments and instrumental sounds on the one hand, and electroacoustic music with loudspeakers as the endpoint, on the other, resulted in the *Broken Ensemble* project in which the physical presence of the instruments provides the sound sources in space.

3.2.1. The *Broken Ensemble* project

Broken Ensemble is a series of pieces or sound installations, which might in principle be regarded as a self-playing ensemble, consisting of a number of broken instruments which can no longer be played in the normal way.[33] A transducer is attached to each instrument, in order to cause its body to resonate and produce sound.[34] In the sound-installation versions (2017 and 2022), an algorithm running on a computer in real time is responsible for reproducing the music in a certain order and sending it to the instruments through the transducers. The sound material used in these works is based on recordings of the same instruments. Like an ensemble, these broken instruments interact with each other, play together and give space to one another while structuring new musical relationships, all of this generated by the algorithm which also ensures that no exact repetition takes place. In the case of the fixed media versions, such as *Reflection*

[33] So far I have collected a broken santur, two broken setars, a broken daf, a broken tombak and a broken violin. 'The santur is a Persian hammered dulcimer, the form of which is very similar to forms found in North India and Greece […] The setar is a long-necked lute with a teardrop-shaped soundbox. Traditionally, it has three strings, usually strummed with the fingernail, spanning in range across two octaves and a fifth […] The tombak (sometimes called tonbak or dombak) is perhaps the most prevalent form: a goblet drum held horizontally or at an angle and played with the fingers and palms of the hands. The tombak adds the rhythmic element to ensemble playing, but can also be used in solo, virtuosic performance' (Martin 2020, 377-8).

[34] The word transducer 'is commonly used to refer to the device which conveys sonic vibrations to a resonant object' (Rogalsky 2006, 23).

(2016) for three broken instruments and four loudspeakers, one channel of pre-composed music is assigned to each number of sound-producing bodies, in this case seven.

The story of Broken Ensemble began with me receiving a damaged *santur* from a friend who did not know what to do with it. Drastic humidity changes had severely deformed the body of the instrument with large cracks, and it was no longer playable.[35] I took the opportunity to carry out experiments with it. During these explorations, I began to use a transducer in order to cause its body to resonate, so that the instrument itself became a unique 'loudspeaker', retaining its own original characteristics. Later on, I collected some more broken instruments to form an ensemble.

A conventional loudspeaker consists of vibrating paper or plastic cones (dome-shaped in the case of most tweeters) contained in a box which is intended to resonate with the cone(s) as little as possible, so as to be acoustically transparent and not 'colour' the sounds it reproduces. In contrast, with my broken instruments (in combination with transducers), the body of the instruments (including all the strings, the sound board, skin and so on) becomes resonating material, emphasising colouration rather than transparency. The characteristics of the instrument's body, such as its shape, size and material, determine the sonic idiosyncrasy of these 'loudspeakers'. Furthermore, the manner in which these instrument/loudspeakers propagate sound in space also differs from that of a conventional loudspeaker. While the latter is described in terms of vertical and horizontal dispersion angles, the former projects sound in a more omni-directional fashion, just as an instrument does.[36] A similar example of such instrument-like loudspeakers can be found in the 'diffusers' designed for projecting the sound of the Ondes Martenot. First demonstrated in 1928, this was one of the first electronic instruments, and was designed to be played with an expressivity comparable to that of a violin or flute - the keys of its keyboard are able to move laterally to produce vibrato, and alongside the keyboard is a long ribbon bearing a ring, which can be moved horizontally to produce more or less wide glissandi. From the outset, its loudspeakers or 'diffusers' were intended to be part of the instrument rather than something external to it; various 'diffusers' have been produced for it, each with a different sound production technique and with different sonic characteristics, showing an early approach to employing instrument-like loudspeakers to project electronic sounds.[37]

However, as mentioned above, loudspeakers are usually desired and designed to be a transparent medium, which means that they reproduce the sound sent to them in the form of electrical signals as faithfully as possible; they should not impose their own presence and physicality on what is heard. In his series of compositions entitled *Rainforest* (1968-1973), the American pianist and composer David Tudor seeks the opposite effect, which comes closer to

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[35] This was the result of bringing the instrument from Iran with its relatively dry climate to the Netherlands.

[36] Certain instruments do have a clear directionality in their sound projection: for instance a trumpet (and other brass instruments) mainly project the sound through their bell.

[37] The *Metallique* diffuser is essentially a gong with a transducer attached to resonate it. As a result it produces a metallic sound. Another one, named *Résonance*, 'uses a set of seven brass springs stretched in front of a speaker to create resonance and reverberation. Unlike a spring reverb, in which the instrument's signal is electrically passed through the springs, the springs of the *Résonance* are excited mechanically' (www.thekingofgear.com). A third diffuser, *Palme,* has a construction similar to a guitar; twelve strings which can be tuned in various ways, rest on a bridge containing a transducer through which sound is transmitted to the 'instrument', and resonates in the strings.

my conception of broken instruments as loudspeakers.[38] He attached transducers to various objects, and aimed at refracting sonic material through the physicality of these objects, as 'natural filters' (Rogalsky 2006, 56), which changes the input sound based on the characteristics of that object. He also compares his loudspeaker-objects with musical instruments, or, in his words, 'generating instruments':

> One of the ideas in my Rainforest series is that loudspeakers should be individuals, they should be instruments. So if you need a hundred of them to fill a hall, each one should have its own individual voice ... After all what is a loudspeaker? At present it's a reproducing instrument, but my feeling all along has been that you should regard it as a generating instrument ... Why shouldn't there be a thousand or more ways of building loudspeakers? ... Suppose you build one which only responds to the frequencies between 100 and 200 [Hz]? ... If you put sine waves through it, then you get quite a different sound emerging ... The loudspeaker is transforming what goes into it, instead of reproducing it. (Tudor 1972, 26)

Similarly, in Broken Ensemble, any kind of sonic material could be fed to the instruments. However, my interest lay not so much in utilising these instruments as a 'general' loudspeaker (or as a 'natural filter' as in the *Rainforest* series), but in projecting the specific type of sonic vocabulary which originally belonged to that specific instrument/loudspeaker. As such, when the transducers are fed by sounds recorded from that very same broken instrument, a particular acoustic effect emerges, as if the instrument is actually being played, as a result of the accentuation of the resonant frequencies of the instrument. The instrument echoes its own sounds, so to speak. I expanded this idea further by processing and manipulating the recorded sounds from the instruments. A new layer was thus introduced into the sonic vocabulary of the instruments, which could be regarded as 'impossible sounds'. For instance, the pitch range of the instrument might be (electroacoustically) expanded, or it might seem to play extremely fast tempi or multiple simultaneous sounds, physically impossible when played by a human being. Nevertheless, the resulting 'hyperinstruments' still have their physical limitations in terms of intensity, volume and frequency response. It is not possible, for instance, to achieve sound levels beyond the capacity and the physicality of an instrument, or frequencies lower than those that can be produced by a sounding body of a certain size.

Broken Ensemble presents a paradox. Unlike traditional acousmatic music for loudspeakers which is concerned with pure listening without the visual presence of the sound sources, here the sounding objects have a strong visual presence although instrumentalists are absent. Usually loudspeakers are designed to be as unobtrusive as possible: black in colour and neutral in appearance. Even in the case of the Acousmonium with illuminated and colourful loudspeakers (see Chapter 2), there is no connection between their physical appearance and the sounds emitted from them. In *Broken Ensemble*, though, this connection is clearly present, and affects the listener's perception of the music. In other words, the sounds heard are perceived to correspond to the visual appearance of the sound-producing objects. For me this phenomenon has a poetic significance, and both negates and challenges the acousmatic conception, in which

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[38] According to Tudor, *Rainforest* 'in its original version (1968), is a collection of small speakers, sculpturally constructed from physical materials having different resonant characteristics. These instruments, each having a different "voice", establish a means of sound transformation without electronics: the source sounds, when transmitted thru the physical materials, are modified by their resonant nodes. The source sounds used are performed live, with sound generators specially made to produce unpredictable oscillations' (Tudor 1988).

the causes of sounds are hidden. *Broken Ensemble,* and similar approaches to employing non-standard loudspeakers or loudspeaker-objects, can offer new modes of projecting and materialising sound in space, opening up new possibilities for both composing and performing electroacoustic music, also bringing the worlds of (acoustic) instrumental and electroacoustic music closer together and blurring their boundaries, so that we might imagine *instrumental music for loudspeakers* or *electroacoustic music for instruments*.

3.3. Spatial polyphony

> When new instruments will allow me to write music as I conceive it, the movement of sound-masses, of shifting planes will be clearly perceived in my work, taking the place of linear counterpoint. (Varèse 1936, in Cox and Warner 2017, 41)

According to the Oxford English Dictionary, polyphony is 'the style of simultaneously combining a number of parts, each forming an individual melody and harmonising with each other'. The composer Simon Emmerson describes polyphony in contemporary terms as 'more than one simultaneous coherent "line" of musical thought' (2007, 113), while for John Cage it is a matter of the 'copresence of dissimilarities' (Harley 1999, 150). According to the composer Paulo Chagas , two important aspects of polyphony are *multiplicity* and *individuality*. He explains that '[t]he notion of polyphony implies the perception of multiple and simultaneous sound events organized in a system of relationships producing a temporal processing of meaning' (2006, 47). 'Spatial polyphony' is a term that I employ to describe my approach (and that of some other composers such as Xenakis, Stockhausen and Horacio Vaggione, as will be discussed below) to multichannel/spatial composition, in which space, location and movement of sounds is a fundamental aspect of the way sounds are interrelated and form a polyphonic texture, since separation and distance between sounds and/or sound sources in itself has the effect of mobilising polyphonic qualities. Traditionally, individual lines or voices in polyphonic music are distinguished by divergences in pitch and rhythm, while divergences in timbre can also play an important role in enabling listeners to discern various 'melodies' or musical events, and give each its own individuality. Polyphonic qualities can of course encompass many other parameters beyond pitch, rhythm and timbre, including contrasts between pitched and noisy sounds, between sustained and short sounds, between reverberant and dry sounds, soft and loud sounds, synthetic and concrete sounds, or foreground and background sounds. All of these variable features may participate in the contrapuntal characteristics of the music, and enhance its polyphonic texture. By introducing space into this equation, the polyphonic texture acquires a further dimension: the locational counterpoint between voices or musical events. Earlier composers such as Charles Ives and Henry Brant in their instrumental music 'explored the simultaneity of various musical processes that take place at different points of space', according to the musicologist Maria Anna Harley, who infers that '[t]heir ideas of the coexistence of several distinct strands within a composition are rooted in polyphony' (1997, 88). The philosopher and musicologist John Dyck asserts that spatiality in music can play an important role in polyphony by 'unifying or distinguishing multiple musical parts' (2021, 280). He suggests a concept of 'spatial clarity' where '[s]pace "separates" or "unifies" musical parts in a way distinct from pitch, timbre, and volume' (2021, 282). This helps to foreground the contrapuntal qualities in music, where '[t]he degree of stream segregation covaries with the spatial distance between sound sources' (2021, 282). A multichannel configuration, for instance, is an effective way to implement such stream segregation.

Polyphonic thinking has been central to my compositions even before I began to concentrate on electroacoustic music, specifically in relation to my research into the characteristics of carpet designs and their potential connection to music.[39] Similar qualities in carpet design manifest themselves in the co-presence of diverse motifs and patterns at multiple scales, that eventually establish a complex and 'polyphonic' visual effect. This phenomenon gave me a new understanding of polyphony in music, which was one of the main inspirations behind the electroacoustic compositions I subsequently began to produce.

3.3.1. Spatial music

Music by nature is always a spatial phenomenon, and the integration of spatiality into musical composition has been present throughout music history, for example in the *cori spezzati* practice in Venetian music around 1600. Around the middle of the nineteenth century, and more intensively in the twentieth century, composers began to consider the spatial aspect of music more purposefully. For example, Hector Berlioz (1803-1869), Gustav Mahler (1860-1911) and Charles Ives (1874-1954) wrote compositions which use 'offstage' instrumental groups separating musical lines in space. However, Harley notes that, even in a traditional setting where musicians are situated on stage, an immanent and underlying spatial quality is present:

> Chamber and orchestral music has a latent quasi-spatial structure when the ensemble placement is standard, well-known and does not have to be specified. Most of the music composed for specific instrumental groups takes for granted certain types of spatial relationships inherent in the kind and size of the ensemble. (1993, 126)

One of the reasons for such arrangement is to achieve a particular blending of the various timbres and intensities of an orchestra. John Cage underlines the fact that the proximity to each other of the musicians on stage is desirable in traditional musical thinking, since it gives rise to a more coherent mixture of their sounds:

> In the case of the harmonious ensembles of European musical history, a fusion of sound was of the essence, and therefore players in an ensemble were brought as close together as possible, so that their actions, productive of an object in time, might be effective. (1961, 39)

For instance, the louder groups of instruments, such as percussion and brass, are traditionally situated further back, while the softer sounding strings are placed in the front. Composers in the twentieth century became increasingly aware of the possible effects of reversing or changing this arrangement. As Harley explains:

> In Xenakis' *Pithoprakta* (1955/1956), the instruments systematically rise and fall in tone and volume, from one side of the stage to the other. As a result, there is "a shift of the sound mass" across the stage. (1994, 295)

It is important to note that perceiving such an effect depends on the position and distance of the listener relative to the stage. Xenakis even suggested that the conductor should be situated within the audience and not on stage (like the sound projectionist in electroacoustic music!), in

[39] 'Composing Music Based on Carpet' (2014), Master Thesis, Institute of Sonology, Royal Conservatoire The Hague.

order to better hear how the blending of different groups of instruments sound and 'mix' in the concert hall:

> The conductor hears the orchestra in a certain way during the performance, he has certain instruments to the right or to the left, he has the string orchestra around him, then the woodwinds and brass farther away, followed by the percussion. The listener in the auditorium does not have the same sound image as the conductor, and the conductor has to conduct for the listener, not for himself. How can he do that when he is not there? He should conduct from the auditorium and listen to the orchestra from that place. (1992, 11)

In presenting fixed media music, the performer – considered, as discussed in Chapter 1, to have a role similar to that of a conductor – is often situated within the audience, as suggested by Xenakis for orchestral conductors, in order to have a good understanding of how the music is perceived in the auditorium.

The roots of such spatial considerations can perhaps be traced back to certain developments of instrumental music from the last century. For instance, the idea of *Klangfarbenmelodie* foregrounds timbre by splitting a musical line or melody between various instruments.[40] Inevitably, this approach splits the melody spatially at the same time, since each instrument is located in a specific point in space, so that the melodic line traverses the orchestra. Building on such latent spatial qualities in instrumental music, even the ones not composed with such intentions, the composer and researcher Jason W. Solomon proposes a concept of *spatial gesture,* described (in the context of string quartet no.14 by Beethoven) as 'a composite, dynamic pattern of motion that emerges in the physical space of musical performance, often resulting from staggered activity of multiple performers' (2019, 120). Such spatial 'patterns' are less perceivable in a traditional frontal setting where musicians are located on stage next to each other. However, when the musicians are spatially distributed in the concert space, as in Karlheinz Stockhausen's *Gruppen* (1957) for three orchestras, or in *Lichter-Wasser* (1999) for soprano, tenor, and orchestra with synthesizer, the spatial and timbral distribution of melodic lines in the space becomes much clearer.[41] According to Harley, '[w]hen the role of spatial projection, sound location and direction become important elements of musical structure, we speak of the music's "spatialisation"' (1999, 148). The American composer Henry Brant (1913-2008), who was intensely occupied with the integration of space in his music, considers spatiality on a par with other fundamental aspects of music such as pitch and duration. He explains that for him 'space is part of the composing plan. If you change the space in a piece of mine, it's no different than changing the notes or the rhythms in someone else's piece' (quoted in Dyck 2021, 283). Similarly, Stockhausen in 'Music in Space' (1959) considered space, more specifically the direction from which sound is projected, as a musical parameter which can (like any other

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[40] *Klangfarbenmelodie* or 'tone-colour melody' was first introduced by Arnold Schoenberg in his book *Harmonielehre* (1911). According to Alfred Cramer, '[t]he term has become accepted as a name for a common twentieth-century practice in which the timbres of successive tones gain melodic importance comparable to that of pitch' (2002,1).

[41] Stockhausen describes the perceived movement of sounds and its connection to timbre in *Gruppen*: 'I also thought in terms of moving timbres: there's one spot that led to something I hadn't expected myself—a chord is moving from orchestra to orchestra with almost exactly the same instruments (horns and trombones) and what changes isn't the pitches but rather the sound in space' (Cott 1973, 200-1). In his article Paul Miller analyses *Lichter—Wasser*'s spatial composition ('shapes') and the movement of the 'melodic' lines in space. He explains that 'the apparent movement of melodic ideas in a stationary ensemble (as opposed to the *actual* movement of sounds through space through real physical movement) is the focus of a great deal of compositional design' (2012, 344).

parameter) be readily serialised.[42] Harley summarises the ideas expressed by Brant in his writings on the spatial organisation of musical material:

> (1) Spatial separation clarifies the texture; this is particularly important if the music consists of several different layers located in the same pitch register.
> (2) Spatial separation is equivalent to the separation of textures in pitch space; one can hear separately layers of music that are located in different registers, and layers that originate from distant points in the performance space.
> (3) Spatial separation permits a greater complexity in the music; which may, therefore, include more unrelated elements perceived simultaneously.
> (4) Spatial separation makes exact rhythmic coordination impossible; distant groups should avoid simultaneous, identical rhythmic patterns.
> (5) There are no optimum positions of the listeners or the performers in the hall; each situation is different. (1999, 150)

These points are also valid for multi-loudspeaker music. The first three describe issues mainly related to spatial polyphony, as discussed earlier. In the case of rhythmic coordination, this can be easily achieved in electroacoustic music. Nevertheless, the size of the venue, the distance between the loudspeakers and the audience, and their arrangement, can have an effect on the perception of rhythmic synchronicity. And, as discussed in Chapter 1, each listener in a multichannel setup hears a unique mix of all the various sound sources.

3.3.2. Multichannel composition

> It is my conviction that our epoch's contribution to the ongoing sea changes in Western music is an evolution of electronic music (in all its forms) that opens up a dimension that has always been a part of music performance but now, with the development of highly sophisticated software and the ever more common use of multi-channel amplifications systems in concert halls, is available to the composer as a structural and expressive resource. This dimension is, of course, space and the spatialization of musical sound. (Dashow 2013, 4)

The growing number of multichannel sound systems around the world, which is the result of technological advances in digital audio, lends an urgency to the exploration and formulation of approaches to composing and performing for multichannel systems, in order to gain a deeper understanding of the affordances of spatial sound and thus to realise the full musical potential of these systems.[43] The composer Eric Lyon argues that one of the reasons that spatial aspects of electroacoustic music have not been fully developed is the dominance of timbre composition which was initially the main concern in the developments of electroacoustic music, an area which has now nearly come to a saturation. Lyon asserts that '[b]y contrast, computer music

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[42] Nevertheless, as Kees Tazelaar (personal conversation) underlines, Stockhausen was willing to compromise on this parameter by mixing down his spatial composition to stereo for release on records and CDs. But he would not do such a thing with the other parameters such as pitch and duration.

[43] To mention a few: The Sonic Lab at the Sonic Arts Research Centre (SARC), Queen's University, Belfast. The IEM-Cube, at the Institute of Electronic Music and Acoustics (IEM), Graz. The Motion Lab at the Department for Musicology, Oslo University. SPACE (Soundscape Projection Ambisonic Control Engine) at the Electronic Laboratory for Experimental Music of the Conservatorio G. Rossini in Pesaro, Italy.

composition for large numbers of speakers is an area ripe for experimentation and discovery' (2014, 4).

When I started studying electroacoustic music, I found spatiality a particularly fascinating aspect, and I soon began experimenting with multichannel compositions, strongly attracted by the potential of the medium itself to generate polyphonic textures. The way that simultaneous musical events could be situated in various points in space opened up a new world of ideas for me. As discussed earlier, electroacoustic music offers a wealth of possibilities in terms of spatialisation of sounds. As Harley puts it, '[f]or electroacoustic music spatiality is a condition *sine qua non*' (1993, 130), and for Denis Smalley, '[t]he spatial experience of electroacoustic music is one of the particular aspects it has to offer that no other musical art has to offer in such variety or with such vividness' (2000, 20). Therefore, spatial polyphony can be best implemented in electroacoustic music where each 'voice', or, in Edgard Varèse's terminology, each 'plane' can be projected anywhere in space, either from a loudspeaker, or from a virtual point in between loudspeakers.[44] In this regard, the difference between spatial instrumental music, such as Xenakis' *Terretektorh* for orchestra, and spatial electroacoustic music is that, in the former, a given sound location is limited to the sounds of that specific instrument. For instance, if a violin player is situated in the concert venue at a specific point, the only sound projected from that point is the violin sound. However, in electroacoustic music, the sound source (the loudspeaker) can produce an almost infinite variety and combination of sounds . The sound source is not bound to its own physicality (as in the violin example), but is a blank carrier which can project a plethora of sonic identities, and can be situated almost anywhere in a space.[45] An instrumentalist's positioning is often limited for practical reasons: situating a piano above the audience would not be an easy task! In *Prometeo* (1985), Luigi Nono aimed at expanding the spatial placement of musicians, by utilising a bespoke construction (designed by the renowned Italian architect Renzo Piano) to locate musicians at various heights within an architectural space. In contrast, rigging loudspeakers in various heights and positioning is considerably more conveniently realised.

According to the electroacoustic composer Robert Normandeau, multichannel composing has two principle motivations. The first is that less complex sounds are presented by loudspeakers 'with better accuracy and clarity', while the second concerns the localisation of the sounds in space: 'music spatialized over a group of speakers placed throughout a hall allows the listener to better hear the polyphony of the music' because each layer or voice in the polyphony arrives at the ears of the listener from a different location in space (2009, 278). In my opinion, these two aspects are closely entangled and also relate closely to Brant's criteria for spatial instrumental music described above. When musical material is divided over multiple sources (loudspeakers) for reasons of increased clarity, spatial polyphonic qualities automatically come into being since those loudspeakers are situated in various locations. The composer Ludger Brümmer explains the advantage of multichannel composition in reducing and nuancing the masking effect that occurs when signals are combined together in a mix and 'quiet sounds are drowned out by loud sounds' (2017, 46). When those sounds are projected from different locations, their spatial

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[44] According to John D. Anderson, for linear melodic lines, Varèse borrowed the geometric term *plane*. (1991, 35)

[45] Obviously, loudspeakers vary in terms of their sonic characteristics, and their physicality (size, shape, type of internal components) plays an important role in their character and sound reproduction capabilities. Nevertheless, to a great extent, they all can reproduce almost any sound, some better than others. As the composer John Croft puts it, '[a] loudspeaker can, in principle, produce any sound; on an instrument, almost all sounds are impossible, and of those that are possible, some are more difficult to produce than others' (2007, 62).

separation allows for more varied mixes in terms of contrasts of loudness between different sounds or layers. Kees Tazelaar (personal conversation) explains that composing for a multichannel sound system allows for articulating complex musical structures, resulting in what he calls 'transparency'. For instance, in *Source Signals 2* (2021) Tazelaar constructs dense arpeggio-like structures over an eight-channel configuration; the resultant sonic quality (of the individual elements each with a specific location) therefore emerges in space. In other words, the material and its spatial organisation become one. The composer Barry Truax compares stereo with the eight-channel format, and underlines the higher degree of dynamic control in the latter, as well as the possibility of integrating spatiality into the composition process:

> Having eight discrete sources available, all independently controllable, is not only acoustically richer for tape music (since detail is not lost through stereo mixing) but also challenging compositionally in order to integrate a spatial conception into the work. (1999, 143)

Such a spatial conception may be clearly perceived in the work of the Argentinian composer Horacio Vaggione, who considers 'the spatial dimension of sound as something to be composed', in terms of 'size, situation, extension, speed, phase correlation, and so on', resulting in a polyphonic texture:

> I try to give each sound-object a particular, unique spatial feature. The textures created this way are spatially polyphonic or "polyspatial." This is why you can perceive a dynamic spatial depth. (Vaggione quoted in Budón 2000, 18)

While Vaggione actually creates his spatial polyphony in stereo format, his intention is generally to diffuse the music over a larger number of speakers so that the latent spatial characteristics of the music become apparent, causing it to sound almost indistinguishable from music composed in more than two channels.

Chagas underscores the importance of spatiality to the possibility of distinguishing timbral qualities within a polyphonic texture in Stockhausen's *Gesang der Jünglinge* (1956):

> The revolutionary accomplishment of *Gesang der Jünglinge* is to provide the first example of the integration of the composition of timbres with spatial articulation. Spatialization here is not treated as an ornament of the electroacoustic composition for enhancing the listening experience, but as a structural principle of the composition that "intervenes to clarify the composition of timbres" (Decroupet and Ungeheuer 1998, 128). In this sense, this approach to spatialization can be considered an extension of polyphonic thinking, as it applies the principles of independence and control of musical elements to the spatial domain of the composition. (2014, 111)

The musicologists and researchers Pascal Decroupet and Elena Ungeheuer further explain how the distribution of musical material over the multichannel setup affects its perception:

> The electronic and vocal parts . . . have a common denominator: each layer being heard in one loudspeaker, the distinction of the components of the polyphony is, if not easy, at least possible. […] it is the spatialisation which intervenes to clarify the composition of

> timbres by allotting to certain loudspeakers all the variants of one category of timbre and by concentrating the irregular changes in only one loudspeaker. (1998, 128)

Broadly speaking, two main approaches to multichannel composition can be distinguished. The first of these, the *source-point* approach, regards loudspeakers as points (sound sources) in space, comparable to musical instruments. According to the composer Christopher Burns, a characteristic of this approach 'is the tendency to activate and embody the loudspeakers as physical presences in the performance of the work' (Burns 2006, n.p.). The second approach is concerned more with a phantom image that emerges from the synergy of the multi-loudspeaker setup, so that the presence of the loudspeakers at particular points in space is of less importance: in fact this method aims rather at 'dematerialization of the loudspeakers' (Burns 2006, n.p.). The stereo format is a simple example of such an approach, where a sound field is established *in between* two loudspeakers. The Wave Field Synthesis (WFS) system is an advanced example of creating such a sound field, where virtual sound sources and trajectories in space can be established fairly accurately (and with a greater stability than that of a stereo image) by integrating numerous loudspeakers, equally distanced from one another and surrounding the audience.[46] Here the composer is not concerned with the number of channels, but with the location and the trajectory of sounds. Such an 'object-based' approach can also be found in Ambisonic technology (Zotter and Frank 2019),[47] which, similar to WFS, employs a high-density loudspeaker array (HDLA) in order to establish a sound field where virtual points can be created within a 3D space.[48] Natasha Barrett (2021) discusses composing in ambisonic formats (encoding) and the challenges of presenting (decoding) ambisonic pieces, pointing out the problem that there is still no standard HDLA setup in concert venues. Ambisonic pieces, like those composed for WFS, are highly dependent on specific software/hardware configurations in order to be fully materialised. Since the sounds and spatialisation data are stored separately, the WFS and Ambisonic systems may be scaled up and down based on the size of the space, and, as a result, the number of loudspeakers changes while the sound field's proportions stay the same.[49] Of course, the aforementioned two approaches (source point and HDLAs) can be combined in a composition. Moreover, source point techniques can be implemented within any HDLA system, for instance by placing a 8-channel piece in a WFS system in the form of eight discrete points in space, a technique I have employed multiple times. Whether the sonic result is convincing depends on the type and accuracy of the HDLA system in use and the characteristics of the musical material. Barrett's *Virtualmonium* project (2016) simulates a 'loudspeaker orchestra', such as the Acousmonium, with Ambisonic technology, by creating virtual loudspeakers (with various positions, directions and frequency responses) in space. In other words, *Virtualmonium* uses loudspeakers to emulate loudspeakers! According to Barrett, this 'allows composers to custom-design loudspeaker orchestra emulations for the performance of their works, rehearse and refine performances off-site, and perform classical repertoire alongside native 3-D formats in the same concert' (2016, 55). *Virtualmonium* thus demonstrates the potential of implementing any sort of virtual sound sources within a 3D sound field.

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[46] For instance, the WFS system developed by the Game of Life organisation, which is approximately ten by ten meters in size, consisting of 192 loudspeakers and 24 subwoofers.

[47] According to Natasha Barrett, '[i]n the object-based method, audio objects or audio stems are coupled to spatial audio description metadata' (2021, 178).

[48] Ambisonic setups often include heigh by using loudspeakers also above the audience.

[49] In this case, the composed sound trajectories and virtual sources will be recalculated based on the current setup and number of loudspeakers.

Although an HDLA-based approach can theoretically reproduce any phantom sound source in space, in practice the actual control over the location, direction, proximity, and even the type and character of the loudspeaker, is best achieved with physical loudspeakers rather than virtual ones. While future developments in spatial sound would perhaps deliver better sonic results and bring higher degrees of accuracy and control, a critical question remains as to the compositional and musical relevance and merit of such advanced possibilities in spatialising sounds, to which spatial polyphonic thinking offers one possible answer.

Generally speaking, compositions based on the source-point approach are less adversely affected by changes and variations in the loudspeaker arrangement originally intended by the composer. As Burns highlights, '[o]ne advantage of the source-point spatialization techniques described above is that they are highly adaptable to different configurations of loudspeakers' (2006, n.p.). On the other hand, compositions based on the virtual image approach are highly dependent on an accurate reproduction of the sound system configuration envisaged by the composer, in order to retain the 'correct' image, which might otherwise be deformed or destroyed. For instance, in my composition *Tom+Bak* (2020) for eight channels – composed with the source-point approach – the exact placement of the loudspeakers is not crucial, and the configuration of the eight channels can be altered. In this music, spatial polyphonic qualities emerge from a simultaneity of various rhythmical gestures or patterns on the Persian percussion instrument called *tombak* (see above). The sound material has undergone almost no processing, so that the result is as if eight percussionists are situated in the space. Such a polyphonic quality is perhaps closer to spatial polyphony in instrumental music, especially works like Xenakis' *Persephassa* (1969) where six percussionists surround the audience and their sounds are made to circle around the audience by means of overlapping crescendos and diminuendi in the different instrumental parts. At times, the patterns in *Tom+Bak* create a canon-like effect, or, to use Brant's term, 'spill', where one instrument begins and others join in one by one until the space is filled (Brant 1967, 232). Presenting a piece like this in various loudspeaker configurations establishes new relationships between its rhythmic patterns. The spatial polyphonic effect is brought more clearly to the foreground when the loudspeakers surround the audience.

During my studies at the institute of Sonology, I spent extensive hours in the studios experimenting with multichannel sound, both eight-channel and WFS. Fascinated by my discovery of spatiality in music, I tried to develop compositional methods in which these multichannel configurations played an integral role. These experiments were crucial for me in terms of developing an understanding of spatialisation. In the following part, I will discuss in more detail some of the spatialisation techniques I have utilised in my compositions, specifically in relation to polyphony, with explanations of how these techniques translate to performance practice.

3.3.3. Symmetrical spatialisation

As the term suggests, this is an approach for distributing the musical material in space in a symmetrical manner, an approach I developed from considering the concept of symmetry in carpet designs, where multiple networks of patterns together create a complex whole. I implemented this idea in my music for the first time in *Toranj* (2012) for eight channels, and since then it has been part of my toolbox. Symmetrical spatialisation was my first systematic approach towards incorporating spatiality in the composition process, leading directly to my explorations

of the polyphonic potential of spatial composition. Related musical materials are distributed over the multichannel system in a symmetrical manner. As in traditional polyphony, each layer occupies a certain frequency range, so that a 'vertical' dimension is generated by the distribution of sounds through a more or less wide range of frequencies. A carpet gives the viewer an immediate impression of symmetry as the whole can be perceived at once, and I intended to invoke this visual quality by creating music which is spatially symmetrical, as opposed to the kinds of symmetries where music unfolds over the course of time (such as, for example, an ABA form). I was also concerned with the idea of experiencing symmetry and asymmetry simultaneously: the symmetrical relationship between corresponding loudspeakers is created not with precise duplications but with subtle variations. Other composers have also explored (a)symmetrical distributions of instruments in space. Pierre Boulez talks about symmetrical and asymmetrical arrangements of timbre in the arrangement of instrumental groups on stage:

> [T]wo groups will be symmetrical if they are situated at an equal distance from an axis of some kind; if they possess homogeneous or non-homogeneous timbres, identical in quality and density, they can be considered as regularly symmetrical; they are irregularly symmetrical if their homogeneity is not of the same nature (a group of brass against a group of strings, for example) or if their non-homogeneity differs in quality and density; they will otherwise be asymmetrical. (Boulez 1971, 70)

A symmetrical arrangement of instruments in itself is not sufficient to create the perception of symmetrical qualities in music, unless it is combined with other compositional strategies. For instance, in Bela Bartok's *Music for Strings, Percussion and Celesta* (1936) the instruments are arranged on stage in a symmetrical manner and the disposition of the piece's musical materials often follows that symmetry, for example at the opening where a motif gradually spreads across the string ensemble as it is repeated and developed. As Harley notes, Bartok 'connects symmetries in pitch space and in timbral domain with symmetries in performance space' (1999, 150). According to the score, the instruments are arranged on stage in a symmetrical manner: percussion and keyboards in the middle are surrounded by two identical string groups, one on the left side of the stage and the other on the right. In the first movement, the opening fugue subject is presented symmetrically by the left and right viola groups playing in unison. Musical materials (repetitions and sequences) consistently alternate between the two string groups, establishing various symmetrical relationships, and enhanced by the position of the other timbrally contrasted instruments. The music's pitch organisation and temporal structure also involve symmetrical relationships (Gillies 2000, 291). In electroacoustic music, a multichannel setup spread around the entire space allows for even more complex symmetrical relationships between sound sources, which are not only limited to the stage.

3.3.4. Spectral spatialisation

Another approach to multichannel composition is to implement spatial separation between frequency bands, which may be done in several different ways, resulting in different qualities. The general idea is to split the frequency spectrum of a given sound and distribute the resulting components over a multichannel setup. As such, these components (projected from various locations) converge and recreate the full spectrum *in space*, so that spectral spatialisation may be defined as a process of decomposing sound and recomposing it in space.

In a study on the effectiveness of various spatialisation techniques in creating a sense of envelopment, Hugh Lynch and Robert Sazdov (2017) concluded that such strategies of splitting a sound spectrum over a multichannel sound system in space are perceived by the listeners to be the most enveloping and engulfing, specifically when the frequency bands are changing over time.[50]

I employ this approach in my own compositions extensively, and I am continually exploring its affordances during the composition process. For instance, by splitting the spectrum of a short sound object into eight frequency bands, and assigning each to a separate channel (of an eight-channel sound system), the resultant sound appears to take on an extended shape in the space, instead of coming from a single point. The way in which frequency bands are distributed through the multichannel setup directly affects the perceived shape, and can be used as a compositional parameter. Going one step further and applying delays to these components – in other words, manipulating the temporal aspect of the material – causes a different quality to emerge as a function of the change in alignment of the frequency components, which can in turn transform the timbre of the original sound. The amount of delay greatly affects the sonic result: whereas short time delays create an arpeggio-like effect, longer delay times create isolated sound events. Of course, further processing can be applied to each of these frequency bands individually; additionally, the division of the spectrum can be increased to a much higher number of narrower frequency bands. Variations like these provide extensive possibilities for the integration of spatiality into the process of composing the sound material.

I applied this technique for the first time in 2012 in my composition *Dohasht* for 16 channels. In *Dohasht*, a recording of percussive tapping on piano strings is used as a building block. The dense frequency spectrum of such a sound lends itself well to spectral division, so that, when it is split into several frequency bands, each of these still contains an abundance of frequencies. While the idea of *Klangfarbenmelodie* is concerned with splitting a melody horizontally, in spectral spatialisation sounds are divided vertically. Normandeau discusses a comparable approach to *timbre spatialization* where space plays an important role in the reconstruction of the timbre. As he explains:

> What is unique in electroacoustic music is the possibility to fragment sound spectra amongst a network of speakers. When a violin is played, the entire spectrum of the instrument sounds, whereas with multichannel electroacoustic music timbre can be distributed over all virtual points available in the defined space. (2009, 278)

In fact, such strategies in spatial polyphony are comparable to the pointillistic technique in painting, in which colours, in the form of small dots, are painted next to each other directly on the canvas instead of being mixed on the palette beforehand. Subsequently, the resultant 'mixed' colours emerge in the eyes of the observer, being mixed in their mind. According to Gernot Böhme, in pointillism '[t]he colours the painter wishes the onlooker to see are not located on the painted surface but "in space", or in the imagination of the onlooker' (2013, 4). Observing such paintings from close up does not reveal the image. Similarly, spatial polyphonic techniques require space and distance in order to be perceived by the listener. As a result, each listening position in a concert hall has its own unique 'mix' of these multiple points or sound

[50] According to Lynch and Sazdov, envelopment 'is defined as a sense of being surrounded by sound' and engulfment 'as a sense of being "covered" by sound' (2017, 17).

sources. In contrast to the idea of a 'sweet spot' where an 'ideal image' is recreated at a specific point, spatial polyphony gives rise to multiple sweet spots, each giving a different perspective on the music. This can motivate revisiting a performance and listening to the same piece multiple times, from different locations. Obviously, such qualities will not emerge in a stereo mix-down of a multichannel piece; they remain an exclusive feature of spatial music, fully experienced only when the music is presented in a spatial configuration.

As discussed earlier, multichannel pieces composed with the source-point approach are more flexible in the sense that they allow for some variations to the initially intended multichannel arrangement, which in turn gives rise to different actualisations of the piece. In my experience of performing my pieces composed with the spectral spatialisation technique, I could change and bend the multichannel configurations without destroying the material, but instead creating a new variation of the sonic material and the way it forms extended shapes in space.

3.3.5. The *Pejvak* method

Pejvak, which means 'echo' in Persian, is the term I use for a spatialisation method that I have developed based on and inspired by the phenomenon of echo or reverberation, which exemplifies another strategy for achieving spatial polyphony within a multichannel configuration. Sounds reflect from hard surfaces, and on each reflection or iteration they lose part of their energy until they fade out into silence. Echoing is a natural behaviour of sound in a space. The Pejvak method takes this paradigm and schematically expands and transfigures the delayed repetition and decaying which is characteristic of echoing. Each sound source (loudspeaker) represents a reflecting surface on which the sounds are made to 'bounce' by means of electroacoustic processing rather than physical reflection. Three parameters are involved in this process: the degree of reduction of intensity for each iteration, the delay time between each iteration, and the spatial location of each iteration, together establishing a network of diminishing or decaying repetitions in a space. An extra compositional layer can be added here by modifying and processing the sounds on each iteration. By varying the aforementioned three parameters (with or without extra processing), highly diverse results can emerge, from a realistic echo effect to an abstract one in which the delay times are exaggerated so that the sounds are no longer perceived as echoes. This technique works best with short sound objects, so that the relationships between the iterations in the space are better delineated. Applying multiple layers of such a process gives rise to a complex and dense spatial polyphonic texture.

I applied this method for the first time in *Hafthasht* (2019), composed for 24 channels. The piece begins with rather clearly perceivable iterations of short sound objects framed by silence. This might be called 'sonic *chiaroscuro*' in which relatively short sound events emerge from and recede into a background of silence.[51] Close to the end of the piece, these iterations shift towards a more realistic echo effect. In other words, the piece begins with 'abstract' echoes and ends with 'real' ones. Pejvak is therefore another compositional method directed towards the integration of space as a musical parameter. Again, music produced with this method can be actualised in a variety of manners with different loudspeaker configurations.

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[51] Chiaroscuro is an Italian term which translates as light-dark, and refers to the balance and pattern of light and shade in a painting or drawing Chiaroscuro is generally only remarked upon when it is a particularly prominent feature of the work, usually when the artist is using extreme contrasts of light and shade. (https://www.tate.org.uk/art/art-terms/c/chiaroscuro)

3.3.6. Spatial micropolyphony

The affordances of electroacoustic music, such as the possibility of layering and controlling numerous 'voices' can turn spatial polyphony into a kind of micropolyphony as described by György Ligeti (Clendinning 1989, 3), or 'sound masses' as described by Edgard Varése (Anderson 1991, 35) where individual voices or layers are concealed in highly dense textures. The term micropolyphony, first introduced by Ligeti, denotes a dense polyphonic texture in which the individual lines (voices) are not discernible as such. According to contemporary music scholar Eric Drott, 'in micropolyphonic pieces, the circulation of independent voices within a narrow ambitus produces a masking effect, the overlapping of parts interfering with their segregation into distinct streams. Individual threads become difficult to discern and, as a result, merge into a fused fabric' (2011,7). This is the threshold where perceiving (spatial) polyphony blurs into a monolithic texture. A *granular synthesis* technique, employing numerous 'sound grains' as building blocks, can benefit greatly from multichannel configurations.[52] Each grain (or each group of grains) may be assigned to different points in space (different channels), and thus projected from a different spatial direction. In his book *Microsound* (2001), the composer Curtis Roads discusses the possibilities of distributing sound particles spatially via a multi-loudspeaker setup, which can result in a 'cloud' of sound:

> Through new particle scattering algorithms, micromodulation, per-grain reverberation, and convolution, we have now extended spatialization down to the level of microsound. When we project these microspatial effects in a physical space over widely separated loudspeakers, these tiny virtual displacements appear far larger, and the sounds dance. (2001, 233)

Some of the aforementioned techniques, such as spectral spatialisation and Pejvak, might produce such a spatial micropolyphony by increasing the number of layers and musical events, although the sonic outcome tends, as Drott points out, to become a dense immersive monolithic texture, blurring the spectral shapes or the relationships between initial sounds and their echoes.

3.3.7. Sound movements

Spatial polyphony can also be achieved through coordinated movements of multiple sounds, or a combination of moving and static sounds. As the composer James Dashow explains:

> Several events in motion simultaneously along different trajectories add a physical (directly experienced) sense of counterpoint to the ensemble of events that is occurring. Following the trajectories of two or more sound sequences that move through perceptual space produces a fresh kind of contrapuntal awareness: you have the sense of musical linear interactions, but now physically transcribed in such a way that the musical lines moving around you define space – or, better, make you aware of space (and the effect of counterpoint) in an entirely new sense. (2013, 5)

[52] According to Curtis Roads, '[a] grain of sound is a brief microacoustic event, with a duration near the threshold of human auditory perception, typically between one thousandth of a second and one tenth of a second (from 1 to 100 ms)' (2001, 86).

In theory, all the aforementioned point-source approaches can also be implemented using moving (virtual) sound sources. However, achieving convincing sound movements requires a precise arrangement of the multichannel sound system, which might not always be possible for technical and architectural reasons. This reduces the range of possible actualisations of a piece. Among the available technologies for moving sounds in space, Wave Field Synthesis (WFS) is one of the more successful approaches to create convincing sound trajectories. When I have an idea for a composition which involves moving sounds, I prefer to implement it on the WFS system, since this provides a higher degree of accuracy and stability in reproducing sound movement, in comparison with more conventional sound reproduction methods. I have composed three pieces for WFS: *Dor* (2012), *Sefrhasht* (2016) and *Yekhaft* (2021), each of which focuses on musical interrelationships between sound materials and the inherent potential for movement in space.

In Persian, the word Dor has different meanings such as 'cycle', 'turning' and 'whirling'. Being inspired by the whirling ceremony of Sufis, circular movement is the key gesture throughout the piece. All the sound materials are recorded from an ancient (circular shaped) frame drum known as daf, whose poetic and ritualistic function plays an important role in forming the narrative structure of the piece. The sound movements relate closely to those executed in recording the drum, with a microphone moving in a circular pattern to follow the movement of rubbing and scratching the drumskin. The same kind of circular trajectory was then implemented on the WFS system. In *Sefrhasht*, I combined moving virtual sound sources with spectral spatialisation (using static and moving virtual sound sources) in WFS. The music consists of four layers: static polyphonic sources, extremely slow movements, short gestures and extremely fast movements which function as sound oscillators. All these layers coexist and overlap, or appear in isolation. In *Yekhaft* I also explored the connection between sound production movements and their representation on the WFS system. Here all the sound materials were produced by bowing strings, and the bowing movements form the core idea of the composition's spatialisation, so that the sounds describe arc-shaped trajectories.[53] The length and speed of these trajectories in space are proportionate to the speed and intensity of the bowing itself.

In terms of their presentation, WFS pieces use one of the least flexible formats, since their composed virtual sound sources and trajectories can only emerge using a highly specific and uncommon combination of hardware and software. In other words, any variation to the precise arrangement of the loudspeakers in a WFS system results in deformation and disturbance of the intended trajectories. While this system provides a unique listening experience, it is at present an non-standardised technology so that presenting a WFS piece on a system other than that for which it was composed might require implementing all the movements once again on the new platform. Presenting a WFS piece is often considered to be no more than 'playback' (due to the rigidity of the format), although, in my own experience, controlling and balancing the mix of the various elements in the music, in relation to the venue and the atmosphere of the concert, is often required before (in the soundcheck) and during the performance. In presenting my WFS pieces, I often actively change the loudness and EQ of individual tracks (musical events), and of the overall mix, as the music unfolds.

[53] All the bowing was done on the strings of a santur, which, originally, is not a bowed instrument.

3.3.8. Critical reflections on spatialisation

In my experience, there will always be surprises, both positive and negative, in how ideas for spatialisation turn out in practice, since, in comparison to orchestral compositions, there is less tradition or body of theoretical work to draw upon. Some recent studies attempt to fill in this gap by providing some theoretical and practical insights into how space as a musical parameter can have an influence on our musical understanding. For instance, Luca Danieli et al. (2021) conducted a study on 'sonic trajectories and the perception of cadence in electroacoustic music'. A sense of closure in a musical cadence is traditionally achieved by harmonic progression. Their experiment provides some useful information on how various sound trajectories in space can evoke the perception of a sense of cadence or closure or 'completeness'. While the results show that certain spatial patterns evoke such musical phenomena, it appears that the results also depend on the group of listeners and their acquaintance with spatial music. Their research is certainly a step in the right direction, but clearly much more investigation is needed in order to establish a solid conceptual framework.

Gary S. Kendall and Andrés Cabrera (2011) discuss some examples of misconceptions in spatial audio, resulting in aspects which do not work as expected: '[m]aybe more than any other facet of technological music, mastering spatial audio seems to involve a learning process in which one slowly discovers the things that work and those that don't' (2011, n.p.). Similarly, Ludger Brümmer confirms that '[t]he desired spatial impression defined by parameters can differ from the perceived impression, sometimes in significant ways' (2017, 55). Such considerations lead directly to the performative concepts discussed in the present thesis. Apart from the limitations imposed by technology and/or acoustics, a common issue arises from thinking of sound and spatial sonic relationships in visual and geometrical terms. Visually conceived patterns, shapes and trajectories will not necessarily be perceived as such in the sonic domain. As Kendall and Cabrera put it, '[s]onic artists need to be alert to the nuances and idiosyncratic relationship of spatial hearing to spatial thinking' (2011, n.p.). Spatialisation, therefore, is better informed not by abstract geometrical designs but by sonic realities described by psychoacoustics, which is concerned with how we actually perceive sounds and their spatial qualities, rather than how we imagine they might be perceived.

In the article 'Octophony: Electronic Music from Tuesday from Light', Stockhausen delineates the interconnection between the musical material and its spatial movement in his piece *Oktophonie* (1991). Sophisticated 3D sound trajectories are designed to be projected on an eight-channel configuration in the form of a cube, which also allows for vertical sound movements. Stockhausen underlines his compositional strategy in foregrounding the (polyphonic) simultaneous sound movements, and by reducing activity in other musical parameters such as pitch and rhythm thereby allowing for a better perception of the spatial movement:

> In order to be able to hear such motions – above all, simultaneous ones – the musical rhythms must be drastically slowed down; the pitches must change only very occasionally, and only in small steps or with glissandos. (1993, 163)

Indeed, an important part of composing multichannel music involves being conscious of the interconnection between the musical material and its spatial attributes, not imposing spatiality on the material but causing it to emerge from the inherent characteristics of a given sound object. Spatialisation is thus not something to be done once a composition is 'finished', but

something embedded in the composition process at every stage. Moreover, as Gottfried Michael Koenig already wrote in 1961, we need to be cautious 'so as not to fall unresistingly into gimmicks or into a fetishisation of the medium' (1961, 47). Put differently, spatial arrangements or moving sounds in space ought to be musically and compositionally motivated, rather than acting merely as effects or ornaments, or simply because the requisite technological means are at hand. As Dashow aptly underlines:

> Spatialization is already changing the way music is conceived. One could say that up to now, musical composition has been largely a question of "what happens when." With spatialization, composition now becomes "what happens when and where." As more work is done to refine spatialization concepts and discover new modes of musical thinking in terms of space, it becomes clear that spatialization is our genuinely new contribution to musical art. (2013, 6)

As Koenig remarks, it might, be considered inappropriate to ascribe the same musical importance to the 'where' of a sound that we accord to its 'what' and 'when'. Nevertheless, I argue that the crucial point in composing spatial music is to establish a meaningful and musical relationship between 'what', 'when' and 'where', so that each contributes to a composition in its own way and to its fullest extent.

3.4. Post-mix

Post-mixing, being an adaptive, creative and practical approach to the presentation of fixed media music in public spaces, brings an element of the composition process onto the performance stage. This idea stems from my involvement in presenting fixed media music in concert venues in recent years, and from dealing with the challenges inherent in such a process. Unlike the well-known approach of 'sound diffusion' (see Chapter 1) in which a smaller number of channels (usually two) is actively projected or diffused through many more sound sources (loudspeakers) during the performance,[54] post-mix is defined as composing for a larger number of channels and mixing them down to fewer (or the same number of) sound sources, depending on how many loudspeakers are available at the venue.

Something similar is described by Jonty Harrison and Scott Wilson as *stem* composition (2010, 245), referring to the common practice of sound engineers in mastering where '[s]tems constitute the submixes or – more generally speaking – discretely controllable elements which mastering engineers use to create their final mixes'. Harrison and Wilson continue that '[i]n a similar fashion, one can compose in stems, separating out elements that need to be treated discretely in a final spatialisation, which in itself may vary to a small or great extent from one performance to another' (2010, 245). Such separation of the constituent musical elements further increases the scope for actualisation (Chapter 1) as it expands the range of choices a performer can make. Harrison and Wilson state that 'composing in stems does not in itself imply any particular final distribution or technique'. Post-mix, on the other hand, is not concerned with an arbitrary relationship between 'stems' and their eventual spatial distribution, but with a spatial compositional concept which may be varied from one situation to another while retaining its integrity, and whose internal relationships thus vary in some aspects while remaining true to the original concept in others. For instance, a piece can be composed in a higher number of

[54] Curtis Roads in his book *Composing Electronic Music* refers to such practice as *upmixing*. (2015, 385)

channels for a specific arrangement at its first performance – as in *Sehasht* (see below) – and then be rearranged for another presentation. The main objective here is to increase the adaptability of the composition in relation to various presentation circumstances, which vary, often dramatically, from concert to concert. The goal of post-mixing is not to recreate in the concert an 'ideal' piece as heard in the studio, or to bring 'discretely controllable elements' (cf. Harrison and Wilson's stems) to be assembled into a spatial composition *in situ*, but for a specific musical conception to be *completed* within the context of a performance situation. The 'imagined' composition is actualised only in the moment of its concert presentation.

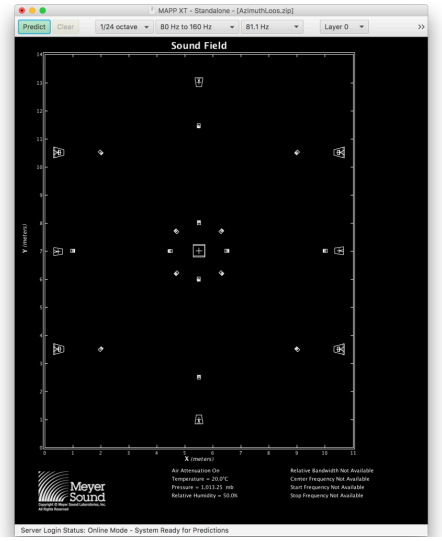
This may be seen as opening up fixed media music to a further dimension of interpretation, where the performer is able to highlight (or diminish) certain elements in the music, at the same time making it easier to adjust the composition to the acoustics of various venues. For instance, in a particular concert hall, certain sound materials might sound too faint or too harsh because of the acoustics, and in particular the frequency response of the space. Having precise control over the interactions between the constituent layers of the music makes it possible to accurately rebalance those relationships. In the following case study, I will demonstrate how post-mix can be conceived in practice.

3.4.1. Presenting *Sehasht* in three different spaces

Sehasht (2016) is a fixed media piece composed in 24 channels. Presenting this piece in various situations and circumstances gave rise to the idea of post-mix, by making clear the potential advantages and importance of such an approach to composing and performing fixed media music. *Sehasht* was composed for the first concert given by Azimuth (see below) in Studio Loos in The Hague.[55] Since one of the central objectives of the Azimuth organisation has been to promote multichannel spatial music, we designed a 24-channel sound system, which, at that time, was not a common occurrence. Knowing the venue and having participated in determining the exact arrangement of the loudspeakers in the space, I composed a piece specifically for this elaborate setup. A crucial element of this process was a 'mini-residency', a week prior to the concert, to work with the system and to finish and fine-tune my piece in the same space and with the same sound system as would be used for the premiere. Such a possibility is generally speaking quite luxurious. In most concerts of electroacoustic music, there is only enough time for a quick sound check and a rehearsal of about one hour per piece, which is often insufficient especially for longer pieces. This is usually also the first time that the piece can be heard in the form the audience will hear it, as opposed to the studio(s) where it was produced. In the case of *Sehasht*, thanks to the mini-residency, there was sufficient time for me to listen and make adjustments in the actual situation. Having a variety of loudspeaker groups in diverse positions and facing in various directions (see image below) created extensive possibilities for 'orchestrating' the music in the space. In typical multichannel setups, the audience is surrounded by loudspeakers, but here sounds could also be projected outwards from a central eight-channel ring, giving rise to the possibility of a more complex spatial polyphony.

After the premiere, I was invited to present *Sehasht* at other locations. Initially, I was sceptical about presenting the piece in any arrangement other than the 'original' one. However, given that recreating the original setup would always be difficult to achieve in another space, I decided to take on this challenge and see to what extent I could adjust and bend the original compositional

[55] www.loosdenhaag.com/what-is-loos



Azimuth #0 loudspeaker setup

intentions to fit a new situation. My first opportunity, in 2017, was in a Sonology Discussion Concert in the Arnold Schönberg Hall in the old building of the Royal Conservatoire in The Hague. A 16-channel sound system was set up, consisting of an eight-channel ring surrounding the audience (the default setup for most Sonology concerts), and another eight-channel system situated on the stage forming an arc. This onstage system was not intended for my piece, but for another live performance in the same concert, but I decided to find a way to use it creatively. This arrangement was vastly different from the setup in Studio Loos, as were the size and shape of the space itself, which, as a traditional concert hall, was much larger and much more reverberant. Having 24 discrete tracks in the composition enabled me to experiment with various configurations on this 16-channel setup. This involved mixing down two groups of eight tracks onto the surrounding ring – the material that was originally meant to envelop the audience. The other eight-track group was assigned to the arc of loudspeakers on stage, which formed a choir-like entity so that the sound material projected through them took on a kind of 'soloistic' character, giving a new meaning to the musical relationships composed into the piece. This 'soloistic' effect was not originally intended, but made musical sense in the context of a typical concert arrangement where the audience faces in a single direction towards the stage.

In October 2022 I had the chance to present *Sehasht* once more, this time in the Conservatoriumzaal of the Royal Conservatoire's new building in The Hague. Here, the spatial circumstances were not dissimilar from those of the previous performance – a large concert hall with a forward-facing seating arrangement. This time, a 24-channel sound system was available, however with a different layout: one eight-channel ring surrounded the audience at ear-level, and a second ring was situated on a balcony facing upwards. The considerable distance between the two rings created a sense of vertical depth, generating a new and interesting musical effect by adding height to the spatial polyphony of the piece, another new dimension not originally anticipated. Here again, I used an arc-shaped eight-channel array on the stage to complete my 24-channel setup. I preferred this actualisation of *Sehasht* to the first one, although the future may hold yet more possibilities for bringing out different aspects of the music which might have been relatively latent at the time of composition.

Reflecting on my experience of presenting *Sehasht* at various locations and in different circumstances, it became clear to me that this piece, despite consisting of 'fixed media', was in fact quite *flexible* in being able to take on new sonic shapes with each performance. This led me to rethink the ontological status of fixed media compositions, to formulate it in terms of the concept of the virtual and the actual, as discussed in Chapter 1, and to realise the potential of

composing in a *higher* number of channels than might be used in a concert, which in turn prompted the idea of post-mix. In my experience, each concert is substantially different from every other, not just in atmosphere, but as a result of how the various locations impose on the music their own physical conditions and characteristics, such as their scale, shape, acoustics and possibilities in terms of the positioning of loudspeakers and audience. Moreover, the type of equipment often varies from venue to venue, necessitating the 're-orchestration' of the piece for each event. Post-mix, therefore, is not only a practical solution to the variability of concert circumstances, but has an important artistic dimension in embodying a motivation to realise a given piece anew each time it is performed, so that 'fixed media' compositions become open and alive, and are 'completed' differently at each concert in response to circumstances and contingencies.

After the experience of *Sehasht*, I expanded the idea of post-mix in *Charhasht* (2017) for 32 channels, composed for another Azimuth concert, this time with a 32-channel sound system designed for the Nutshuis in The Hague. Subsequently, in 2018, I presented the piece during the TodaysArt festival in the Satosphère (a temporary inflatable dome-shaped venue) on an 8-channel sound system.[56] An unwanted comb-filtering effect, resulting from reflections within the dome, required extensive EQ, which I was able to apply separately to each track thanks to the separation of the materials. The number of tracks used in a composition will depend on the compositional ideas and their spatial implications. Moreover, mixing and controlling the higher number of channels is often a demanding task which at times might become overwhelming for the performer. (For related reasons I reduced the number of tracks in *Hafthasht* (2019) from 32 to 24 after its premiere.) But the main point of the post-mix principle is not the number of channels in itself, but the possibilities it opens up: to shape and actualise the piece in response to the context of each presentation.

3.5. Dynamics in fixed media music presentation

> The ears should go to the music, not the music to the ears.
>
> (Beatriz Ferreyra)

A seemingly simple but crucially fundamental aspect of the performance practice of electroacoustic music is the controlling of loudness as the music unfolds. According to the acoustician and researcher Reinier Plomp, '[l]oudness generally refers to auditory intensity', and, in comparison to other attributes of sound, such as pitch and timbre, is 'strongly dependent on environmental conditions (such as distance and reflections)' (2002 ,29). Unlike (acoustic) music where loudness is the direct result of the physical effort of the performer, there is no direct correlation in electroacoustic music between loudness and effort: producing loud sounds is in fact quite effortless. A *fortissimo* on a piano requires a physical effort from the performer, and cannot exceed a certain loudness level owing to the physical limitations of the instrument and the playing technique. In electroacoustic music, any sound material may be projected more softly or loudly just by a simple movement of the faders on the mixing desk at any given moment, regardless of the dynamics already incorporated into the piece at the composition stage. Loudness is thus a crucial parameter of the performance of fixed media music, but in quite a different way compared to its role in instrumental music. While loudness can be precisely and objectively measured, it is one of the most subjective aspects of music perception. Not only

[56] www.sat.qc.ca/en/satosphere/

do people have different aural organs and therefore different hearing capacities; cultural and aesthetic factors also play an important role. Something that might be considered annoyingly loud for one person could be a comfortable volume for another. Furthermore, the type of sound material and its spectral composition affects the perception of loudness:

> Two tones of the same physical intensity can still differ considerably in their perceived loudness, depending on their spectral structure. The more the intensity is spread over a wider frequency range, the louder the tone seems to be. The most extreme difference in perceived loudness is between a sinusoidal tone without harmonics and a tone consisting of a large range of strong harmonics – the sound level of the sinusoidal tone may need to be as much as 12 dB higher in order to be heard as equally loud as the complex tone. (Plomp 2002, 29)

These considerations should be taken into account both at the composition stage and in the presentation of music to be heard exclusively through loudspeakers. My own experience is that finding a proper volume is crucial for a successful performance of fixed media music: playing the music too loud (which is actually a common occurrence) tends to destroy the subtleties and nuances of a piece. According to the music researcher Arnie Cox '[l]oud sounds "come at us" and in some cases "push us away"; they require no effort on our part to hear them, but they can motivate protective or otherwise aversive responses' (2016, 207). It is often observable that if loudness reaches an extreme, people in the audience begin to cover their ears. This is the moment that the trust and bond between audience and performer is breached; one can no longer focus properly on the music, knowing that such extremes might happen again. Nevertheless, for some composers, loudness and the high intensity of sounds is an aesthetic aspect of their music, such as the performances of Thomas Ankersmit, where the extreme volume can make the human body vibrate. Everyone who has attended a concert of Xenakis performing his own electroacoustic pieces confirms that it was always uncomfortably loud. According to Agostino Di Scipio, '[t]he deafening première of *Bohor*, in 1962, caused Pierre Schaeffer's bitter disappointment, although that piece was dedicated to him!' (2010, 180). He underlines that:

> Xenakis acknowledges that the idea of immersion is an important feature in *Bohor*, and that *Bohor* needs volume for the ear to penetrate into the sound and hear the minute details of the sonorities. (2013, 2)

Similarly, the composer James Brody talks about a performance of *Bohor* in 1968:

> A tremendous furor was aroused in Paris in October 1968 at a performance of *Bohor* during the Xenakis Day at the city's International Contemporary Music Week. By the end of the piece, some were affected by the high sound level to the point of screaming; others were standing and cheering. "Seventy percent of the people loved it and thirty percent hated it" estimated the composer from his own private survey following the performance. (1971 n.p. in Roads 2015)

The composer and author James Harley believes that the reason for Xenakis' loud performances was actually the fact that he had problems hearing high frequencies 'owing to his wartime experiences' (1998 ,75). But it may be that playing such music too softly indeed fails to convey its intended impact and power, because certain frequencies might lack presence and because

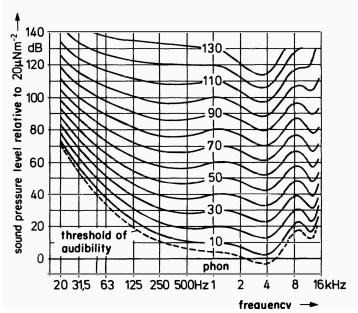
Xenakis intended the audience to hear the music with the overwhelming power he imagined it to have.

Quietness, on the other hand, can also be a powerful compositional tool, for example to promote a heightened sense of awareness and attention. As Arnie Cox explains,

> quietness has another effect. The acoustic impact here is more of a non-impact, making listeners come to the sounds. This unusual effort (effort is too strong a word) is, I find, integral to devoted engagement with this music, as it is in attending to significant portions of, say, Feldman's *Rothko Chapel*, or listening to quiet musical moments and silences generally. Of course, some listeners might be frustrated by the effort in such cases (here, I think effort is not too strong a word). The quietness makes a demand, and engaged listeners will feel something about this demand. (2016, 207)

I argue that this 'demand' can sometimes have a much stronger musical impact than high sound level, as I explored in my composition *Toranj* (2012), which begins at the threshold of hearing – the audience is not sure whether the music has started or not – and continues slowly to reach an extreme loudness towards the end. Establishing the 'right' loudness is crucial in performing *Toranj*. The threshold of hearing is not only subjective, but also depends on the space and the acoustical circumstances, so that it is a delicate task for the performer to maintain this 'demand' and control a crescendo curve over almost 22 minutes, like a conductor performing Maurice Ravel's *Bolero*. I often employ such a large dynamic range as a compositional element, which in turn requires great attention to detail in a performance to ensure that quietness and loudness are both appropriately represented.

Besides influencing the mode of perception, the intensity of sounds also affects their perceived quality. A given sound object has different characteristics at different sound levels. According to the figure below, our perception of the frequency spectrum in relation to loudness is not linear: a given sound object at a lower intensity is perceived as missing a significant proportion of its lower frequencies, affecting the composition of the frequency spectrum and hence the perceived quality of that sound (Blauert 1997,120). To understand those various characteristics and behaviours, I always listen to my sound material at different volumes while composing. This correlation between sound level and timbral qualities underlines the importance of loudness on the sonic outcome. Finding the proper volume – and actively adjusting it as the piece unfolds – is a complex issue, depending on various elements such as musical structure, material of the piece, the space and its acoustical characteristics, the aesthetic choice of the performer as well as the atmosphere of the concert. It is therefore the task of a performer to find a balance among all these elements.



Curves of equal loudness level for sinusoids (Blauert 1997,120)

3.6. Azimuth

In the light of the various challenges I experienced in performing my multichannel music, I realised how difficult it is to present this music in the 'real world'; it is often frustrating to convince concert programmers why it is important to have a multichannel setup in their venues, and why the high costs of doing so is justified, given that most venues work with stereo sound and that sound engineers are not accustomed to thinking in more complex spatial terms. I often had to convince them why eight or more loudspeakers had to be arranged in some specific way when, according to them, a fine stereo PA system was already installed in the hall! This problem stems, of course, from the dominance and omnipresence of the stereo format, as well as a lack of awareness of the concept of spatial music. Apart from the loudspeakers, a suitable mixing desk in a suitable location (not, for example, at the side of the space) is needed in order to route the signals and to be able to control them independently and accurately. The main problem, in my opinion, is the lack of organisations specialised in this field, with both the necessary technical knowledge and artistic insights. This is how and why Azimuth was born in 2016, after some discussions and brainstorming with two colleagues-friends. Azimuth is dedicated to promoting and developing the composition and performance of multichannel music by organising concerts in various locations in order to introduce this music to a more general public, and to give the composers the possibility to develop new spatial compositions. Azimuth is not bound to any specific system, setup or equipment, but takes a flexible approach to the circumstances of each performance as well as the needs of the music being presented, with an emphasis on exploring the architectural features of various venues, including spaces not originally intended for concerts. From the outset it was clear that Azimuth should not be a sound reproduction system or another 'loudspeaker orchestra' along the lines of BEAST or the GRM Acousmonium, or a permanent setup such as Klangdome; rather, it should be a platform which connects composers and audience, while exploring the architectural sites as the locus to establish unique spatial sonic experiences.

Azimuth provided an opportunity to observe other composers' approaches to presenting their fixed media music in public. Some composers created new pieces in the knowledge that a sophisticated multichannel system was available to them, bringing up the question of how such pieces might then be performed on other occasions. Here, the post-mixing might offer a convenient and compositionally fruitful solution, as discussed above. Other composers reworked and adapted their existing compositions for Azimuth concerts, either by 're-orchestrating' the composition for the available multichannel setup or diffusing their multichannel composition live over the Azimuth system. Horacio Vaggione's approach in the Azimuth #3 concert (2017) was quite idiosyncratic. After spending some time with the system and trying out his composition *24 Variations* (2001) in the venue (Studio Loos), he decided to split the whole sound system into two halves (skipping the centre loudspeakers), and statically assign the two-channel (stereo) music to each half, in distinction to the common practice of sound diffusion in which the performer moves the stereo image through the multi-loudspeaker setup during the concert. He mentioned that the reason behind his decision was the symmetry and balance of the sound system. Nevertheless, he controlled the levels during the concert.[57] The sonic result was quite surprising and spatially rich, due to the specific technique he utilises

[57] In contrast, Trevor Wishart sometimes prefers to sit among the audience during the concert, eradicating his agency as a performer completely.

in creating a stereo image through very slight time delays between the channels (Strassmüller 2008, 6).

Francisco López, on the other hand, constructed a performance rather than presenting a piece. He combines various musical elements flexibly, based on the circumstances of each performance, rather than performing a single piece, to create an experience built and constructed during the performance. According to López, presenting a 'fixed piece' in various situations is bound to create problems since each space requires a different approach. This is similar to what was discussed earlier as 'completing' the composition during its performance. For his performance Azimuth (together with Lopez) designed a sound system where he could diffuse his stereo source over eight clusters of four different loudspeakers and one subwoofer. In this way he could vary the colour of the material for each channel by diverse mixtures of those four loudspeakers. He also specifically wanted to use an analogue mixer in order to be able to have a constant and simultaneous control over all the parameters (EQ, sends, etc.).

Taking the performative aspect still further, Ji Youn Kang composed a live piece inspired by and based on the specific setup of the Azimuth #8 (2019) concert. She used the room resonances of the space as the main material, by picking them up with two microphones attached to her wrists and two other microphones in the hall. The result consisted of continuously stabilised audio feedback coming out of 16 loudspeakers and 8 wooden panels with transducers.

In addition to the wealth of possibilities in materialising fixed media pieces in space, length and temporal aspects can also be modified for each presentation by adding or removing various parts to or from the composition. For instance, in presenting my piece *Charhasht* (2017) at Azimuth #7 (2018) in the Satosphère, I decided to extend the length of the piece, given the circumstances of the concert. This decision was based on the unique dome-shaped concert venue where, in the absence of any chairs, the audience could lay down or sit on the soft floor. I believed that a longer duration better matched the relaxed bodily condition of the audience. I added an extra (penultimate) section of around three minutes before the ending of the piece, which at the same time better completed the dramatic structure of the music. At another concert, I removed a middle section from *Tom+Bak* (2020), making the overall length more suitable for the opening of the programme. Those experiments led me to the idea of constructing a seamless performance, together with the singer and composer Marie Guilleray, in a concert during the Peel Slowly and See festival (2022) in Leiden. When we were asked to give a concert together, we decided to combine various parts of our pieces to form a single whole instead of each performing a separate piece. Similarly, Richard Barrett, in his contribution to Azimuth #3, extracted a number of 8-channel fixed media sections from his composition *life-form* (2012) for cello and electronics, and combined them into a new sequence. Such examples demonstrate that the temporality and the structure of fixed media pieces can also be open to modification from one performance to another.

From the very first Azimuth concert on, we decided to break with the conventional arrangement in which audience seats are organised in rows facing the stage. This is a functional arrangement when attention is centred on music-making actions taking place on that stage, with the seating area designed to provide an optimum perspective on the performance for the majority of audience members. However, such an arrangement is less compatible with fixed media music pieces, and specifically those in which space plays an important role, for example when the music is projected from various locations, thus destabilising a frontal point of attention. The

presence of the 'performer' in fixed media music is, therefore, of a different nature than that in most other music (see Chapter 1). Having the audience sit in a circular arrangement - with no raised stage and no frontal directionality - might correspond more closely to the spatial and immersive nature of multichannel music, and also provides a situation where audience members can easily see each other and be aware of each other's presence, giving rise to a social bond, and enhancing the atmospheric qualities of the event (see Chapter 2). In practice, realising such an arrangement is sometimes limited by the architecture and the shape of the space, so that a creative solution or compromise has to be found.

Working in this way with Azimuth has certainly deepened my understanding of the interrelationships between composition and performance practice in fixed media music, both through presenting my own compositions and in observing the different approaches taken by other composers. This experience continues to have a profound influence on my present and future compositional work.

Azimuth #5, Nutshuis, The Hague, photography Anna Glinka

Conclusion

> The experience of the 8 loudspeakers is extraordinary. There is no room for anything but immediate listening. The air was so alive one was simply part of it. (Cage 1953 [1993], 143)

In this letter to Pierre Boulez, John Cage reflects enthusiastically on the experience and the atmosphere of the first concert at the University of Illinois (1953) with eight tape recorders and eight loudspeakers surrounding the audience, where his piece *Williams Mix* was premiered. 70 years later, the extraordinariness of listening to multichannel music still strikes me every time I attend a concert of electroacoustic music.

The main objective of this research has been to understand and articulate the importance, indispensability and artistic possibilities of the public presentation of fixed media electroacoustic music, regarding such presentation as the only way to fully materialise and experience this music. I have shifted the focus from the fixity of the medium towards the diversity and wealth of the listening experiences that it can engender, and I celebrated the creativity and imagination that multiple actualisations of a piece of fixed media music can afford. I have explored this topic through a close observation of my own practice as a composer, performer and listener of fixed media music, as well as through documenting and observing other composers' approaches, conducting interviews with some prominent practitioners in the field, and drawing on various sources of literature such as music history, electroacoustic and computer music, sound studies, conducting, architecture, and philosophy. Throughout this process, I have experimented and enacted the ideas generated through my research by composing new works of fixed media music for various configurations, sound systems and technologies, as well as presenting them in diverse circumstances. By considering the composing and performing processes as components of a single continuum, I have delineated the reciprocal relationship between these processes to shed light on the question of what it means to *perform* fixed media music. I have done so by providing an insight into the practice from within, reflecting on my own activities and concerns in the form of (audiovisual) autoethnographic work.

The electroacoustic technology of sound recording has transformed our conception of music: from documenting and 'storing' a musical performance (as in recording a concert) to *constructing* a performance through editing, to composing the music *with* and *onto* the medium. While this notionally fixed medium seemed to suggest and promote the emancipation of the music from live performance, in practice the collective listening situation and the bodily presence of the audience gave rise to a performative situation and a quality of liveness. The responsibility for shaping the audience's experience, by controlling the parameters involved in materialising the 'fixed' sound files, requires an agent that we may call a performer. My research has demonstrated that fixed media music should not be regarded as an abstract entity, but rather as something that needs to be materialised and formed as a sonic substance in space, so that it can come to life and become music. In other words, the sounds heard by the audience are inseparable from the space of their performance; the circumstances under which such a performance takes place play an important role in the sonic result. It follows that there is no perfect and ideal *realisation* of a piece of fixed media music, but rather different *actualisations* related to the circumstances and contingencies of the situation in which they are presented. Just as with orchestral performance, CDs or online platforms for private listening give only a limited impression of the richness and spatiality of the music.

While giving a comprehensive account of spatialisation techniques and their history was beyond the scope of my research, I have nevertheless tried to formulate an understanding of the role and importance of space as a musical parameter in composing and performing fixed media music by proposing the concepts of *spatial polyphony* and *post-mix*. Spatial polyphony is concerned with thinking compositionally in terms of multiple sound sources at every stage in the process of music making, rather than considering this as an 'ornament' added at the end of the process. At the same time it grounds the work within its performance context, so that the work comes to full existence only in the performance space. Listeners to such spatially conceived compositions find themselves so to speak *inside* the music, becoming more active participants rather than distant 'observers'. Composing in a higher number of channels than those to be used in a performance – which I have termed *post-mix* – proved to offer more flexibility in adapting fixed media pieces to various circumstances. This in turn prompts a more creative and artistic approach to performance, which, as demonstrated in my case studies, may generate quite new musical experiences from a single piece.

Anyone who has attempted to make an audiovisual documentation of a concert of fixed media music knows that this is most likely doomed to fail. Apart from the technical difficulties of recording in low light conditions, the concert situation of fixed media music somehow resists being documented, and the recorded material fails to communicate the essential qualities of the live experience, seemingly to a greater extent than with other musics. I argue that a principal reason for this lies in the *atmospheric* aspects of the concert situation, which are not reproducible in a recording but can only be sensed physically in the performance space: the absence of a stage with performers causes listeners to be more aware of their own bodily presence and that of their fellow audience members. An audio recording of fixed media concert presentations is also reduced relative to its source, the original sound file. Depending on the recording technique, it carries with it the acoustical footprint of that concert hall, which has no relevance when the music is heard in another space. Even using spatial recording techniques such as Ambisonics does not remove the problem of listening to one space inside another. Nevertheless, I have always tried to make ambisonic recordings of my concerts, resulting in an archive of ambisonic B format files. However, I find myself less and less frequently going back to listen to those recordings. If I need an 'impression' of one of my pieces outside the studio or concert hall – in other words a stereo reduction – I prefer to recreate that version from the 'original' multichannel sound files, removing any expectation that the ineffable atmosphere of the concert event might be sensed through the recording. Rethinking the fixed media music concert situation in terms of atmosphere, as discussed by Gernot Böhme and others, provides a deeper understanding of the ineffable feelings which occur only at the here and now of the concert moment. This involves a synergy of various elements ('atmosphere generators' according to Böhme) which together constitute the atmosphere of the concert. When I compose now, I tend to think more broadly than just in terms of the composition itself; I have become more conscious of the circumstances of its presentation in a more holistic manner. Imagining the atmosphere of the concert, in turn, inspires me and guides me through the composing journey. While fixed media music can and often does take place in an acousmatic situation, where the music is 'invisible', lighting can still play an important role as an atmosphere generator. Through this research project I realised the importance of lighting and peripheral vision in shaping the experience of listening to fixed media music, an area which requires further investigation.

Having a background in instrumental music composition, I found that the affordances of electroacoustic music opened up a new *modus operandi* in working with instruments. I have continued to explore the question of what it might mean to make instrumental music for loudspeakers, expanding on the possibilities of shaping and forming instrumental sounds, not only by exploring new timbres but, more importantly, by re-contextualising them, specifically in the context of using traditional Iranian instruments. Although this research has concentrated on electroacoustic music as something distinct from instrumental composition, my work on the Broken Ensemble project should serve to underscore that I regard my work with fixed media as a continuation and extension of composition for more traditional resources, rather than as something alien to it. Broken Ensemble explored the potential and affordances of alternative (or nonstandard) loudspeakers for presenting fixed media music, and the way these might affect and shape the sonic material, while also shaping the performance situation through their visual presence and materiality.

Future perspectives

I plan to develop the spatial polyphonic dimension further by composing for a 'broken string orchestra', increasing the number of sound sources beyond the four instruments that I have utilised so far. This could also include capturing the 'noise' of the audience as input data to control certain variables in the music, introducing an interactive layer to it. Another aspect that I plan to explore includes the use of design and lighting to shape and define the visual presence of this string orchestra in space. Also emerging from this PhD project is a plan for a new research project on discovering the most suitable type of transducers and the manner of their attachment to the instruments, with the goal of achieving a richer sound and having more control over the sonic result, for instance by attaching multiple transducers of various types and sizes to a single instrument.

On a practical level, this research prompted the idea of founding an organisation, Azimuth, involved in presenting and promoting fixed media electroacoustic music, a laboratory to experiment and put into practice my (and the co-founders') ideas in composing and performing this music. Playing to audiences from diverse socio-cultural backgrounds, many of whom would be experiencing such music for the first time, Azimuth proved that fixed media electroacoustic music can reach audiences beyond academic and research contexts; our concerts established a loyal community of composers and listeners. The experience of Azimuth in return enriched this research by setting creative challenges to working with limited resources and non-concert hall venues. For example, Azimuth wishes to continue its activities by exploring new modes of presenting fixed media music, like organising open air concerts which grounds the musical experience in a background of ambient sounds, thus giving rise to new kinds of atmospheres. Another area of investigation would be designing the concert situation in interior spaces more consciously, through collaboration with artists from disciplines such as set designing and lighting.

Hence, this research project has raised questions that open up perspectives for future research, also regarding the communication of ideas and performance suggestions from composers of fixed music to possible performers of their work, in the absence of a traditional score. To explore this area, I will embark on a project of 'publishing' my fixed media music, not as reduced (stereo) versions, but as 'raw' material: a package including the original sound files accompanied by suggestions on how to actualise the pieces. The intention is to investigate how best to

communicate the musical ideas of the composition and the intended quality of its constituent sounds, as a guide to other performers as they adapt it to whatever performance circumstances. The intention here is not to specify an 'ideal' performance but to suggest how performers might think about this adaptation. In addition to technical information and suggestions for post-mixing, such a 'score' may involve an analysis of the work and its structure to give an insight into the dynamic interrelationships between its sections. These instructions could take the form of an explanatory, anecdotal, poetic or abstract text, and can even include pictures, illustrations, videos or anything that can communicate the *atmosphere* which surrounds the work.

On the audiovisual part

The idea of integrating video into my project gave it an equally important dimension. The resulting double research trajectory involved, alongside its focus on sound, space and atmosphere, an exploration of the affordances of the audiovisual medium in artistic research. I carried out extensive experimentation in combining video, sound, image and text in order to find my way through the infinite possibilities that such combinations would offer. The audiovisual medium enabled me to articulate issues and aspects of my research that were difficult to convey through text or sound alone, especially in working with concepts such as atmosphere. In fact, what I was doing the whole time was composing, sometimes with sounds, sometimes with images and sometimes with words. The audiovisual part of my dissertation is itself a fixed media piece, which requires performance, just like its subject matter. In other words, the multichannel pieces integrated into this part of the dissertation are post-mixed when they are presented in public, together with the multichannel soundtrack and the spoken text and interviews. The presentation of the documented experiences thus becomes a new experience – reality doubling back on itself.

The integration of the audiovisual medium introduced a new observational angle into the practice through the lens of the camera: it allowed me to observe certain things that otherwise might have gone unnoticed, and this helped me to elaborate and reflect on those issues in the textual part of this thesis. Moreover, through interviews with composers and practitioners in the field, and by documenting their practice, I was able to gather some firsthand and up-to-date information and gain insight into the current state of affairs in the field. The audiovisual medium also helped me in the process of self-reflection through documenting my own performances.

One of the challenges here was the combination of video and spatial audio. While the image has a frame, and thus occupies a fixed point in space, the multichannel sound track surrounds the audience. This might create a conflict, formulated by Michel Chion (1994) as *spatial magnetisation*: a psychological phenomenon where the image 'magnetises' the sound events as if they emanate from the image, negating their original location. This phenomenon, in fact, undermines spatialisation. Therefore, I had to be conscious as how to combine the visuals with the spatial sounds. By reducing the level of activity in the image during the denser spatial polyphonic moments, for instance by employing static shots, or abstract and out of focus (blurry) images, or even eliminating visuals altogether the 'magnetisation' effect could be mitigated and the focus could turn to listening.

The experience of making this audiovisual part of my dissertation inspired me to design a course to help and motivate other students to integrate various media in their artistic research. I have now been teaching this course as a Master elective at the Royal Conservatoire in The

Hague since 2023, and I find it extremely illuminating to observe how each student adapts these techniques and approaches in relation to their own capacity and interests. 'Non-traditional research outputs' (NTRO) are still in its infancy and given the countless possibilities and the potential that the audiovisual medium offers, specifically in relation to artistic research, it is yet to be fully explored. I hope that the audiovisual component of this thesis can serve as a point of departure for others, as well as myself, to develop further this fusion of (spatial) sound and visual communication in the presentation of research outputs in the field of music, as well as other disciplines such as, dance, theatre and visual arts.

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Summary

This dissertation examines the public presentation of fixed media electroacoustic music and investigates the performative capacities which are involved in materialising such music in order to shed light on the question of why the public presentation of fixed media compositions is actually the only way to fully experience this music. While electroacoustic music *production* has been the main focus of academic work in this area in recent decades, less attention has been given to its public presentation. This dissertation therefore reflects on what performing means in the context of fixed media music, where prefabricated music is presented through loudspeakers in a concert venue.

The dissertation consists of a written part in three chapters, alongside an audiovisual part for video and multichannel sound track. It is not intended that one of these should be an illustration of or a commentary on the other, but that both carry equal weight and importance as outputs of this research. Chapter 1 of the written part discusses the idiosyncratic features of fixed media music, and explores the interconnections between composing process and performance practice. It considers various manifestations of performative agency in the process of making and presenting such music, suggesting that the composing and performing processes may be considered as components of a single continuum. In this chapter I also underscore the importance of public presentations of fixed media music, exploring how the absence of music production activities on stage (such as playing an instrument or singing) elevates the awareness of the corporeality of the listening bodies of the audience in the here and now of the concert situation, which accounts for a quality of liveness. Such a perspective shifts the focus from the (alleged) fixity of the medium towards the diversity and wealth of the listening experiences that it can engender.

Chapter 2 discusses the concert situation of fixed media music in relation to the concept of *atmosphere*. I mainly draw on the work of the German philosopher Gernot Böhme, who formulates atmosphere as a new approach to aesthetics. For Böhme, atmosphere has an *in-between* status, being neither a subjective and psychological phenomenon, nor a completely objective quality of things and the environment. In this light, the experience of music is shaped holistically through a synergy between the various elements (or 'atmosphere generators') which participate in the concert situation. For instance, the role of lighting and peripheral vision is discussed in the context of the *acousmatic situation*, where the cause of sounds is concealed or occluded by the electroacoustic medium. This new perspective suggests that the ontological status of a composition is an actualisation which takes place in an atmosphere, rather than having been definitively completed once its sound files have reached their final form in the studio.

Through my own practice as a composer and performer of fixed media music, in chapter 3 I discuss various practical issues around composing fixed media music and presenting it in public. The role of space as a musical parameter, and its importance in composing and performing music in general and in fixed media music in particular, is discussed by proposing the concept of *spatial polyphony*, where spatiality can introduce a new dimension in fabricating and experiencing polyphonic texture through the organisation of simultaneous musical events in space, which are (analogously to the traditional definition of polyphony) both perceptually discrete and structurally connected. This in turn motivates the deployment of a multichannel sound system in a more musical manner while developing the musical materials, rather than the

spatial aspect being something added at the end of the composing process. Subsequently, I propose a concept of *post-mix* as a practical and performative approach towards composing and performing fixed media music, where composing in higher number of channels than that to be used in the performance allows for more flexibility in adapting a piece of fixed media music to various circumstances. Through a case study, I demonstrate how post-mixing can lend itself to the generation of various different sonic results, while still preserving the identity of the composition. In this third chapter, I also examine alternative 'non-loudspeaker' sound sources for projecting electroacoustic sounds, and how they can shape the musical material. In my *Broken Ensemble* project, I utilise broken instruments in combination with transducers as loudspeakers to materialise sounds in space. Finally I discuss the activities of Azimuth, an initiative founded by myself and two colleagues, as a platform for presenting and promoting multichannel electroacoustic music. The experiences with Azimuth have enabled me to engage with many of the questions that emerged in the course of this research project, and to put into practice its concepts and findings.

The audiovisual component of my dissertation explores the subject matter of my research through the affordances of the audiovisual medium. It includes elements such as interviews with some prominent practitioners in the field and documentation of their approach in presenting fixed media music, as well as more abstract and 'atmospheric' visual elements accompanied by a multichannel soundtrack. Through mixing the actual concert presentation of fixed media music and documentary elements, I set out to give an experience of listening to fixed media music while demonstrating various concert situations and atmospheres. I illuminate diverse approaches of presenting such music publicly, and demonstrate the process of preparation and engaging in dialogues with other practitioners. The audiovisual format thus offers more creative possibilities for self-reflection, so that the result is both a multichannel composition in itself and a poetic interrogation of that medium.

More generally, the research has yielded valuable insights into the nature and potential of thinking about fixed media music in terms of performativity and of the audience's involvement in active perception, especially through the concept of atmosphere. These insights have in turn informed the evolving concepts that form an important focus of my compositional work, such as spatial polyphony and post-mix. They also have a more general relevance to the theoretical and practical investigation of multichannel fixed media music and its possibilities, which, it is hoped, will form a meaningful contribution to the discussion of this still young area of compositional and technical thinking and practice. Moreover, the audiovisual component of this dissertation will hopefully open up a new path in artistic research by showcasing its affordances, specifically in the field of music.

Samenvatting

In dit proefschrift onderzoek ik de publieke presentatie van *fixed media* elektroakoestische muziek, alsmede de performatieve kwaliteiten die nodig zijn bij het daadwerkelijk tot klinken brengen van dergelijke muziek. Het onderzoek gaat in op de vraag waarom de publieke presentatie van *fixed media* composities de enige manier is om deze muziek optimaal te ervaren. De afgelopen decennia ging de meeste aandacht van academisch werk uit naar de *productie* van deze muziek; minder aandacht werd besteed aan de publieke presentatie ervan. Dit proefschrift reflecteert daarom op de uitvoeringspraktijk van *fixed media* muziek, muziek waarbij vooraf gecomponeerde elektroakoestische muziek wordt gepresenteerd via luidsprekers in een concertzaal.

Het proefschrift heeft een schriftelijk deel met drie hoofdstukken en een audiovisueel deel bestaande uit een video met een meerkanaals soundtrack. Het ene deel is noch een illustratie van, noch een commentaar op het andere: beide zijn in gelijke mate belangrijk als resultaat van dit onderzoek.

In hoofdstuk 1 van het geschreven deel bespreek ik de idiosyncratische kenmerken van *fixed media* muziek en verken ik de verbanden tussen het compositieproces en de uitvoeringspraktijk. Ik reflecteer op de verschillende performatieve uitdrukkingsvormen bij het maken en presenteren van dergelijke muziek, en beweer dat het compositieproces en de uitvoering beschouwd kunnen worden als componenten van één continuüm. In dit hoofdstuk onderstreep ik ook het belang van publieke presentaties van deze muziek, waarbij ik onderzoek hoe de afwezigheid van activiteiten op het podium (zoals het bespelen van een instrument of het zingen) het bewustzijn van de eigen lichamelijkheid van de luisteraars in het hier en nu van de concertsituatie verhoogt, wat een extra kwaliteit aan de *live* situatie geeft. Een dergelijk perspectief verlegt de focus van de (vermeende) onveranderlijkheid van de muziek naar de diversiteit en rijkdom van de luisterervaringen die het kan voortbrengen.

Hoofdstuk 2 gaat in op de concertsituatie van *fixed media* muziek in relatie tot het begrip *atmosfeer*. Ik put voornamelijk uit het werk van de Duitse filosoof Gernot Böhme, die atmosfeer inbrengt om het concept esthetica opnieuw te denken. Atmosfeer bevindt zich voor Böhme in een soort tussenruimte: het is geen subjectief en psychologisch fenomeen, noch een volledig objectieve kwaliteit van dingen en hun omgeving. In dit licht wordt de ervaring van muziek holistisch gevormd door een synergie tussen de verschillende elementen (of 'sfeermakers') die deel uitmaken van de concertsituatie. Zo wordt bijvoorbeeld de rol van verlichting en de beperkte rol van het visuele besproken in de akoesmatische situatie, dat wil zeggen een situatie waarin de geluidsbron is verborgen of afgedekt door het elektroakoestische medium. Met dit nieuwe perspectief verandert de ontologische status van een compositie in een *actualisatie* die plaatsvindt in een bepaalde atmosfeer, in plaats van voltooid te zijn zodra de geluidsbestanden hun definitieve vorm hebben bereikt in de studio.

Aan de hand van mijn eigen praktijk als componist en uitvoerder van *fixed media* muziek, bespreek ik in hoofdstuk 3 verschillende praktische kwesties rond het componeren van *fixed media* muziek en de presentatie ervan in het openbaar. De rol van ruimte als muzikaal element en het belang hiervan bij het componeren en uitvoeren van muziek in het algemeen en bij *fixed media* muziek in het bijzonder, worden besproken via het concept *spatial polyphony*. *Spatial polyphony* kan een nieuwe dimensie introduceren in het creëren en ervaren van een polyfone

textuur door de organisatie van gelijktijdige muzikale gebeurtenissen in een ruimte, die (analoog aan de meer traditionele definitie van polyfonie) zowel afzonderlijk waarneembaar als structureel verbonden zijn. Dit motiveert vervolgens het gebruik van een meerkanaals geluidssysteem op een meer muzikale manier *tijdens* het ontwikkelen van het muzikale materiaal, in plaats van dat het ruimtelijke aspect iets is dat aan het einde van het compositieproces wordt toegevoegd. Vervolgens stel ik het concept *post-mix* voor als een praktische en performatieve benadering van het componeren en uitvoeren van *fixed media* muziek, waarbij het componeren voor een groter aantal kanalen dan het aantal kanalen dat gebruikt zal worden in de uitvoering meer flexibiliteit biedt in het aanpassen van een compositie aan verschillende omstandigheden. Aan de hand van een case study laat ik zien hoe *post-mixing* zich kan lenen voor het genereren van verschillende auditieve resultaten, waarbij de eigenheid van de compositie toch behouden blijft. In dit derde hoofdstuk onderzoek ik naast het gebruik van luidsprekers ook alternatieve geluidsbronnen voor het hoorbaar maken van elektroakoestische klanken, en hoe deze het muzikale materiaal vorm kunnen geven. In mijn *Broken Ensemble* project gebruik ik bijvoorbeeld kapotte instrumenten in combinatie met *transducers* als luidsprekers om geluiden tot klinken te brengen. Tot slot bespreek ik de activiteiten van *Azimuth*, een initiatief opgericht door mijzelf en twee collega's, als platform voor het presenteren en promoten van meerkanaals elektroakoestische muziek. De ervaringen met *Azimuth* hebben me mede in staat gesteld om me bezig te houden met de vele vragen die in de loop van dit onderzoeksproject naar voren kwamen, en om de concepten en bevindingen ervan in de praktijk te onderzoeken.

De audiovisuele component verkent het onderwerp van mijn proefschrift via de mogelijkheden van het audiovisuele medium. Het bevat interviews met een aantal prominente musici/componisten, de documentatie van hun aanpak in het presenteren van *fixed media* muziek, maar ook meer abstracte en 'atmosferische' visuele elementen begeleid door een meerkanaals soundtrack. Door het bij elkaar brengen van een presentatie van *fixed media* muziek en elementen die eigen zijn aan het genre documentaire, wil ik een ervaring mogelijk maken van het luisteren naar *fixed media* muziek en tegelijkertijd verschillende concertsituaties en sferen demonstreren. De audiovisuele component belicht verschillende benaderingen van het publiekelijk presenteren van dergelijke muziek, laat het proces van voorbereiding zien, en bevat dialogen met vakgenoten. Het audiovisuele formaat biedt daarbij ook creatieve mogelijkheden voor zelfreflectie, zodat het resultaat zowel een meerkanaals compositie is als een poëtische reflectie op dat medium.

In algemene zin heeft het onderzoek waardevolle inzichten opgeleverd aangaande de aard en het potentieel van het denken over *fixed media* muziek in termen van performativiteit en actieve betrokkenheid van het publiek, vooral door het inbrengen van het concept atmosfeer. Deze inzichten hebben op hun beurt de zich nog steeds ontwikkelende concepten opgeleverd die een belangrijk aspect zijn gaan vormen van mijn compositorische werk: *spatial polyphony* en *post-mix*. Deze concepten hebben ook een meer algemene relevantie voor het theoretische onderzoek naar en praktische mogelijkheden van meerkanaals *fixed media* muziek, wat hopelijk een zinvolle bijdrage zal leveren aan de discussie over dit nog jonge gebied van compositorisch en technisch denken en doen. Daarnaast kan de audiovisuele component van dit proefschrift een nieuwe weg openen in artistiek onderzoek door de mogelijkheden van dit medium te laten zien, specifiek op het gebied van muziek.

Curriculum Vitae

Siamak Anvari, born in Tehran in 1981, is a composer and sound artist based in the Netherlands. He is active in the field of electroacoustic music, composes multichannel pieces, makes sound installations and collaborates with other artists in interdisciplinary projects, as well as teaching courses and workshops. He received a master's degree in composition from the Art University of Tehran in 2009 and completed his second master's degree with distinction at the Institute of Sonology at the Royal Conservatoire in The Hague in 2014. In 2016, he enrolled in the docARTES doctoral programme, carrying out an artistic research project on performance practice in the context of fixed media music. His music is often concerned with utilising space as a musical parameter, and he often works with various multichannel sound systems and loudspeaker configurations. His music has been selected and presented at several international festivals and events including Continuum Festival at Centre Iannis Xenakis in Normandie, ZKM in Karlsruhe, Germany, Ars Electronica Forum Wallis in Switzerland, and Circuits Festival in Malta. He is currently a research associate at the Institute of Sonology. He is also one of the founders of Azimuth, an organisation for production and performance of electroacoustic music inside the Netherlands.

Music portfolio

https://on.soundcloud.com/azXF5kkkpAuw5KqR6