Responsive Space – Liveness through spatial distribution of sound and image

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ABSTRACT

In this project a performance framework called "Responsive Space" has been created, which allows a flexible way of working with distributed sound and image projections. The system consists of a multichannel speaker-system, up to three video projections, a local Wifi network with a connected webserver and mobile devices. The audience is invited to log into the local network with their mobile devices. In the browser of the mobile devices sound and image is generated or streamed.

This offers the possibility of a great diversity in the spatial distribution of sound and image. As experienced in previous projects with live audio-streaming and mobile devices the spatial gesture of music as a musical parameter comes to the fore. In the performances the audio is streamed with an icecast-server and visual output is generated with javascript on the client's browser. The imperfection of time synchronization leads to very interesting effects. The awareness of space and the interaction of the audience with each other leads to the emergence of a social space in the concert.

In addition to the dimension of space this setup also examines the relationship between different media layers. This is central for the question how to achieve "liveness" - which in my opinion can also be achieved with this spatial arrangement and distribution of sound and image.

1 INTRODUCTION

There is an ongoing discussion about liveness and the use of media. Emmerson argues, "whatever the origin is of what I receive, how does it address me (and others)?" [5] Fischer-Lichte doubts that liveness is possible in mediatized performances. [17] She argues it still needs the performer to address the audience directly. In contrast, Auslander argues that every performance is a mediatized performance, because it is already part of our world. [18] In loudspeaker concerts the sound generation is separated from the

sound reproduction and there is often no way to understand how these sounds are produced. In contrast to instrumental music with performers playing live, there is no certainty of witnessing a unique moment that lends something special to the present and the moment. [14]

This project follows the idea that space can make a significant contribution to giving viewers the feeling of "Liveness". In contrast to a strategy that places the physical presence of the performers in the foreground, the spatial arrangement of image and sound projections is also suitable to create liveness and presence and to bring the peculiarity of the moment closer to the audience.

In this context, it is also important how the artistic work can address the listener personally and at the same time achieve the perception of a unity with distributed image and sound sources. The experiences from earlier projects were included as well as considerations on how a distributed audio stream can be combined with visuals in space and on mobile devices.

1.1 Previous projects

In the project "The Neukoms" [1], and the follow-up project "Cloudspeakers - a mobile performance network" [2] or similar projects like "fields"[14] two phenomena were observed which came into existent surprisingly during the development and execution of the performances. The simultaneous use of a multi-channel speaker system and the integration of the mobile devices of the audience lead to an unusual listening situation that emphasizes the spatial character of music. The spectators themselves were able to determine the volume and orientation of the sound and started to interact with the mobile devices and each other. This awareness of space and the interaction with each other led to the emergence of a social space in the concert.

1.2 The sonotope

In this setting the live electronic performance is fed into the multi-channel speaker setup, which is arranged around the audience. The performing musicians are also able to decide to stream a part of their output via a local Wifi network to the mobile devices of the audience. The audience then receives the audio stream through a browser running on their mobile devices. This leads to a diverse distribution of the sound sources in the room and – due to the

different latencies of the mobile devices - to a time delay of the sound events. As a result, the spatial gesture of sound as a musical parameter comes to the fore. In addition, the loudspeakers and the speaker of the mobile devices have different sound characters and different impact areas. While the loudspeakers can impact the entire public performance space, the effective range of the mobile devices is very limited. The scope of these speakers covers only the very personal space and adjacent range of a listener. These different characters and effects of the sound sources lead to an unfamiliar perception situation, which has been called Sonotope [1] and are reminiscent of a forest.
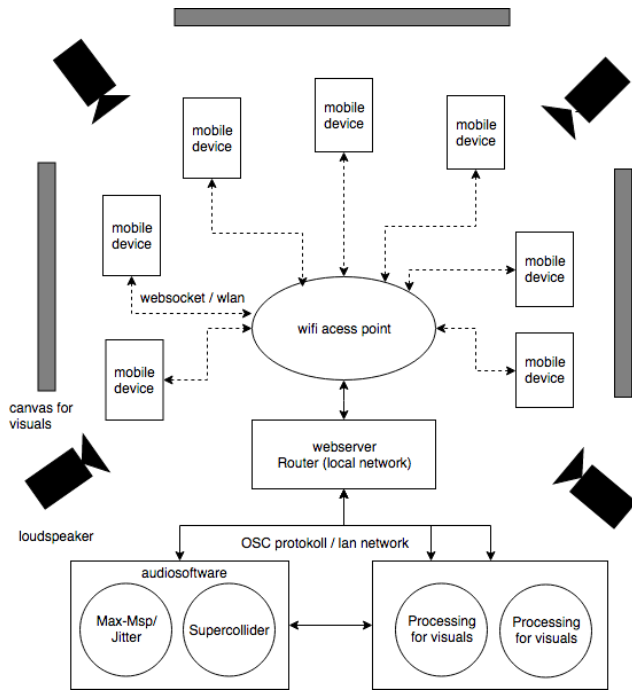

Figure 1. Communication diagram of the setup

2   RESPONSIVE SPACE
2.1. The Setup

The Setup includes a multi-channel speaker system, up to three visual projections distributed throughout the room, and a local network for the listeners' mobile devices. The audience is invited to log into a local network and use his/her smartphone. In the browser of the mobile device (or computer) sound and image is generated or streamed.

This offers the possibility of a great diversity in the spatial distribution of sound and image. The audience is invited to come with their personal smartphone, tablet or computer and log in to the network. Sound and image are generated in the room and through speakers as well as in the browsers of the viewers' mobile devices. The audio software communicates via the OSC protocol to the video software and a web server to which the mobile devices of the audience are connected. For audio-processing supercollider is used.

There are different parameter mappings from the audio source to the visual output, which is transmitted with OSC messages. This OSC messages are sent via LAN to the computers (I used separate UDOO X86 Minicomputer with Linux), which run the visual programming software processing. The web server (which was integrated into the performance computer) receives the audio program's OSC data and forwards it to the individual clients (the smartphones) via Web Socket. (figure 1). The webserver is running with a Node.js Framework called rhizome. [3]

A raspberry pi with a soundcard (pisound) is used to broadcast the audio stream. The visual output is generated with processing on the computers and p5js on the clients. The source code is available on github. [5]

2.2   Artistic works

The first piece was an audiovisual piece called "Open Form". Stochastic processes generate layers of five different sound types. The piece examines which gestural possibilities the respective sound offers, and in which temporal dimensions these tonal gestures form meaningful unities. A "gesture", I would describe as a small musical motif, which then can be altered and varied in sequences. Temporal change plays a major role in the creation of shapes and their sequences in time. Overlaying and combining the types of sound results in unpredictable configurations and shapes. The gestural forms result from the superposition of sounds and the density of events.

Every sound type is mapped to a visual form. According to the sound character of the five different sound types I tried to find a corresponding visual form. I mapped various parameters of the sound synthesis to the visual output via OSC. The mapping includes the frequency, the volume, panning, and from granulated sound I derived the grain length. They are directly connected to the position in the vertical, the brightness, the horizontal position and the density of a texture. Additionally a separated process generates a random walk which is mapped to parameters of the visual output.

There are variations of the visual output on every mobile device. And there is a difference between the visual output on the mobile devices and the projections on the screens in the room.
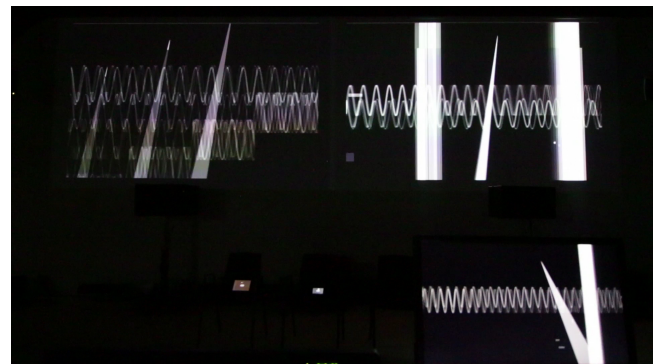

Figure 2. Open Form III (2018). Videostill.

3 THE SPACE IN CONCERT

Space was always an important parameter in noncommercial electroacoustic music. It has a long tradition to experiment with various kinds of loudspeaker setups, which explore the possibilities to distribute and move the sound in the space. The Acousmonium created by the Groupe de Recherches Musicales (GRM) in 1970 or the Birmingham Electroacoustic Sound Theatre (BEAST) are still in use. In the cinema we see a development towards 3D-Sound or similiar systems to create an immersive experience. But generally spoken, music is more often perceived as an arrangement of events in time rather than in space. As Emmerson argues, time and space in music are not independent or absolute, "time needs space and space needs time". He describes: "a performer might ask 'where are we?' in reference to a printed score or a given structure in the (perhaps unwritten) music, but this question can also be asked with respect to a venue, furthermore we can ask it about a historical or sociological 'position'. It seems this question is the most comprehensive it is possible to ask!" [5].

Music theory more often deals with questions of harmonic and temporal structures of a music piece than with the question of space. It might be the case, following Emmerson's argument, that the space could be understood in many different ways and therefore it is harder to make distinct classifications. The space in a musical piece also often means the space of the sounds within the music piece apart of the situation or context of a concert or a social context. Emmerson suggested a division of the space universe into four components of increasing scope: event, stage, arena and landscape. This description of sound areas covers the public space, but with the use of mobile devices and sound sources with a very limited range we might to go more in detail to a smaller and personal area of space.

3.1 The hidden dimensions

Dennis Smalley has used the theories of proxemic classification as a basis for describing the sound spaces created in a performance with instrumental music [6]. He refers to theories of Eduard Hall [7] where he divided zones of social interaction into four distinct zones. These four spheres of action are described with spatial dimensions that are in a very dynamic relationship to each other. Eduard Hall describes these relationships as a kind of contraction and expansion of the spheres of influence. The intimate zone includes the very close physical area in which interpersonal acts such as gentle touch but also, for example, contact sports take place. This is followed by the personal zone, which covers about one arm's length and where we directly communicate in a personal way, the social zone in which the social interaction of a group of people takes place, and finally the public zone which includes the whole space in which an event takes place. Accordingly, Smalley describes zones and sonic spaces within a concert or music performance. The gestural space encompasses the sphere of influence of the individual and is characterized by the physical action and movement of the instrumentalists. This describes also a very close and intimate sonic space, where the sound is very close

to the ear. The Ensemble Space is the sphere of influence of the entire ensemble and encompasses the entire acoustic field of the ensemble and thus also the stage space. The Arena Space finally includes the entire performance space with the ensemble and the spectators.

3.2 Sound zones with distributed loudspeakers

These divisions are more or less clearly separated, and the dynamic relationships of the individual sound spaces vary with the division of the concert space and the circumstances of the concert. These descriptions fit for an instrumental performance with a classic arrangement of ensemble, stage, and audience. But which acoustic spaces arise in a concert with electroacoustic music in which the loudspeakers are arranged around the audience, the performers are perhaps in the middle of the room, or the smartphones are used as sound sources and are distributed throughout the room? In this arrangement, there are sound zones that overlap and are interlocked. The sound space of the arena results from a multitude of action zones, which can be configured and changed depending on the listener's point of view and the nature of the room. This results in a series of interesting questions on how such a constellation can be described, and how it can be further developed: Which sound zones are created in such a concert situation, what characterizes the individual sound zones, and what are their dynamic relationships? What are the connections between the physical, the musical, the social and the acoustic space? Is the moving sound synonymous with the gestural space of an ensemble?
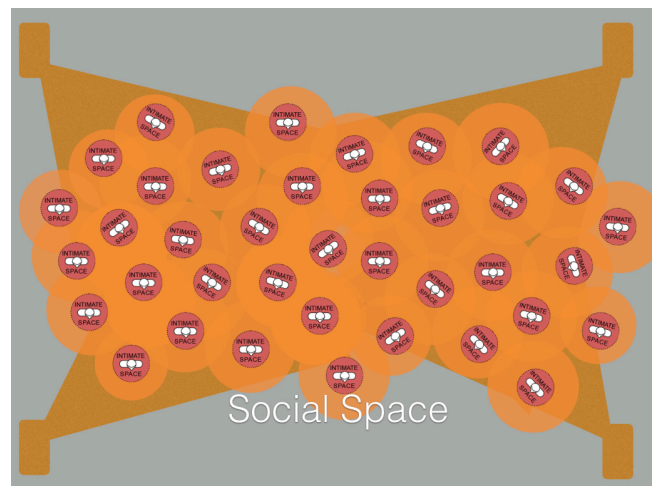

Figure 3. Sound zones within a performance space using mobile devices of the audience together with a loudspeaker system

3.3 Dislocation and Relocation

With technology it is possible to record sounds (and also images) and remove it from the original source and relocate it. Pierre Schaeffer's original definition of acousmatic music and the 'acousmatic dislocation' derives from the consequences of the use of new technologies like telephone, radio or recordings. With

technology it was possible to separate the sound from its source in space and time. To the dislocation of space and time Emmerson added the dislocation of mechanical causality. He describes sound synthesis as a radical rupture with the past, where no longer a mechanical object produces the sound. In acousmatic music we sometimes do not know what causes the sound we hear in a loudspeaker. Instead of listening to the quality and musicality of the sound we tend to think about the question, what causes the sound. But Emmerson asks "(…) but need we know?" [5]

New media was developed to overcome the distance of time and space and bridge the gap. Emmerson also emphasizes the interactive and responsive dimensions of new technologies. It is possible to communicate over far distances. Emmerson argues that the dislocation gives a way to relocation, but perhaps only when our anxieties over the process have been reduced. Times are changing and people get used to things. We have learned to accept, that any kind of mediatized sound is part of our world. There is no need to make distinctions between real or virtual sound and images any more. There is a new generation of listeners which has extended the memory of the mechanical world of sounds including electronic sounds which are part of our world.

3.4   Integration and recombination of media

In the "Responsive Space" also visuals are integrated. The intention was to create a setup to examine the relationship between different media layers like audio, visuals and the space.

As we have experienced surprising effects with the use of mobile devices when we distributed audio through their loudspeakers, it is a logical step also to use the mobile devices for visual output. It is interesting to see, how the visuals influence the artistic artwork and how it is playing together with sound and space. The visuals are generated and distributed on the screens of the mobile devices.

The visual content can also be generated with computers or various kinds of analogue techniques completely independently from audio sources. A commercial film tries to recombine the different media sources to create an illusion of a fluent narrative work. Artistic audiovisual performances more freely recombine different media types. These works have more in common with abstract paintings and experimental films of the early days (like Oskar Fischinger and others) [9]

However, in audiovisual performances we tend to see audio and visual events related to each other. According to Chion the "audiovisual contract" [10] let us search for synchronized moments or let us think of references and connection between audio and visuals. Chion explains this with the word "Syncrése", where image and sound can melt to a new unit. According to Cook's Thesis the best way to combine different media types is to find complementation. The other possibilities, like being in contrast or similarity would lead to more uninteresting artistic works. [11] For my setup it would be interesting to see, how the different media types can be recombined and how the dimension of the space comes into the game. Obviously the "audiovisual contract" also works with distributed screens. On one hand, the audience is still

searching for synchronized events between audio and visuals. In the case of the distributed audio sources, which are more delayed than the visual output, these relationships become more complicated. Then it is not so clear anymore, which visual belongs to which audio source. Still it was possible to find these synchronized moments, but it seems to be more interchangeable in this distributed form. The audience has also the choice to perceive only the very personal space the output of the personal device or to perceive the surrounding space. Ideally, the viewer feels personally addressed, as well as part of a group and part of a public space. This special listening situation and the awareness of space leads to a sympathy which I would call "Liveness". [12]

However, it is a difficult task to create these performances that appeal to individuals and groups without overstraining attention.

3.5   From reduced listening to extended listening

The same phenomena could be observed in the visuals. Concerning the acousmatic music Pierre Schaeffer suggested to find a way to exclude the distraction of the sound source and only try to listen to the sound itself. This kind of 'reduced listening' was for sure helpful in the early days of electronic and acousmatic music, but how should we listen to and perceive multimedia and intermedia performances?

Further, I would argue that there is also no need to exclude the material world, like the 'reduced listening'[19] suggested. It is indeed possible to listen to quality of sounds, and extend our ears (and eyes) to the concert space, the social space and the atmosphere around us.

3.6   The use of mobile devices

The relationship of people to their mobile devices is shaped by daily interactions. It is a very personal device, and many private and business communicative work is done with it. It ranges from phoning, writing e-mails, text messages or notes to a collection of personal photos and video recordings. In addition, smartphones are also multimedia machines. Videos or music are played and the personal collection of apps can perform all sorts of tasks for buisness or distraction. The smartphones and other mobile devices can also be seen as a kind of extended human sensory organ [13], with which humans perceive and interact with their digitized environment. The device thus works in a very personal and individual area, and in the context of the "Responsive Space" it is something surprising and unusual for the audience that these devices are addressed in the performance. After our experience with the performances, even during the concert, even if the mobile devices are used only for playback, an interaction with the devices and a communicative exchange between the audience with each other arises. Viewers begin to play with their devices, they have control over the volume and orientation of the devices, and start to communicate with each other. Not always verbally, but also through gestures and the control of their devices. Similar observations are described in the project Fields [14] in which similar systems were developed. The electro-acoustic music of the performers was emitted on a quadrophonic speaker system and the

mobile devices of the spectators, who were in the middle of the performance area. A framework has been developed that allows possibilities of sound synthesis on the mobile device and also offers modules for interactive use [15][16].

3.7   From social space to collective space

As described in the project, the smartphones, which use a very private context, will be expanded to a collective experience in these concerts. The single control with his personal device to a private composition, personal space occurs in communication to a public, collective space. This leads to the emergence of a social space in concert. This can also lead to a series of further developments, opening up a series of interesting questions: what conditions must be met for such a collective experience to be achieved? What is the relationship between personal space and the collective space? Which compositions and performances are possible with such constellations? Which compositions are possible, or how can they be arranged? Is it possible to perform a collective composition with the participation of the audience? In what relation do the performers stand to the collective?

3.8   Liveness in the multimedia performance

In this setup certainly people can be reached in their personal or even intimate space. However, the mobile devices are not just sound sources, they also provide a visual interface that can be used for artistic performances. It seems to be clear, that the personal mobile device can address the listener very directly, because the listener already has a kind of relationship to her/his personal device. The distance of the visual output of the mobile devices to the listener does not have the same impact. The visual output works through the staging and integration of the visuals in the room. But the generated image in the mobile devices can also be seen as a part of a bigger image, which comes to existence through the interaction of many individual devices. It increases the effect, that the audience feels personally addressed and part of a community at the same time.

4   CONCLUSION

The sound space of the performances was characterized by a special liveliness, which for me arose from the peculiarities of the spatial situation as well as from the possibility to address the listeners with their personal devices and to integrate them. The use of sound sources or screens in a heterogeneous distribution and the interplay of different sound and impact areas could be a way to integrate the viewer/listener into a performance. It offers great opportunities to experiment with different spaces and the spatialization of sound. It is a challenge to make performances which work smoothly, but also very interesting to explore its possibilities.

6   ACKNOWLEDGMENTS

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