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Interactivity in Music - Annotated Bibliography.

500 words abstract

Most of the time, when kids are requested to ring the bell for getting off the bus, excitement and anxiety overwhelmed the moment. Maybe the feeling of controlling sound is the reason, or maybe the dominance over the bus as a result of their sound-making action generates hedonism and gratification. Controlled sound is an experience that is commonly seen in everyday life, but not as common in the music field as we may think. Nevertheless, there are some artists that have been working on this concept with remarkable results. When the responsibility and authority that normally a performer and composer have in a regular piece of music is given to the audience, the engagement and interest changes, it generates an environment where the cycle of music creation and enjoyment is perceived differently. On this research, the main goal is to create a musical piece that can be seen as a hybrid between sound art and electroacoustic music, where the interactivity factor emulates the mentioned everyday experiences, but through the artistic eyes of social equality and communication as a principal and fundamental human characteristic. To get plausible results, the proposed piece reconsiders the traditional model of music making, where composer, and frequently performer, inhabit the top rung of an artistic hierarchy in which the audience passively observe. The compositional model used here redistributes evenly the act of creation amongst each of these actors (composer, performer, and audience). This model allows the development of a collaborative musical situation in which the outcome is achieved via the creation of non-hierarchical roles of these actors: audience behaviour and input influences score material, creating an evolving content for the performers to play, as well performers alter audience behaviour, score and resulting sound, etc. The purpose of this unending biological-like network of influences is the creation of an active filter that allows the hearing of specific sounding material, percolated out of a dense amount of aural possibilities. Technically speaking, this is achieved by immediacy of sound reaction and computer interactivity;

audience and performer's physical positioning, movements, behaviour and input are correlated with active and immediate sound location, displacement and processing, lighting, and score reaction. There is also a written component on the research, on it, the analysis of sound interaction in music history during the 20th century is presented, focusing on movements and composers that influenced new thinking. Also, pieces that use graphic, text based, and animated scores are explored. Straightaway, the interactive element itself is analyzed in an overview of the two existing music genders that have been dealing with this phenomenon and can be considered precursors of this model: interactive sound installations, and electroacoustic music that uses the principle of real-time sound processing. Finally, a chapter is dedicated to non-strictly musical aspects of technology that have contributed with this concept: the video game industry, which has provided an extensive list of electronic devices; and the augmented reality, virtual reality and mapping production, which have researched largely about the concept and application of interactivity.

Annotated bibliography (14 items)

1. Auslander, Phillip. "Sound and Vision: The Audio/Visual economy of Music Performance." In *The Oxford Handbook of New Audiovisual Aesthetics*, edited by John Richardson, Claudia Gorbman, and Carol Vernallis, 605-621. Oxford: Oxford University Press, 2013.

This article oversees the phenomenon of the lack of coherency between visual cues and audio response happening in concerts where a musician performs a laptop or some kind of MIDI interface. The debates that this topic has generated during the years are also commented. It presents support from both sides: the ones that are closer to a more traditional thinking (those whom affirm that a visual component is crucial for the understanding of the performance) and those that their approach is "acousmatic" (concept which affirms that there is no need of having a visual component to understand the aural performability). On one hand there is music where the visual is completely ignored (electroacoustic music, for example), on the other hand, sometimes the visual component is more important than the musical content (teen pop bands, for instance). Popular bands' studio recordings versus live recordings are presented as an extension of this problematic. During the 60's some musical groups used the aesthetic of dark scenarios, many times this was made for giving the audience a chance to enjoy deeply the lighting show presented in a live concert, this practice grew exponentially towards our days, the inclusion of controllers, lasers, audio-rhythmic lights, etc. is almost mandatory for a show in the twenty-first century. Finally, Auslander talks about the use of organs in live performances (where the entire instrument is never seen), the inclusion of dressing and choreographic content in rock/pop concerts, and Pat Methany's MIDI controlled robotic orchestra. Since the goal of this article is to talk about popular music and performance, it provides an overview of what is happening on mass music production, this information will be useful for me because it enlightens me about what people is watching and listening everyday, and so re-shape some principles into my project.

2. Bandt, Ros. "Sound Installation: Blurring the Boundaries of the Eye, the Ear, Space and Time." *Contemporary Music Review* 25, no. 4 (August 2006): 353-365. Accessed on September 15, 2015. <http://dx.doi.org/10.1080/07494460600761021>.

Ros Bandt is a sound artist that has been in the area of sound installations since they were conceptually formed, on the 80s. On this paper, he presents and explains many of his pieces that took place all over the world. One of the most valuable contributions on this article is a definition of Sound Installation, according to Bandt, a sound installation is a space that contains diverse kind of imposed sound components, with the goal of been heard for a long period of time. He insist that sound installations are physical, embodies spaces and make the listener conscious of past, present and future. They allow audience to walk and perceive the piece from different places, this is unique in the musical world, the artist is aware of this freedom and balances the sound component to be enjoyed from all perspectives. Afterwards he talks about his own experience developing, setting up and experiencing sound installations, from here to the end the article is transformed into a personal diary-like commenting that collects experiences and thoughts, the author implies to be the first in creating some of the innovations that are common now in the field. There is a Mixed Media section where he discusses the importance of the use of technology in sound installation and how has increased considerably during the past years. Sound design is lightly discussed next. Ending the article, there is an argument about the necessity of working collaboratively between technicians, artists and gallery personal; as well as the necessary permits and permissions the artist has to consider before and during the presentation of the piece. Despite the fact that this work is just about the writer's work and conceptions (actually, all the bibliography are just earlier writings from the same Bandt), some definitions and historic events are excellent for my work.

3. Collins, Karen. "Implications of Interactivity: What Does It Mean for Sound to be 'Interactive'." In *The Oxford Handbook of New Audiovisual Aesthetics*, edited by John Richerdson, Claudia Gorbman, and Carol Vernallis, 572-584. Oxford: Oxford University Press, 2013.

Interactivity is a topic that can be considered new in the arts, Karen Collins is one of the scholars that has created a large amount of writing, as well as many of the theories that artist nowadays use as a bibliography background. On this article the focus is on sound interactivity on the game industry. Despite the fact that the field of coverage is not the one of my work, the thinking and proposed statements can easily been imported to an

interactive sounding musical piece like mine. Highlighting the importance of the sound in a game, she recognizes seven different interactive implications for the sounding part, most of these implications can be reshaped to fit into the sound art conception: Preemptive Attention and Alert Sounds (musical warnings to inform the user that something will change ahead, this are also related with Pierre Schaeffer idea of acousmatic sound), Confirmation Sounds (verification that an action has been taken), Status Feedback (sounds that inform the user that an action is happening during the present moment), Navigation and Orientation (two conceptions: a permanent sound that informs the user where he is located on the matrix as well as strategically sound placed on specific parts to guide and inform about upcoming events), Peripheral Information (the aesthetic of music that changes according to the scenario or “world” where the user is at), Affective Feedback (informative sounds about the character “feelings”) and Reward and Punishment (sounds that notify about consequences of actions). The section called Implications of Interactivity: Sound and Control introduces the importance of user control as a result of the sound information triggered by the game. The conclusion of the article remarks the meaning of the interactivity cycle between user and game expressed on feedback and control amongst the two.

4. Dannenberg, Roger B., and Joseph Bates. “A Model for Interactive Art.” In *Proceedings of the Fifth Biennial Symposium for Arts and Technology*. Carnegie Mellon University, Computer Science Department (1995). Accessed on December 8, 2014. <http://repository.cmu.edu/compsci/481/>.

As faculty members of the Computer Sciences Department in the Carnegie Mellon University as well as active artists, the authors discuss the topic of interactivity from a technological point of view instead of an artistic one. The article analyzes different models of interactivity between artist, computer, performer and audience in the fields of music and drama and, in a smaller scale, visual arts and interactive dance. These models are illustrated with examples of specific pieces as well as graphics, these pieces are shortly analyzed but enough to extract their concepts. The first one is interactive drama, the model proposed included the audience member as a part of the story development in the piece called Edge of Intention, a virtual world where three imaginary beings live in a screen, on it

the audience controls a fourth one that interact with the other three. While a person is playing, normally there are also other audience members looking at this situation, this makes the person controlling the being both: audience and performer, on this scenario the process of interaction is where the art is held. Music is discussed next, on the piece Nitely News, this is a piece where the composer manipulates live the score for the performer to improvise, these manipulations are made according to what the composer hears from the performer, he produces an annotated and scored feedback in real-time. These two pieces presented back in 1995 a novelty for electronic arts, an interactive model of composition able to include different data input. Despite the fact this is a dated article and technic, it sets and reflects the models for interactive composition that are used nowadays, on my own work, this information is useful as an historic overview of how models for composing changed during the years.

5. Deery, Aidan. "Practical Approaches Towards Interactivity in Soundscape Composition." In *Digital Creativity* 26, no. 1 (February 2015): 32-39. Accessed on September 15, 2015. <http://dx.doi.org/10.1080/14626268.2015.993654>.

Ph.D Aidan Deery is a composer and sound artist interested on field recording and electroacoustic music, on this paper the focus is about how interactive technology is able to connect sounds from a music instruments within the soundscape of an environment. Exemplification is shown on two music compositions by the author. There is a interesting section where soundscape composition, acoustic ecology and field recording are defined, this definition helps the reader understand the small differences that makes three entire different genders, this definitions are very important for my work. The first piece, Cold Wood is for a bass trombone that interacts with field recordings from a forest, it proposes a new model of interaction that permits the traditional listening of the forest but mirrored by the instrumentalist. Second piece is Arcandom, it uses the same principle, with the addition of a coil microphone that reacts to the electromagnetic activity of the performer's laptop, this sounds share the performative space in an imaginary-like sound cloud. Deery, remarks the importance and novelty of soundscape composition and interactivity, and the difference between site-specific electronic works (where the soundscape changes permanently) against traditional electroacoustic music (where despites the fact of been

immersive, the background sounds are controlled by the composer or performer), on this section also is mention the surprising fact that acoustic instruments are not normally used on the practice of ecological sound pieces. Towards the end, some typical problems of working with technologies are discussed and the author proposes his model for avoiding them, the most interesting are the ones that implies using the microphone as an instrument and as a prosthesis. Soundscape will be a considerable component on my piece, and the usage of the microphone as an interactive instrument is very promising for me to adopt.

6. Deweppe, Alexander, Nuno Diniz, Pieter Coussement and Marc Leman. "A Methodological Framework for the Development and Evaluation of User-Centered Art Installations." In *Journal of Interdisciplinary Music Studies* 5, no. 1 (Spring 2011): 19-39.

This research team is based on Ghent University, it is formed by a combination of specialists in art history, computer engineering and musicology. The article oversees the technology systems that are based on motion capture, creating a strong feeling of interactivity and control between the body of the user and the instrument or piece. The main goal is to establish a method for evaluation of sonic and visual action-reaction-couplings. They begin by giving a theoretical background on the use and inclusion of technology as an interactive device through gesture-base control of sound, as well as a large explanation of how some considerations about body and computer connection relates each other and why some technics can be considered more effective than others. Some examples of the usage of this technics are widely explained on existing sound art piece, these installations share the characteristic of been pre-tested for selected audience members whom provided a feedback, this feedback helped to re-shape the devices for a more effective usage and reaction. The authors recommend this prototype-based experience tested on laboratories, the fundamentals of these evaluations is presented on each one of the steps, the results helped improve and shape the final products. Detailed examples of successful researched products are shared next. One of the examples that illustrates this concept is The String, a musical piece that is based on a projection on a screen, where the data of diverse sensors drawn lines and shapes on it, allowing the user to play and perform virtual strings and similar objects, displayed on the same screen. The second example is called SoundField, an immersive augmented reality environment. I

consider this central for my work since the way I have been proceeding for this research is also prototype based, having the experience of another scholar is helpful and inspiring.

7. Freeman, Jason et al. "Using massMobile, a Flexible, Scalable, Rapid Prototyping Audience Participation Framework, in Large-scale Live Musical Performances." *Digital Creativity* (July 2015): 1-17. Accessed September 15, 2015. <http://dx.doi.org/10.1080/14626268.2015.1057345>.

The article discusses the development and use of the software for audience participation known as massMobile. It begins with an historic overview and background of audience inclusion on music performances and sound installations in both presentations: by using mechanical and electronic devices to achieve the interactive factor, on this first section, Freeman sets the scope of the article: the focus is just on live musical performances. The explanation of the development and usage of the network that the software uses is detailed, the technical design is well documented, it names and explains all the involved parts and how they work together for a successful data transmission. Finally, he talks about some projects where the application has been used, stressing the success attained on large audience events, it explains in detail how the network was used showing pictures and collected data. One of these projects is called TeamWork where the audience controls via their smartphones tempo and dynamics of a sounding piece that is played. Another one is a musical piece for jazz ensemble and projection called Sketching, a visual-sound interaction work where the audience develops a graphic score in real-time by using massMobile to be played and improvised in real-time by the ensemble. Despite the fact that this article is only focused on the particular software, the Center of Music Technology team of the Georgia Institute of Technology is well experimented on the field, this can be seen on the large and inspiring bibliography as well as in the detailed and well organized paper. The information showed on this article can be very useful on my research, the tool itself may not be the one that covers my needs, but its development, the problem-solving approach and the large amount of resources quoted gives me plenty material to analyze.

8. Frengel, Mike. "Interactivity and Liveness in Electroacoustic Concert Music." In *The Oxford Handbook of Interactive Audio*, edited by Karen Collins, Bill Kapralos, and Holly Tessler, 299-314. Oxford: Oxford University Press, 2014.

This article begins with the idea that interactivity in arts normally occurs between performer and system, while auditor is a passive witness. This passivity makes them been aware of "liveness" and human-system action and reaction. International award winning composer and Northeastern University and Boston Conservatory faculty Mike Frengel, proposes four models of interactivity in the electroacoustic music performance that echoes concepts on my research. First topic treated is the discrepancy between sound and source in electroacoustic music, when the lack of a visual performer in a electronic musical work is noticeable and affects negatively the moment. Following, he proposes how interactivity has improved these performances when mixed media piece (instrument and electronic) are used. This reflects the more effective component on real-time sound processing (where the electronic component follows the performer) over "tape" based composition (where the performer must follow the electronic). Inside the real-time situation (instrument and computer), Frengel affirm that we can find any of the following four models: The Instrumental Model (digital instruments to be used as a traditional acoustic instrument, but with a settable interface and timbric features), The Conductor Model (where the performer "conducts" the system through controllers, introduction of coordinates, etc.), The Reflexive Model (the system waits for premeditated musical cues to react by changing the incoming audio signal on the spot or by triggering pre-recorded material), and finally The Virtual-musician Model (live-algorithms that intend to work as autonomous improvisatory players, where the system's inputs and outputs are unpredictable but responsive). As many of the articles presented on this bibliography, it talks about the issue of visual action and sound production from the audience point of view. Since my research will embody many of these models on its realization, this classification will be beneficial for acquiring a coherent writing.

9. Götz, Dipper. "Interactive Interfaces: Installations Produced at the ZKM | IMA." *Organised Sound* 14, no. 3 (December 2009): 286-298. Accessed on October 20th, 2015. Doi:10.1017/S1355771809990100.

Dipper is a cello player and Musicologist specialized in computer music, he has been working at the ZKM institute in Germany for many years, on this writing he analyzes some of the pieces that have been set up on the galleries of this now legendary music research institution. The article is divided in two parts. The first part is dedicated to the common characteristics these pieces had among them: the interactivity factor. Then, Dipper discusses in a very well written sections different topics that are insightful for researchers working on the field of sound installations: The Installation as a Computer Game, The Installation as a Musical Instrument, The Installation as a Tool for Exploration, The Installation and Sonification, The Installation and Didactics and finally Video Projection. These sections are short and non-technical, but they are very useful as a general view of these important topics. On the second part, fourteen different installations are presented, the author makes an excellent job describing briefly the functioning of each piece. There is photograph documentation on most of the installations, in some of them there are architectural plans that the artist drawn for the set up as well as links for the reader to check video and audio documentation of them. This documentation helps the readers to have a better overview of the works. At the end there is a short section about installations that were not included on the explanation for not having an interactive content, but their names, years and creators are shared and can be tracked on the ZKM website. The coverage of the works goes from 1997 to 2008. On my research this document will be used to collect historic data, analyze pieces by other artists, examine solutions to specific issues, as well as getting inspiration for the interactive component of my piece.

10. Jordà, Sergi. "Interactive Music Systems For Everyone: Exploring Visual Feedback as a Way for Creating More Intuitive, Efficient And Learnable Instruments." In *Proceedings of the Stockholm Music Acoustics Conference*. Stockholm, Sweden (August 2003). Accessed on December 7, 2015. <http://mtg.upf.edu/node/326>.

Since the visual part of my piece is crucial for the development of the interactive component, I considered Jordà's article fundamental on my bibliography. He is a scholar in the topic of interactivity and sound art, as well as Associate Professor at the Music Technology Group, in the Universitat Pompeu Fabra in Barcelona. The goal of the writing is to examine the concept of how visual media can improve the intuitiveness of a developed interface for the

user, and then making complicated musical principles understandable for non-musicians. The first section discusses shortly the design of traditional musical instruments and the idea of exporting this design to digital interfaces is settle. An instrument and interface to be used in an interactive space must have the capability of been self-explanatory, with a very short learning curve, but able to manage difficult tasks. Jordà considers the visual feedback as critical point to achieving this, an instrument that is very simple to manipulate, but at the same time intuitive to be used when watching on a screen the possibilities and tasks happening in the background, this concept is used on the FMOL (a instrument that has been in development since 1997 by Jordà with a successful outcome). The limitation of this device is that its mouse based tracking does not allow the creator to complete certain duties. This limitation is solved on another instrument called The Reactable, where a projector plays an visual interface into a table (projector on the top facing down), and a web cam reads the position of people hands in the projection, this data is re-introduced on the system and the interactivity cycle is completed. Because the graphic content is simple to use, the user can understand the functioning within a short period of time, the complex processing are hidden from them.

11. ———. “Interactivity and Live Computer Music.” In *The Cambridge Companion to Electronic Music*, edited by Nick Collins and Julio d’Escriván, 89-106. New York: Cambridge University Press, 2007.

Live computer music is where the phenomena of interactivity started in the music scene, Sergi Jordà is an experienced installation artist, faculty and researcher closely related with the term. On this article, he introduces the idea of the computer as a musical instrument that can be played because of its ability of creating real-time processing. It positions the computer as an infinite instrument, without register, playability boundaries, nor timbric limitations. The section on First Steps in Interactive Computer Music details the history of interactivity in music from 1957, and it does the same with the first software and synthesizer that were available for creating sound on the spot from 1970, this information is very useful on my research as a historic data. An analysis about what can be done with live computer music covers the theory and problematic about what implications are played when a composer is creating a digital instrument. The longest section of the article is dedicated to the history and analysis of the gestural controllers that have been used to

manipulate electronic signals. It begins with the Theremin in 1919, followed by an interesting discussion on MIDI devices, then the existence of NIME (New Interfaces for Musical Expression conferences and workshops existing since 2001) is presented as well as the use of joysticks, tablets, game pads, knobs, accelerometers, turntables, among others. Also, some modern interfaces are presented: Mischel Waisvisz' "Hands". Nicolas Collins' "Trombone-propelled Electronics", Laetitia Sonami's "Lady's Glooves" and others. The possibility of collective manipulation of an interface is discussed on the segment called Interfaces for Multithreaded and Shared Control, where also the problematic of disconnection from the auditor because of performer visual activity and sonorous results is presented. This article provides important historic information and theoretical background, it will be extensively used when I need contextual information.

12. Maynes-Aminzade, Dan, Randy Pausch, and Steve Seitz. "Techniques for Interactive Audience Participation." *Proceedings of the 4th IEEE International Conference on Multimodal Interfaces* 15, ICMI '02 (2002): 15-22. Accessed December 8, 2015. Doi:10.1109/ICMI.2002.1166962.

This is a descriptive paper where some technics for large audience interactivity are explained, their focus is to acquire an accurate real-time data reading by using simple and effective low-cost technology. The technics are dated, but the approach of mass data collection is what I find useful for my project. The first technic discussed is the Audience Movement Tracking, the goal is to collect data avoiding the use of touchable interfaces, the proposed solution is a camera tracking by real-time analysis of raw video, the captured image is compared with a pre-recorded one, by measuring differences between the two, the system interprets the average movement and outputs it as a number that can be re-introduced into other system as a control of a particular parameter, the weakness of this technique is the calibration needed each time the performance begins, another is the lack of adaptation to changing audiences (latecomers joining to the group affected negatively the tracking process), and finally there is a tendency of the system to pay more attention to the members sitting on the front rows. The second technique is shadow tracking: a projection on a large screen is interrupted by a beach ball that the audience manipulates, because of the distance between projector and screen, the ball creates a shadow on the projection, a

camera pointing to the video screen is able to determine the position of the shadow and re-enter the X-Y coordinates to the system, which is assigned to diverse controls of a ongoing game. The last technique is the Laser Pointing Tracking, where members of the audience point portable lasers to a screen, this dots are tracked by an association method to distinguish their position between frames. On the conclusion section, a valuable set of design principles for interactive audience activities is presented.

13. Nordahl, Rolf and Niels C. Nilsson. "The Sound of Being There: Presence and Interactive Audio in Immersive Virtual Reality." In *The Oxford Handbook of Interactive Audio*, edited by Karen Collins, Bill Kapralos, and Holly Tessler, 213-233. Oxford: Oxford University Press, 2014.

The scholar specialist in Virtual Reality and sonic interaction design Rolf Nordahl and his Ph.D. student Nilsson Niels cover the topic of sound design for virtual reality spaces. They begin examining the different approaches to the idea of "being present", they analyze different scenario like cinema and video games and how Immersive Virtual Reality (IVR) has changed the paradigm on this areas. Following, there are few recommendations about how we should approach to the idea from now on (presence as social richness, as realism, as transportation, as immersion, etc.). Subsequently, they mention what researcher Mel Slater proposes for IVR visual conception, and how it can change our feeling of space: System Immersion, The Place Illusion, The Plausibility Illusion and The Virtual Body. This concepts are exported by Nordahk and Nilsson to the aural scenario, each one is described within the sonorous understanding, remarking the importance of coherency among audio and visual stimuli: Auditory Immersion discusses the importance of multichannel systems, ambisonic and VBAP technology for sound positioning and movement, as well the tools for acquiring spacialization through headphones like binaural, interaural intensity, and HTRF technique. The Auditory Illusions of a Place section talks about the spatial properties of the virtual places, the permanent need of auditory background, the importance of quality and content of the audio material, and the need of internal and cross-modal consistency. Auditory Illusions of Plausibility remarks the importance of coherency between visual actions with sound reaction. Finally, Auditor-induced Body Ownership discusses the technological difficulty of producing sound reactions to the entire body of the user. On my

own work, this information will be useful when dealing with similar problematic, since my piece is meant to be set up in a gallery space, this theories will contribute with the decision making about sound, space and interaction.

14. Wilson, Chris and Michael Brown. "Sound, Space, Image and Music: Hybridity in Creative Process Through Technology, Interactivity and Collaboration." In *Journal of Music, Technology & Education* 5, no. 1 (2012): 89-107. Accessed on October 3, 2015. Doi: 10.1386/jmte.5.1.89_1.

Lecturer and teaching advisor specialized in interactive media Chris Wilson, and senior lecturer in music Michel Brown are based on University of Derby, UK. On this writing, they explore the active creativity achieved by technology in the interaction between sound and image, their idea is to generate a design strategy that is cost-efficient and also that offers successfully results in the instinctive embodied mediation of music technologies. The contextualization of the work is extensive, it begins remarking the need of the inclusion of multimedia, computer games, music and music composition into the higher education. The duality of sound and image is treated from a multimodal approach, it considers the integration of creative thinking something neurological (synesthesia), cultural (musical experience and visual cortex), and historical (Plato, Aristotle and Newton's experiments on sound and color). A project based on digital photography and sound recording, applications of sound-to-image and image-to-sound, and similar experiences are described, these projects inspired the creator to investigate the phenomenon of convergence and divergence among audio and image, a series of experiments are exposed, many remarkable results were attained, apparently the use of sensors that have a reaction on both media created a coherent audio-visual integrity, also the connection between visual color and hue with sound frequency and tone was surprisingly approved by visitors, and finally creative thought between animated and musical (or sonic) movement and shape created different discussions with positive outcomes. A final discussion about the roles of producer and composer in works where interactivity is the cell that generates the music echoes on the issue of authorship and the de-idealization of the image of the composer that I develop on my work. The advices about coherency among sound and audio through interactivity and

the conception of shared creativity will be useful for the theoretical and practical development of my piece.