

Aural Disjunction: An exploration of relationships between slow aural and visual media in film

Jonathan Jackman Butterworth

A thesis submitted to
Auckland University of Technology

In fulfilment of the requirements for the degree of
Master of Creative Technologies

2013

Faculty of Design + Creative Technologies

Contents

List of Figures	III
Attestation of Authorship	IV
Acknowledgements	V
Ethical Approval	VI
Abstract	VII
1.0 Introduction	8
2.0 Significance of Research	11
3.0 Literature Review	12
3.1 Disjunction between Sound and Source: Schizophrenia	12
3.2 Slow Motion Cinematography: A Brief History and Introduction	14
3.3 Absence of Slow Sound in Slow Motion Cinematography	19
3.4 Extreme Slow Sound Art	21
3.5 Sound and Image Synchronisation: Synchresis	23
3.6 Summary of Literature Review	24
4.0 Methodology	26
5.0 Research Design	28
5.1 Audiovisual Installation Art	28
5.2 Audiovisual Installation Setup	30
5.3 Events	31
5.4 Recording and Editing Process	33
6.0 Discussion and Findings	36
7.0 Summary of Findings	39
8.0 Conclusion	40
References	41

List of Figures

Figure 1: Audiovisual installation setup	30
Figure 2: Glass and visual culture objects	32
Figure 3: Plastic and visual culture objects	32
Figure 4: Wood and aural culture objects	32
Figure 5: Metal and aural culture objects	33
Figure 6: Falling glass and visual culture objects	36
Figure 7: Falling plastic and visual culture objects	36
Figure 8: Falling wood and aural culture objects	37
Figure 9: Falling metal and aural culture objects	37

Attestation of Authorship

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."



Jonathan Jackman Butterworth

13th November 2013

Acknowledgements

I would like to thank my primary supervisor, Peter Hoar for his continuous support and rigorous feedback as well as my secondary supervisor, Charles Walker for his additional support on this project. I would also like to thank David Biggins and Jimmy Burrow for their assistance during the filming procedure. Finally, I would like to thank Carlos Delamere for proofreading my final draft.

Ethical Approval

This research does not involve people, conflicts of interest, intellectual property or commercialisation interests. The data for this research arises from the processes of experimenting, analysing and documenting own practical work with no third-party involvement.

Abstract

This study investigates the aesthetic relationship between slow aural and visual media through an audiovisual installation artwork. The aim is to open up new perspectives on sound and image relationships by equally slowing these two modes down to create a *qualitative disjunction* between the sound and image. Many researchers have previously studied and explored the subject of sound and image interactivity. However, little of this work concerns how extremely slowed sounds interact with extremely slowed images. This is because many commercial based slow motion scenes in film are 'sweetened' or fitted with artificial sounds in post production editing to add emphasis or enhance the effect of the images. I propose a slow audiovisual installation art informed by relevant literature that attempts to experiment with the aesthetics of extremely slow images and their extremely slow natural sound sources to provide a slow art experience. In part, this is inspired by the notions of R. Murray Schafer's 'schizophonia' and audiovisual technology saturation that serves as a reflection of our fast-paced screen and media dominated lives. The findings of this study suggest that a qualitative disjunction can be achieved through the extreme slowing down of the sounds and images.

1.0 | Introduction

This research explores the relationship between sound and image when these two modes are equally slowed through an audiovisual installation. I am particularly interested in creating a *qualitative disjunction* between the sound and image where the original, natural sound is slowed down to a point beyond recognition as the counterpart of the visual. A *qualitative disjunction* means that the sounds and images are physically separated from each other as well as their real world sources and disassociated in the way that we observe, perceive and interpret these modes in the audiovisual structure. I derive the term from concept of R. Murray Schafer's 'schizophonia' which refers to the loss of context and removal of a sound from its natural source which will be explained in the following chapter.

Over the past century we have seen radical advances in technology that have changed the acoustics of our sonic and visual environment and have completely modified musical perception and the way we listen (Cox & Warner, 2004; Sterne, 2003). Highly industrialised and urbanised cultures now live in the age of speed, productivity and doing everything faster (Carr, 2010; Kern, 1983; Honoré, 2010). For many people, particularly in Western societies, most of the day is spent staring at a screen as technology provides faster computers and internet speeds combined with hand held devices and apps to draw human consciousness deeper into our media and screen dominated world (Honoré, 2010). People are able to record, edit and reproduce and store and transfer any video or sound freely for playback on any portable source at any given time. Developments and practices in technologies have given us the ability to force sounds far beyond the confinements of their natural origins (Schafer, 2004). It seems like everywhere you go visual and electroacoustic media are shaping our perceptive realities all the time in which the sounds of our sonic environment do not often reflect what is seen, a disjunctive world in which sounds have a loss of context with their sources (Schafer, 2004). This has led to many different views and conceptions concerning the 'soundscape' and the relationships between art and life.

The twenty-first century had seen a shift towards a more visual culture, forming our current screen and media dominated world with the spread of the internet and development of digital video technologies and filmmaking techniques (Gerard & Goldstein, 2005), in particular, slow motion cinematography which is nowadays widely used in a variety of media (Malkiewicz & Mullen, 2009). Slow motion cinematography fascinates us because it allows us to see the formerly invisible with faster eyes than our own. The technology provides the capturing of additional visual information for the better understanding of the physical world whether it is a natural phenomenon, such as the biomechanics of a bird in flight or is often used as an artistic effect in filmmaking to create suspense, highlight emotion or exaggerate a particular moment in time.

At present, 'natural' unedited slow sound is seldom explored. This is because the high speed cameras used to produce slow motion imagery do not also produce slow sound. As a commercial filmmaking standard, sounds are recorded as a separate process from the video camera and are usually enriched in the post production process (Chion, 1994, p. 96).

My research explores the new perspectives on sounds and images opened up by slowing down the original sound alongside the original image. Through recording moving events and then slowing down the resulting sounds and images proportionately, or, splitting the two modes from their sources and recontextualising them together through extreme slowness, I will investigate the perceptions of the relationship between the sound and image when these are slowed down.

My personal interests arise from wanting to challenge our perspectives on how sounds and images work together. I begin with the assumption that the sound will be slowed down to a point where it is no longer recognisable as the original sound of the filmed event. This would create a disjunction between the recorded images and sounds. This type of audiovisual structure may inspire new sound and image aesthetics and concepts in slow motion cinematography, slow art, filmmaking techniques and scientific developments concerning sound in high-speed camera technologies.

I propose a literature informed audiovisual installation that aims to explore the aesthetics and relationship between sound and image through extreme slowness. The installation utilises slowness to create an art space that confronts our high speed culture and the changes to our acoustic and visual environments brought about by technologies of mediation. The slow nature of installation encourages a broader sensory experience in its viewers which will communicate the notion of a sound and image disjunction through a creative slow art.

This thesis contains eight chapters. After this introduction, I position the research by addressing the need for and the significance of this study. What follows in chapter three is an exploration of the literature and theory relevant to the field of study including R. Murray Schafer's 'schizophonia', slow motion cinematography, slow sound, aesthetics of slow art, and finally, a review of Michel Chion's concept of 'synchresis' which serves as a contrast to a disjunctive audiovisual interactivity.

After focusing the research, chapter four discusses the methodologies that I have applied in this study with reasoning to justify these approaches. What follows in chapter five is a research design discussing the need for, and how I conduct this study through an audiovisual installation. Chapter six provides an in-depth discussion on the experience of the art and findings. Chapter seven will summarise my findings. Finally, chapter eight concludes the project by describing main concerns in relation to the research objectives, methods and findings.

2.0 | Significance of Research

The aim of my research is to explore the aesthetics of extreme slowness found in art, in particular, audiovisual media where there appears to be little exploration on natural slow sounds. This will be done through looking at the relationship between sound and image when they are slowed down to extreme rates in an audiovisual installation. The proposed installation presents itself not only as a slow art, but an aesthetic experiment to create a *qualitative disjunction* that draws from a range of concepts surrounding the development and spread of technology, acoustics of our sonic environment and slow art to provide an experience that acts as an evocative confrontation to our hectic modern day lives.

This project may benefit filmmakers and students, film theorists, visual effects artists who are exploring the complex relationship between slow images and equally slow sounds. With sound and imaging technology we can learn from seeing and hearing the world with better eyes and ears than our own. By recording, slowing down and recontextualising the sounds and images, we can experience natural events through a microscope which may reveal new perspectives on how sounds interact with images through extreme slowness. This study could arouse interest in the development of scientific technologies seeking to capture both sound and image events simultaneously at speeds exceeding one billion frames per second. The notion of disassociating sounds from images may inspire new theories and perceptions on how we experience the sounds and images in our own reality in contrast to the sounds and images of what we see and hear in mediated/screen events.

I will set out to challenge some of the unexamined areas regarding sound in slow motion cinematography to open up new perspectives on sound and image interactivity. I hope to inspire new aesthetic ideas and possibilities for audiovisual media as well as to provide new knowledge on the subject that may also inspire similar research. This would be this study's most significant quality.

3.0 | Literature Review

This chapter reviews relevant literature and ideas that inform my study. I begin with R. Murray Schafer's 'schizophonia', a term which describes the splitting of a natural sound from its natural sonic origin through its reproduced electroacoustic recording (Schafer, 1977, p. 90). The term is also used to describe the influence that electroacoustic media has on our sonic environment and provides the starting point for this study. What then follows is a brief discussion of slow motion cinematography/high-speed cameras, an overview of the slow motion process and the effects and aesthetics of slow images in film. Following is a discussion about the aesthetic roles and effects of sound in slow motion cinematography. This section also provides reasons as to why extreme slow sounds are rarely explored aesthetically against their physical world counterpart. Next is a discussion on the aesthetics of relevant slow sound art projects and a review of Michel Chion's 'synchresis', the weld between image and sound in the audiovisual structure that serves as a contrast to disjunction. Finally, a summary of the literature review relative to the research objectives. The aim of this literature review is to inform my ideas and establish a primary relevant knowledge of the field and fundamental concepts and theories surrounding my project. The literature review will also focus the area and direction of my investigation for this research.

3.1 | Disjunction between Sound and Source: Schizophonia

Over the past century, the acoustics of our sonic environment have been altered with developments in sound technologies that have transformed our sense of listening and perception of music (Cox & Warner, 2004). It was the early technology for acoustic capture and reproduction that had encouraged a pre-existing appeal with the idea of acoustic dislocations and respatialisation which allowed sound to be observed and analysed in new ways. The ability of storing and materialising sound fuelled the development of new sound technologies. Now, we can record, reproduce, store, and

materialise any type of digital sound/music on a variety of portable devices anywhere at any given time. We live in a world where we are surrounded by sounds that can exist as objects independent from their sources and any sonic environment is capable of replacing any other (Cox & Warner, 2004; Sterne, 2003).

Raymond Murray Schafer, a Canadian composer and sound theorist stresses the negative of electroacoustical reproduction. He is best known for his work in ecology where his concerns and views of the impact of technology on musical practices and sound environments led him to found *The World Soundscape Project* (WSP) at Canada's Simon Fraser University during the late 1960s (Truax, 2000). The project acted as a critique of the 'lo-fi' sounds saturating the urban environment by combining education and research with a modern study of acoustic ecology. This also included education about soundscapes and noise pollution as well as the recording and cataloguing of soundscapes.

A number of publications by Schafer emerged from this project including *The Book of Noise* (1968), *The New Soundscape*, and *The Tuning of the World* (1977). Schafer introduced the term 'schizophonia', derived from the word 'schizophrenia' and using the Greek prefix *schzio* which means 'split' where he refers to as the 'split between an original sound and its electroacoustical transmission or reproduction' (Schafer, 1977, p. 90). In modern times, the phenomenon of 'schizophonia' is something that happens everywhere all the time with digital technologies.

Schafer's notion is simple. Sounds were once all original sounds; they were linked more to their time and place. Sounds were not mass mediated and standardised experiences, each sound was individual and unique to their time, place and source. Before electroacoustic reproduction, the human voice could only travel as far as one could shout. We have the ability to split sounds from the maker of the sound. They are able to be extracted from their natural sonic sources and able to exist independently (Schafer, 1977, p. 90). He expresses his uncertainties with sound reproduction as it eliminates the sound's natural context and propagation through space where the sounds of one surrounding can simply become another.

I coined the term schizophonia in *The New Soundscape* intending it to be a nervous word. Related to schizophrenia, I wanted it to convey the same sense of aberration and drama. Indeed, the overkill of hi-fi gadgetry not only contributes generously to the lo-fi problem, but it creates a synthetic soundscape in which natural sounds are becoming increasingly unnatural while machine-made substitutes are providing the operative signals directing modern life. (Schafer, 1977, p. 91).

The negative connotations in 'schizo' are purposefully used to describe the loss of context in highly reproduced sonic environments. Schafer feels that the invention of technologies has transformed the sonic environment which we live in.

The notion of schizophonia is key to the concept of a qualitative disjunction form of relationship between sound and image through the extracting and processing of sounds beyond their original sources and removing its natural propagation through space. Additionally, sounds are not often contextualised with their sources where our sonic environment has developed to a point where what one hears is not often a clear reflection of what one sees (Schafer, 1977). I intend to use the idea of schizophonia to process the sounds much further beyond their recordings by slowing them down to the point of extreme in order to disassociate the sounds from the slow images.

3.2 | Slow Motion Cinematography: A Brief History and Introduction

The slow motion effect (frequently abbreviated as 'slow-mo') is a visual effect used in filmmaking to give the appearance that time within the film has slowed down. In modern times, slow motion cinematography features across a variety of popular media such as sports TV broadcasting, commercials, scientific documentaries, music videos and film each serving a range of purposes. There are many reasons why we enjoy viewing slow motion cinematography. The high speed capturing of visual information allows us to see what could not be seen with the naked eye where we are able to perceive the world in high detail (Garber, 2012; Zettl, 2008). This scientific use of slow

motion technology has 'given scientists an opportunity to observe processes that heretofore were beyond their perception' (Zettl, 2008, p. 267) and provides a number of benefits to the understanding of the physical world concerning sciences such as zoology, botany and natural phenomenon, such as droplets of water falling onto a surface or the precise muscle movements and contractions of a galloping horse. An example of this is the biomechanical studies on pitching a baseball in slow motion where there has been a reduction in the number of pitching injuries related to pitching technique and the large amounts of strain and exertion on accelerating the arm (Blewett, 2013). Slow motion is most commonly used in sports broadcasting to capture and replay key moments in a game where judges and referees are able to make more accurate decisions, typically regarded as an instant slow motion replay (Garber, 2012; Zettl, 2008).

The slow motion technique initially emerged from the desire to visualize and understand aspects of movement otherwise imperceptible to the naked eye in the late 19th century. This led to the technological advancements in moving images in which slow motion cinematography was invented in 1904 by Austrian physicist, priest and cineaste, August Musger. The technique was patented by Musger in the same year and was presented in Graz, Styria on July 7, 1907 for the first time using a projector made by cinema owner, K. Löffler (AEIOU Encyclopedia, 1981).

During this period, there was no commercial use for Musger's invention until later in 1916 when film theorist Hans Lehmann suggested the technique to gymnasts, technicians and scientists wanting to study movements occurring too rapidly for the unassisted eye. It was not long after this when filmmakers became quick to pick up on the potentials of the new technology. NAC Image Technology invented the first high speed camera (NAC HSV-200) in 1980 that used standard VHS recording tapes (Brennan, 2004; NAC Image Technology, 2007). A decade later, the first digital colour slow motion camera was invented and developed into a camcorder with the addition of a viewfinder, TV style zoom lens and shoulder pad (Brennan, 2004).

While at first, only well-budgeted studio productions could afford to use these techniques, many of them are now available to the general consumer used mainly for filmmaking purposes (Malkiewicz & Mullen, 2009). The film that eventually popularized the use of slow motion in commercial filmmaking was by Japanese director, Akira Kurosawa (*Seven Samurai*, 1954), and later saw use in American filmmaking with directors such as Sam Peckinpah (*Wild Bunch*, 1969), Martin Scorsese (*Raging Bull*, 1980) and widely recognised, *The Matrix*, 1999 by directors Andy and Lana Wachowski (Dewdney, 2008).

In film, slow motion cinematography gained its appeal from its aesthetic affects which can be used as an artistic effect, and heightening emotions to create romantic, dramatic, comedic, tense and suspenseful auras or to emphasise a particular moment in time. Slow motion can be used to intensify particular moments. For example, slow motion used moments before a runner reaches his goal can prolong the anticipation and exaggerate the overall scene. The technique is commonly associated with and applied to explosion effect shots and underwater footage present in commercial films. Slow motion can also be used to imply increased or high speed activity. If slow motion used in a fast paced cycling race it will not imply that the cyclist is moving slowly, rather, it accentuates the speed of the racer, although this is largely dependent on the context (Zettl, 2008). Slow motion can also be used to simulate the instance of total awareness that people experience in an event of crisis known as 'flight mode' in which the body reacts to danger by releasing adrenaline. During these moments everything appears to be moving slower and you are able to react in a split second before an accident (Eagleman, Fiesta & Stetson, 2007). Slow motion objects also appear weightless and are perceived to be free from gravity and move in ways that violate our expectations (Zettl, 2008).

In modern filmmaking, there are three main ways to achieve the slow motion effect, both of which include a video camera and a projector or television screen. These techniques are overcranking, time stretching and digital processing.

Overcranking

The original and most widely recognized method for achieving slow motion is 'overcranking' – the technique of filming a scene at a faster speed than normal so that when it is projected the action will appear to be slowed down (Ball, Carman, Gottshalk & Harrington, 2010; Jolliffe, & Jones, 2006; Zettl, 2008). Filmmakers often refer to overcranking as the technical term for slow motion as it was originally achieved through the concept of cranking a handcranked camera at a faster rate than the regular 24 frames per second (fps). When each individual film frame is captured at a much faster rate than the rate at which it will be played back, time will appear to be moving more slowly when the film frames are played at normal speed (Ball et al., 2010; Jolliffe, & Jones, 2006; Zettl, 2008).

Time Stretching

The second method to achieving a slow motion effect is through projecting a regular 24fps scene at a slower speed. As opposed to the overcranking method where the frames are captured at a faster rate during the filming procedure, the time stretching method displays the frames at a slower rate during the projecting procedure. This technique is more often applied to video subjected to instant replay, than to film (Jolliffe, & Jones, 2006).

Digital Processing

The third technique that is becoming increasingly common uses post production computer software such as Twixtor, a third party plugin developed by RE:Vision Effects which analyses each frame and produces extra digitally interpolated frames that are inserted in between these frames, creating a smooth transition between the frames that were physically captured by camera (Meyer, & Meyer, 2005; RE:Vision Effects, 2013).

This section has contributed to my research by providing a base understanding of the emergence of the slow motion technique and its processes. A combination of these techniques can also be applied to slow the motion further, interpolating between overcranked frames. However, a more conventional method for achieving extreme slow speeds sometimes referred to as 'true slow motion' is through high speed cinematography which requires much more expensive equipment and more complex techniques. This is commonly used for scientific purposes to capture fast movements in extreme detail (Jolliffe, & Jones, 2006, p.262).

3.3 | Absence of Slow Sound in Slow Motion Cinematography

Sound is an integral part of film and is essential to the message of the image where cinema is a place of images *plus* sounds (Chion, 1994). In modern times with our cell phone and handheld video cameras, sounds and images are generally recorded together simultaneously (Zettl, 2008). However, with advanced recording technology such as slow motion cinematography, the sounds are not a part of the recording process and I find that these slow natural sounds are not often explored. This can be observed in sports slow motion replays in that we never hear the slow sounds that are meant to go with the imagery. Take the example of a slow replay of a tennis player hitting a winning forehand and the crowd leaping to their feet with mouths open roaring with excitement. When presented on screen, we never hear their voices or any of the tennis racquet sounds in 'slow motion', or even at all for that matter. Instead, we hear real-time sounds, edited music layered over top of the visuals or commentators analysing the replay. This is because the high speed cameras do not also record high speed sounds.

In film, filmmakers shooting a slow motion scene in many cases will not be as concerned with the sounds. This is because commercial films are fitted with pre-recorded or artificial sounds in the post production process to enhance the visual. 'Sounds recorded during filming have always been enriched by later addition of sound effects, room tone, and other sounds' (Chion, 1994, p. 96). Particularly for high-budget studios, sound has become more of a separate process as 'sound sweetening' which

Zettl (2008) describes as 'stripping the sound off the video recording, improving its quality, and putting it back on again with the picture portion' (p. 297), however this process is not common in routine television production.

In Vincent LoBrutto's book *Sound-On-Film: Interviews With Creators of Film Sound* (1994), he interviews Gary Rydstrom, a sound designer most famous for his work on films such as *Jurassic Park* (1993), *The Hot Spot* (1990), *Backdraft* (1991) and most notably, *Terminator 2: Judgment Day* (1991). Rydstrom (1994) discusses that in many cases you may decide to mix a particular sound at its original speed with the same sound at a slower speed in order to add complexities to the sound as a unified whole. 'When you slow sound effects down to half or even slower than normal speed, it brings out a whole different quality in them. It's amazing what kind of sounds emerge when you start playing with simple things like tape speed' (Rydstrom, 1994, p. 237).

The effect of a lengthened out motion in slow motion cinematography can be enhanced through a careful application of particular slow sounds. An example of this is apparent during a decisive fight in Martin Scorsese's *Raging Bull* (1980). The weight and impact of each punch is exaggerated with the use of drawn out slow sounds which are also utilised to express a sense of urgency in the overall scene (Ribrant, 1999). In *The Long Riders* (1980) by Walter Hill, the slow motion shooting scenes at the end of the film also use slow sounds to great effect. As we see bullets slowly penetrate body parts of the gang members, the slow 'ricocheting sounds' and 'vibrating tones' of the bullets stresses the viewers sense of pain (Ribrant, 1999, p. 21).

Robin Beauchamp's *Designing Sound for Animation* (2005) also discusses that one method is to slow down the sound effects proportionate to the images. Beauchamp (2005) provides an example of this in the film *The Matrix* (1999) where the soundtrack presents slowed down chords fading in and out to accentuate the characters' slow motion 'leaps from building to building'. There are other methods and techniques for depicting slow motion such as utilising 'signal processing', adjusting the reverb with 'lower mix levels' as well adjusting the rhythms of the music and sound effects to portray visual accelerations and decelerations (Beauchamp, 2005, p. 19).

This knowledge contributes to my study by outlining the gap of knowledge in which natural slow sounds are seldom explored and gaining an understanding of how slow sounds have been implemented in cinema and television in the past.

3.4 | Extreme Slow Sound Art

This section of the Literature Review looks at three related extreme slow sound art projects and reviews the relevant ideas and concepts of these works which have informed my study. These are *9 Beet Stretch* (Leif Inge), *As Slow As Possible* (John Cage) and *Longplayer* (Jem Finer).

9 Beet Stretch is a 24 hour long soundscape created in 2004 by Scandinavian sound artist Leif Inge. The soundscape consists of a 24 hour digitally stretched recording of Beethoven's Ninth Symphony. The piece contains no sound distortions or shifts in pitch and can be viewed as a 24 hour long sound installation or is available to stream on the internet (Expanded Field, 2012). Several viewers who had experienced the '9 Beet Stretch' performance said that the stretching of sound without pitch distortion allowed the deep symphonic sounds to float across the massive and immersive soundscape and felt as if one were listening through a microscope. As the piece is played up to twenty-four times slower than usual, the slow ethereal sounds are pleasantly peaceful and harmonic, however the experience can also become slightly overwhelming and uncomfortable during lengthened moments of dissonance (Gann, 2004; Sisario, 2004). What is intriguing about the work is that certain events in the experience such as the entry of a violin player contain unexamined complexities that have not been explored through listening to sounds in this much detail (Gann, 2004).

According to Ben Sisario (2004) in a New York Times article he describes that the work is slow that changes in the sound are 'barely perceptible'. Simple features of the piece such as a drumroll are transformed into something of a 'nightmarish avalanche' lasting several minutes. While Beethoven's symphony has been exceedingly stretched into an aural texture, the original piece is still strangely recognisable in spirit (Gann, 2004; Sisario, 2004).

The relevance of 9 Beet Stretch to my work is that the experience of listening to extremely slow sounds can create a feeling of time suspension where our perception of time within the space is changed and may provide an escape from the busy modern working environments where we are overloaded with a flow of mental stimulation.

The second project is *As SLOW aS Possible (Organ²/ASLSP)* which is a 639 year long piece of music composed by John Cage and is the longest lasting musical performance yet and still ongoing. The performance began in 2001 at the former St. Burchard church in Halberstadt, Germany and will conclude in 2640. The piece was originally written in 1987 as an adaptation from the earlier version of the same piece (*ASLSP*, 1985) which only lasted between 29 and 70 minutes in duration. Cage did not initially specify the duration for this piece, though the length was eventually decided upon because the first church organ in Halberstadt happened to be built 639 years before the start date of the performance (Judkis, 2011). As the performance is so slow, the organ that it is currently being played on was only partially built before the performance had started. Pipes and a machine referred to as a 'blower' were added to the organ in 2008 to maintain a constant stream of air which keeps the music steady. People who come to visit the performance tend to turn up on the event of a chord change which are months in between. In 2008, more than a thousand visitors came to listen to the event of a chord change and the performance is available to listen to through internet live streaming - <http://www.aslsp.org/>

A similar work is *Longplayer* composed and developed by Jem Finer during 1995 and 1999 as a one thousand year long composition. The piece started playing at midnight on 31st December 1999 and will conclude on 31st December 2999, where it will have completed its first cycle and will begin again. The piece is composed using ancient standing bells referred to as 'Tibetan singing bowls' which are able to be played by humans or machines. The work is designed to endure and be adaptable to environmental and technological changes as a 'self-sustaining institution' (The Longplayer Trust, 2013). Up until present, the Longplayer performance is maintained mostly by computer technology although as described, the work was designed for survival with full awareness that over a one thousand year period this technology

would become inevitably outdated. As a result, the project was designed so that the sound is 'not in itself bound to the computer or any other technological form' (The Longplayer Trust, 2013). The conceptual background of the project simply deals with the representation of the expansiveness of time. While this could have been represented in the form of anything, the creator's ideas have taken shape as an extremely slow musical composition and, 'it can also be understood as a living, 1000-year-long process – an artificial life form programmed to seek its own survival strategies' (The Longplayer Trust, 2013).

The relevance of these works to this study is that the experiences of them can be viewed as commentaries and correctives to our hectic, high speed culture. The extreme slowness and constant presence of these slow sounds adds a meditative element to the experience which I will incorporate into my work. In these soundscapes, the idea of 'time efficiency' is considered foreign. Rainer Neugebauer, board chairman of the John Cage Organ Foundation for 'As Slow As Possible' says 'here you can feel something that we urgently need today – serenity' (Emami, 2011).

3.5 | Sound and Image Synchronisation: Sychresis

As a contrast to a disjunctive relationship between sound and image, sychresis is the relationship between something one hears and something one sees in the context of the audiovisual structure. Michel Chion is a French film theorist and experimental music composer who has written many publications on sound and image interactivity in the context of film. In the book *Audio-Vision: Sound on Screen*, Chion introduces the term 'sychresis', which is an acronym formed by combining the words 'synchronise' and 'synthesis' and is defined by Chion (1994, p. 63) as 'the spontaneous and irresistible weld produced between a particular auditory phenomenon and visual phenomenon when they occur at the same time.' This idea would be the opposite of a disjunctive relationship and is mainly concerned with sound effects in film in which the filmmaker may often edit in sounds to emphasise particular moments in the images. A classic example of this is the visuals of a street fighter performing a punch on an opponent played in exact synchronisation as the sound of a quick and forceful 'slap'.

This will read correctly as a powerful hit as opposed to a sound fault in the filmmaking process.

In this study where the goal is to orchestrate a qualitative disjunction through extreme slowness, the sounds and images will be so slow during playback they may not appear as a synchresis relationship as the sounds will no longer sound like the original natural sounds from the filmed event. Although the sounds and images will be played back in synchrony with respect to their real time occurrences, the extreme magnification of the event may also have the sounds appear asynchronous with the images as it takes time for sound to travel through space.

3.6 | Summary of Literature Review

Sounds were once all linked of origin to their time and place. Now, with our advances in sound technology, all sounds can be captured, stored, transformed and materialised through computers and speakers and are able to exist independently from their natural real-time sources. This is idea of 'schizophonia', a term nervously coined by R. Murray Schafer that refers to the splitting of a sound from its natural source, where any sonic environment can stand in for any other, taking away the sounds original context and natural propagation through space. The relation to schizophonia is that this study will slow down the already reproduced sounds and images from natural events hoping to separate the meanings of the sounds to a further extent from the images.

The slow motion technique initially emerged from the desire to visualize and understand aspects of movement otherwise imperceptible to the naked eye. Filmmakers were quick to utilise this new technology and began to explore with the effect, creating slow motion cinematography. However, the high speed cameras used to produce slow motion imagery do not record sounds. Slow motion scenes in commercial films are always fitted with artificial sounds in the post production process as sound sweetening, thus the natural slow sounds of a scene are seldom explored.

In related projects, slow sounds are explored as a Slow Art with a conceptual background dealing with the expansiveness of time and the confidence that civilisation will be alive long enough to see them concluded. The experience of these works includes a meditative element and can be viewed as a confrontation to our hectic high speed culture where we strain to be more and more productive and time efficient.

The objective of this research remains simple: I intend to show that by recording natural sound-image events (a schizophonic splitting of the sounds and images from their natural sources and contexts), slowing them down at extreme rates and juxtaposing them back together, the sounds may appear to be completely disassociated and further split apart from their contexts and meanings with the images, a disjunctive relationship between sound and image. The audiovisual installation serves to isolate my ideas more clearly to the viewers through theoretically representing this disjunction using the notions of 'schizophonia' and the extreme slow nature of the work in order to confront our hectic and fast paced technological culture as a creative art.

4.0 | Methodology

This chapter describes the methodologies adopted in this study and explains why these approaches are appropriate for the nature of my investigation.

The process of performing research is the inquiry or investigation of something in a systematic, informative manner and is usually divided among two types - *basic* and *applied*. While the goal of applied research is to improve the existing practices of a discipline, my research is basic in nature because it seeks to provide new knowledge in areas rarely explored. In her book - *Qualitative research: A guide to design and implementation*, Merriam (2009, p. 3) writes that '[b]asic research is motivated by intellectual interest in a phenomenon and has as its goal the extension of knowledge. Although basic research may eventually inform practice, its primary purpose is to know more about a phenomenon.'

The method of my study is qualitative as it looks at the perceptual relationship between the modes of sound and image. The qualitative method of research aims to gather an in-depth understanding of *meaning* in their work and generally investigates the *how* and *why* focused questions in the research design procedure (Denzin & Lincoln, 2005; Hesse-Biber & Leavy, 2010). This is where Hesse-Biber & Leavy (2010, p. 4) define 'meaning' as '[t]he social meaning people attribute to their experiences, circumstances, and situations, as well as the meanings people embed into texts and other objects, are the focus of qualitative research.' Practitioners of qualitative research are more involved with creativity and intellectual words and texts to generate meaning from their work as opposed to quantitative research methods which relies heavily on numbers, statistical measurements and data analysis (Hesse-Biber & Leavy, 2010; Stake, 2010).

Practice-led research is one of many qualitative methods. It is a process of refining ideas through cycles of practical experimentation and critical reflection (Scrivener,

2000). We can only understand the world first through experience, and only later may we be able to theoretically engage with its methods and concepts. People can engage in creative practice as research because they have additional insights resulting from the process of making things (Bolt, 2004). As a result, new knowledge and perspectives can emerge from creative practices, methods and tools. The search for a new method, or the demonstration of how research makes a contribution to new knowledge in a particular research discipline, is the essential goal of creative arts research (Bolt, 2004).

The methodological approach for this study is a qualitative practice-led enquiry to investigate slow audiovisual relationships. The reason for this method comes from the need to experiment and analyse how the slow sounds and images aesthetically interact with each other. For my investigation where the goal is to create a qualitative disjunction a qualitative practice-led research is a most appropriate method.

The following chapter describes the practice-led approach to this research with criteria where I explain the audiovisual installation process along with a description of the equipment, software packages and other resources required.

5.0 | Research Design

As slow sounds cannot be found in any commercial production, it was necessary and much more convenient for me to create my own work by producing slow sounds from recorded sound events. This also allowed me the freedom to experiment and focus on particular elements and aesthetic ideas drawing from 'schizophonia' and slow art that are presented in the work. The creative practice in this project consisted of recording and capturing images and sounds. These raw files were then slowed down using computer software. The resulting images and sounds were then exported to DVD and mp3 player playback devices for projection display. This chapter explains the need for an audiovisual installation and why it is the most appropriate method. This includes a detailed decision making process and criteria for creation of the audiovisual installation along with a description of the equipment and resources required.

5.1 | Audiovisual Installation Art

An installation is a contemporary form of art that is often site-specific and describes works that are designed to create or change our awareness and understanding of a space (Reiss, 2001; Rosenthal, 2003; Sturken, 2000; Suderburg, 2000). Installations can exist in a range of exterior spaces but is commonly referred to interior spaces such as art galleries, theatres and museums. Some of these works are performance art, sound art, soundscapes, visual music, sound sculpture, audiovisual and interactive installations that each serves their own purpose. An installation is not always a temporary exhibition, some remain as permanent works, however, both aim to utilise the surrounding space in order to encourage the viewers to engage with a more open sensory awareness relative to the concept(s) of the work (Reiss, 2001; Suderburg, 2000).

As the goal of this research is to separate the sound from image, I wanted to create a space that surrounds and engages the audience with the image and sound interactivity. For a study that deals with the perceptual 'schizophonic' split between source and reproduction the genre of installation most appropriate to providing this experience is audiovisual.

An audiovisual installation is a type of installation artwork that utilises video and audio technology and incorporates the surrounding space as a key element in the overall concept(s). With the spread and accessibility of aural and visual digital technologies, audiovisual installations have popularised since the early years of video art in the 1970s (Kaye, 2007, p. 20; Mondloch, 2010, p. 41). In modern times, audiovisual installations are displayed in range of urban and industrial environments and landscapes including galleries, theatres and museums which can include interactive performances and projections. Audiovisual installations tend to be site-specific but their diversity allows them to be easily adaptable to other spaces (Manasseh, 2009).

As the concept is the central motivation of my work, it can also be considered a 'conceptual art' where the heart and most valuable element of the work lies in the concepts and ideas that are employed and are more important than any resource limitations (Sol LeWitt, 1967, p. 79).

5.2 | Audiovisual Installation Setup

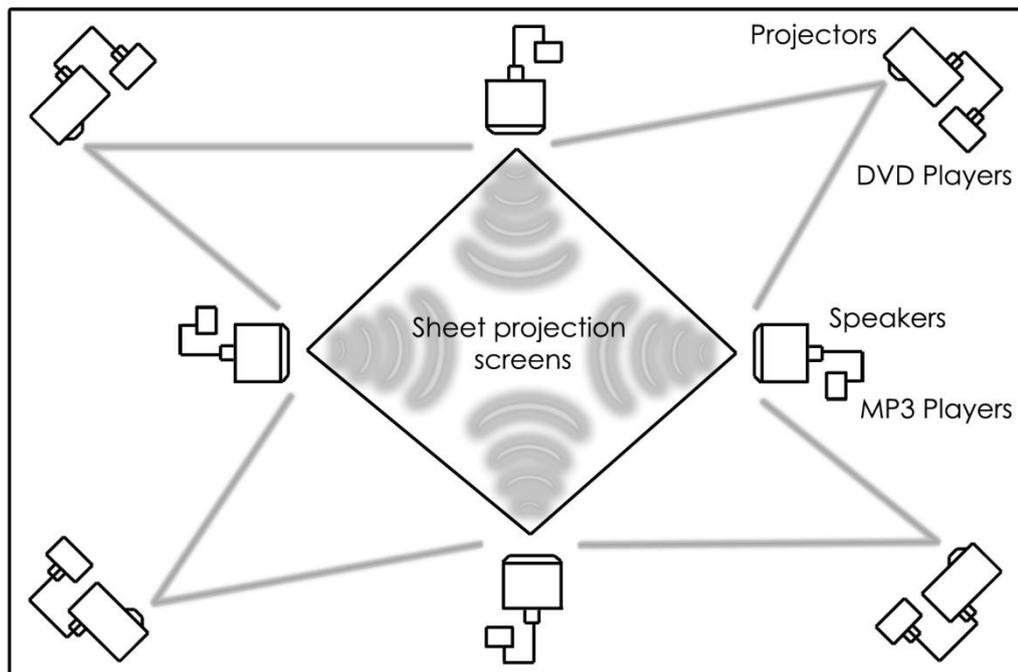


Figure 1: Audiovisual installation setup

The diagram illustrates that the set up includes four of each of the following: Standard video projectors, standard DVD players, DVDs (inside each DVD player), DVD RCA cables, mono speakers, standard MP3 players, 3.5mm male to 2 Red/White RCA audio cables, stretchable sheet screen fabric rigged together for a rear projection set up. The viewers will stand at the centre space of the installation inside the projection sheet screens.

I designed the setup to include physical elements that would add to the qualitative disjunctive experience and to help isolate and convey my ideas more clearly to the viewers. As each of the eight images/sounds materialize from their own individual speaker/projection sources; this establishes a literal and physical disjunction between the sounds and images, representing the 'schizophonic' split of a sound from its source. The diagram shows that the speakers are separated in local space and their sound propagations are directionally separated from centre of the images by placement in each of the corners of the screens to be evocative of 'schizophrenia' in a spatial perceptive sense. This is where the sounds and images are able to exist

independently from their natural sources of origin and can be materialised, transformed and modified at any time.

Once all equipment is powered and connected, all eight devices need to start their playback simultaneously. The most convenient way to do this in this particular set up is to gather all four mp3 players and all four DVD remotes in one place and simultaneously switch the four mp3 players on at the same time as pressing the 'play' button on each of the DVD remotes. As the nature of the work is extreme slowness, a perfect playback synchronization of all eight sounds and images is not necessary as it will be barely noticeable and not central to the ideas of the work. As the nature of viewing this work extends over several hours, I chose specific equipment that has loop play functions for each of the devices that allow me to set up extended plays of the installation if necessary.

The installation is designed to be set up anywhere with a power source although it is limited to areas that can provide that power source for all four corners of a room. Most of the devices in the installation require power sources, especially in the event of extended loop play.

5.3 | Events

For this project, I needed to record the sounds and images from natural real-world events as the first part of the schizophrenic splitting-from-source process. I chose to utilise technology and media related objects specifically for their evocative qualities that are associated with the cult of speed, productivity and time efficiency. The natural sounds will come from the objects falling and hitting a hard concrete surface which will be recorded. This will be explained in more detail in the following sub-chapter. The characteristics of the objects are intended to represent their own integration into our daily lives as technology, where they have saturated our visual and sonic environments. While still identifiable, all of the objects are broken into small pieces or destroyed which can signify that this installation space serves as an escape from the fast-paced culture. This is where we are constantly assaulted with flows of mental

stimulation with the internet, phone calls, emails, news feeds and other information (Carr, 2010; Hohlbaum, 2009; Honoré, 2010), as well as experiencing slow nature of the sounds and images themselves.

The primary purpose of the recording procedure is to only capture sounds and images from real-time events, however, to adapt to the squared nature of the four screens I divided the objects into four groups – two regarding image/vision, and the other two regarding sound/hearing. I tried to vary the sounds between the four groups as much as possible by adding various materials that produced similar sounds and were physically associated with each theme. As it is not necessary to achieve specific sounds, the following serves only to allow my project to have a variety of sounds as well as to aesthetically tie the objects to the work. I will briefly describe each object group in relation to their attachment to our lifestyles as necessary to understand their representation in this work as well as a description of the intended sounds from each of the four events.



Figure 2: Glass and visual culture objects

Screens, computer monitors, televisions, touch screen phones are evocative of the everyday technology that our eyes are fixated upon and which dominate many of our lifestyles as a visual culture (Gerard & Goldstein, 2005). For a large portion of the western world, most of a busy working day is spent glaring at screens which are also representative of media saturation particularly in the urban areas of our visual environment. This group of objects when falling on to a concrete surface will use the sounds of ‘glass smashing’ where the majority of the contents consists of broken screen glass from each of the TV, monitor and cellphone screens and has additional glass shards and debris added to allow the glass to produce ‘tinkling’ and ‘sparkling’

sounds in the background. The TV and monitor screens are the exceptions with their hard plastic casing which are the largest objects in this group and will create a loud crash followed by the cracking and breaking of their glass parts upon hitting the ground.



Figure 3: Plastic and visual culture objects

Cameras, video cameras, mouse and keyboards, CD drives, VHS and cassette tapes are evocative of the technology we use to capture, store, enhance and reproduce imagery and what we see of the natural physical world. These gadgets are representative of schizophrenic in a visual sense in that these are the modern devices that allow us to reproduce our visual world. When landing on the ground, this group of objects intends to produce a series of ‘plastic rattling’ sounds where many of the pieces are of lightweight plastic material. The heavier objects in this group such as the video camera, CD drives and VHS tapes will create deeper plastic ‘claps’ and while the plentiful amounts of keyboard keys, computer RAM microchips, floppy disks and other plastic debris will make lighter ‘chipping’ sounds.



Figure 4: Wood and aural culture objects

Stereo speakers, head/earphones, computer speakers and telephones are evocative of the physical objects we use and listen to and are constantly surrounded with in our

acoustic environment (Collins, Schedel & Wilson, 2013). These parts and gadgets are a symbol of the increasing amounts of lo-fi sounds that our ears are being polluted with just about anywhere you go, particularly in the urban landscape. This group of objects uses a 'wooden' sound where most of the content consists of medium density fibreboard wood from the speaker boxes, wood cut offs and cardboard paper. The sounds are intended to be thick 'knocks' and 'clops' from the fibreboard and 'knacks' from the smaller pieces. In this group, there are larger plastic pieces such as the telephone and computer speakers which may interfere with overall wooden based sounds but should be backgrounded with the ratio of wood content and careful placement of these particular objects during recording. Other parts such as the cables, paper, earphones and speaker fabrics are too light and will make no sound when landing on the ground.



Figure 5: Metal and aural culture objects

Contrasting to the visual culture objects that we use to reproduce what we see with our eyes, the objects in this group - voice recorders, mp3 players, radios, microphones, vinyl records, music CDs are evocative of the technology we use to record, store enhance and materialise the sounds we hear in our sonic environment. These objects also represent schizophonia where these are the modern devices that are at the forefront of the schizophonic process allowing us to reproduce our sonic environment. This group of objects produces 'metallic ringing' sounds with much of the content being solid dense metals and aluminium parts with the exception of a few plastic discs and cables. The intended sounds are 'dings' from the dense bolts and microphones as well as a series of 'chings' and 'rings' from parts like the CD drive and radio enclosures, metal frames and brackets. The sounds of the plastic CDs and vinyl records, tin scraps,

cords and antennas are lighter and will be largely backgrounded by the heavier objects when they hit the concrete.

5.4 | Recording and Editing Process

This section describes my criteria for creation and technical process for each of the four images and sounds.

Images

Capturing the images consisted of shooting and capturing raw video footage with a Phantom v642 high-speed digital camera. The camera was capable of various shooting speeds (fps) which was parallel to the output resolution of the raw file. At the moment of recording, assistants including myself poured and dropped the mediated objects on the ground which was repeated as necessary for each of the four groups. I decided on a plain blank background to eliminate any outside influences and to put more focus on the objects.

For the best quality for my installation setup, I decided to shoot at PAL standard definition (576i) at the speed of 11,200fps. The files were rendered out from the camera at an HD pixel resolution of 1920x1080 which produced files varying from approximately 30-45 minutes in duration. For playback on the DVD players, I rendered and exported the videos through Adobe Media Encoder CS5 at full quality at 720x576 pixel resolution to the Quicktime (.mov) format. Finally, I burned the each of the four video files to separate DVDs for compatible playback on the DVD players for projection.

Sounds

To record the sounds I used an Audio Zoom H4n handheld audio recorder that was hand operated to record for the same real-time duration to that of the Phantom v642 camera. For the best recording quality, I used a windscreen filter to prevent any

outdoor wind noise and positioned the recorder at an approximate 1.5 metre distance from where the mediated objects were landing with an appropriate recording volume after pre-testing.

To slow the sound down, I used third party software application Paul's Extreme Sound Stretch developed by Paul Nasca (Nasca Octavian PAUL, 2011). This software allows me to slow down most audio file types to the desired duration by stretching them out to extreme lengths, even several days in duration. This program analyses the sounds frequencies and splits the sound up into smaller pieces (usually around 100 milliseconds) called 'windows' and transforms each window into a texture via spectral smoothing. The process is repeated for each window of the audio file (NPR Music, 2010). The program offers three modes – 'Stretch' which allows for audio/sound file stretching of up to 10,000 times. The 'HyperStretch' which can stretch up to 1,000,000,000,000,000 times (10^{18}) and the 'Shorten' mode which compresses the length of a sound (Nasca Octavian PAUL, 2011). My only criteria for creation regarding the sound are that the sounds are to be slowed down by the same rate as the visuals were slowed down and that the sounds and images must match and synchronise in their new slowed down timelines.

The sounds recorded with the Audio Zoom H4n produced Wave Sound (.wave) files approximately 10 seconds in duration at 1536kbps quality. After importing, I used Paul's Extreme Sound Stretch to slow the speed of the sounds down to exactly match the duration of the corresponding images. After this process, the software renders and exports the stretched sounds to produce 30-45 minute long files in the .wave format. Finally, I used Adobe Media Encoder CS5 to convert each of the four .wave files at full quality to the .mp3 format for compatible playback on the mp3 players and speakers.

6.0 | Discussion and Findings

This research set out to create a qualitative disjunction between sound and image by slowing these two modes down through an audiovisual installation. This installation invites viewers to exit a fast-paced culture where we are constantly assaulted by a flow of mental stimulation in many of our working environments; to experience an extreme slow dislocation of natural recorded sounds from their natural recorded visual events. The slowness and extended duration adds a meditative element to the work to create a feeling of time suspension in an experience that encourages the viewers to engage with the ideas represented.

This chapter describes the relationships between the images and sounds and what happens as the installation is played out. Following, is a discussion of findings of the work regarding a qualitative disjunction.



Figure 6: Falling glass and visual culture objects

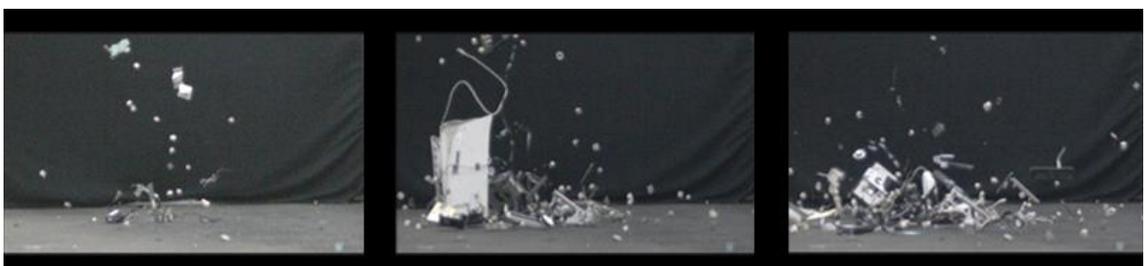


Figure 7: Falling plastic and visual culture objects

Each of the screens presents visual and aural cultural technology debris falling onto the ground in extreme slow motion. From the speakers which are positioned in the corners of the screens, we can hear the aural counterparts of each of the four images which are played in synchrony. The duration of each of the four sound/image pieces is varied from approximately 30-45 minutes in length and is set to a loop function so that the pieces will slowly overlap each other over an extended viewing of the installation.

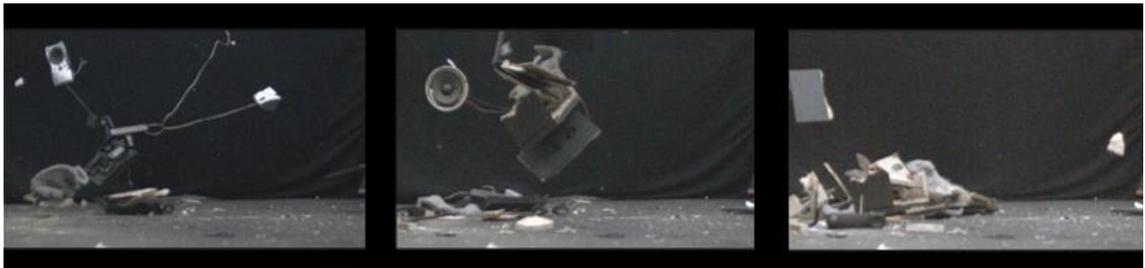


Figure 8: Falling wood and aural culture objects

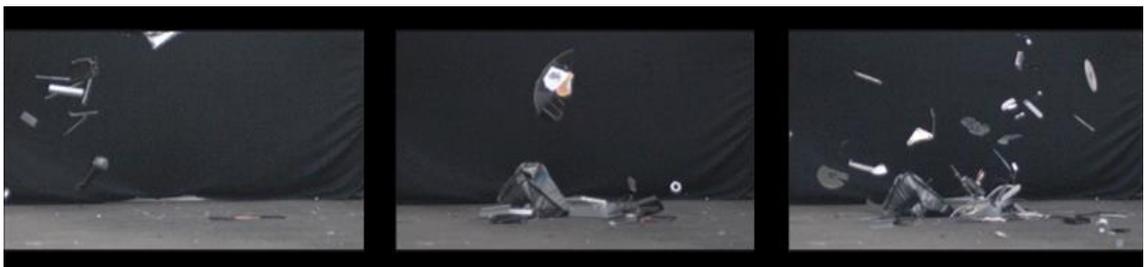


Figure 9: Falling metal and aural culture objects

There are many interpretations and concepts to be perceived through experiencing the installation. In each of the pieces, we can observe the objects falling in extreme slow motion and as they make contact with the ground we only begin to hear the gradual entrance of the slow sounds that have been transformed into aural textures consisting of subtle ringing echoes that slowly climb up to unsettling nightmarish drones that proceed to last several minutes as they gradually fade out again.

The extreme slow drones and echoes from each object are present long after they have hit the ground and have been stretched and drawn out to the point where it is difficult to tell which slow sound corresponds with its image. In the event of extended viewing, this is more evident where the sound/image pieces overlap each other as the

sounds have become similar in perception as a result of being slowed down. It is here where we can observe that the interaction and relationship between the sounds and images presented are disassociated from each other in the sense that the slow sounds no longer sound like they are related to the imagery and are interpreted and perceived to be thematically unrelated to the images.

Findings

The message and intention of the work draws on the relationships between art and life to bring awareness to the fast world around us and how speed and the growth of technology influences our way of living as a visual culture and the acoustics of our sonic environment. This installation attempts to blur the lines between 'art' and 'life' and places the viewer in a space to experience the world at extreme slow speeds. The intention here is to create a heightened sensory awareness in the viewer as a tool to express the schizophrenic reproduction of reality through the use of slow technologies in order to experience a dislocation of sounds from their images.

In this space, we can observe that the sounds are disassociated from the images where the sounds have been stretched out to a point beyond interaction with the images and are literally separated in space. Through the notion of schizophonia, the act of recording the sounds and images has also removed these modes from their natural occurrences and propagations through space and time. The additional amplification of these mediated existences by slowing the sounds and images down has transformed the sounds into aural textures that are completely unrelated to the images. The sounds have now lost their meanings in context with the images, and this implies that the sounds are further separated from their original natural source versions. The sounds and images presented in the installation create a relationship of qualitative disjunction.

7.0 | Summary of Findings

The findings of this study suggest that the sound and image can achieve a relationship of qualitative disjunction when these two modes are slowed down to the point of extreme. The sounds and images are observed, perceived and interpreted to be physically dislocated in existence, directional propagation through space and aesthetically separated from their real-time origins in the audiovisual structure.

8.0 | Conclusion

The goal of this research was to orchestrate a qualitative disjunctive form of relationship between the modes of sound and image where the sounds are disassociated and physically separated from the images in the way that we observe, perceive and interpret these two modes in the audiovisual structure.

In order to investigate these aims of the study, I adopted a practice-based research approach using the format of an audiovisual installation which allowed me to incorporate theoretical and physical concepts regarding R. Murray Schafer's 'schizophonia' which the research was driven by.

Through the experience and the discussion of the aural and visual interactivity presented in the installation, my findings show that a audiovisual relationship of qualitative disjunction can be achieved when these two modes are slowed down to the point of extreme.

The whole process of bringing together the installation for this research has been a journey. From the beginning there has been a large element of risk taking and trust in a technological possibility, and in the idea for a piece that confronts an audience with some of those fundamental conflicts mediation and technology is creating for us. I propose that a qualitative disjunction is just one way to achieve a relationship where the sounds and images are disassociated. Throughout my study, I have found that sound and image interactivity is much more complex than what is thought and that more specific sounds may very well work better than others which is largely dependent on the context. To further explore this topic, it would be interesting to investigate exactly what point the sound 'breaks free' from the confines of synchresis, or to incorporate a 3D approach to the project through the exploration of 3D holophonic sounds that may inspire new aesthetic ideas for audiovisual media.

References

AEIOU Encyclopedia. (1981). *Musger, August*. Retrieved 11 June, 2012, from http://www.aeiou.at/aeiou.encyclop.m/m966878.htm;internal&action=_setlanguage.action?LANGUAGE=en

Altman, R. (1992). *Sound Theory, Sound Practice*. London, Britain: Routledge.

Altman, R. (2007). *Silent Film Sound*. Columbia University Press.

ASLSP. (1985). *Organ²/ASLSP*. Retrieved 15 April, 2013, from <http://www.aslsp.org/de/home.html>

Ball, J., Carman, R., Gottshalk, M., & Harrington, R. (2010). *From Still to Motion: A Photographer's Guide to Creating Video with Your DSLR*. IN: New Riders Publishing.

Beal, A. C. (2006). *New Music, New Allies: American Experimental Music in West Germany from the Zero Hour to Reunification*. University of California.

Beauchamp, R. (2005). *Designing Sound for Animation*. Burlington, MA: Elsevier/Focal Press.

Belton, J. & Weis, E. (1985). *Film Sound: Theory and Practice*. Columbia University Press.

Blewett, W. (2013). *The Science of the Fastball*. McFarland.

Bolt, B. (2004). *Art Beyond Representation: The Performative Power of the Image*. London: I.B. Tauris.

Bolt, B. (2007). The Magic is in Handling. In: E. Barrett & B. Bolt (Eds.). *Practice as Research: Approaches to Creative Arts Enquiry*. (pp. 27-34). London: I.B. Tauris.

Brennan, M. (2004). *Digital Slow Motion The Beginning*. Retrieved 13 June, 2012, from <http://hd24.com/page8/page38/page38.html>

Buhler, J., Deemer, R. & Neumeyer, D. (2009). *Hearing the Movies: Music and Sound in Film History*. Oxford University Press.

Cancellaro, J. (2005). *Exploring Sound Design for Interactive Media*. Delmar Cengage Learning.

Carr, N. G. (2010). *The Shallows: What the Internet is Doing to Our Brains*. W.W. Norton.

Chion, M. (1994). *Audio-Vision: Sound on Screen*. West Sussex, England: Columbia University Press.

Chion, M. (2009). *Film, a Sound Art*. West Sussex, England: Columbia University Press.

Collins, N., Schedel, M. & Wilson, S. (2013). *Electronic Music: Cambridge Introductions to Music*. Cambridge University Press.

Coulter-Smith, G. (2006). *Deconstructing Installation Art*. Casiad Publishing.

Cox, C. & Warner, D. (2004). *Audio Culture: Readings in Modern Music*. New York: The Continuum International Publishing Group Inc.

Denzin, N. K. & Lincoln, Y. S. (Eds.). (2005). *The Sage Handbook of Qualitative Research*. (3rd ed.). Thousand Oaks, CA: Sage.

Dewdney, C. (2008). *Soul of the World: Unlocking the Secrets of Time*. HarperCollins.

Eagleman, D. M., Fiesta, M. P. & Stetson, C. (2007). *Does time really slow down during a frightening event?* PLoS ONE, 2(12), e1295. doi:10.1371/journal.pone.0001295

Expanded Field. (2012). *9 Beet Stretch Leif Inge*. Retrieved 16 March, 2013, from <http://www.expandedfield.net/>

Gann, K. (2004). *Norwegian minimalist raises Beethoven molto adagio bar*. Retrieved 14 March, 2013, from <http://www.villagevoice.com/2004-02-10/music/norwegian-minimalist-raises-beethoven-molto-adagio-bar/>

Garber, M. (2012). *Loaded Words*. NY: Fordham University Press.

Gerard, A. & Goldstein, B. (2005). *Going Visual: Using Images to Enhance Productivity, Decision-Making and Profits*. John Wiley & Sons.

Hesse-Biber, S. N. & Leavy, P. (2010). *The Practice of Qualitative Research* (2nd ed.). Thousand Oaks, CA: Sage.

Hohlbaum, C. L. (2009). *The Power of Slow: 101 Ways to Save Time in Our 24/7 World*. Macmillan.

Honoré, C. (2010). *In Praise of Slow: How a Worldwide Movement is Challenging the Cult of Speed*. London: Orion.

Emami, G. (2011). *'As Slow As Possible': World's Longest Running Concert At St. Burchard Church Turns 10*. Retrieved 23 March, 2013, from http://www.huffingtonpost.com/2011/11/21/as-slow-as-possible-concert_n_1104863.html

Jolliffe, G., & Jones, C. (2006). *Guerilla Guides: The Guerilla Film Makers Handbook*. London: Continuum International Publishing Group.

Judkis, M. (2011). *World's longest concert will last 639 years*. Retrieved 23 March, 2013, from http://www.washingtonpost.com/blogs/arts-post/post/worlds-longest-concert-will-last-639-years/2011/11/21/gIQAWrdXiN_blog.html

Kahn, D. & Whitehead, G. (1994). *Wireless Imagination: Sound, Radio, and the Avant-garden*. MIT Press.

Kahn, D. (1999). *Noise Water Meat*. MIT Press.

Kaprow, A. (2003). "Notes on the Creation of a Total Art." In: J. Kelley (Ed.). *Essays on the Blurring of Art and Life*. Berkeley: University of California Press.

Kaye, N. (2007). *Multi-media: Video Installation Performance*. London, Britain: Routledge.

Kern, S. (1983). *The Culture of Time and Space 1889-1918*. Cambridge, MA: Harvard University Press.

Kwon, M. (2004). *One Place After Another: Site-Specific Art and Locational Identity*. Cambridge and London: The MIT Press.

LeWitt, S. (1967). "Paragraphs on Conceptual Art", *Artforum*, 5, no. 10 p. 79-83.

LeWitt, S. (1969). "Sentences on Conceptual Art", *Art-Language*, 1, p. 10-12.

Licht, A. (2007). *Sound Art: Beyond Music, Beyond Categories*. NY: Rizzoli International Publications.

Malkiewicz, J. K. & Mullen, M. D. (2009). *Cinematography: Third Edition*. NY: Simon and Schuster.

Manasseh, C. (2009). *The Problematic of Video Art in the Museum, 1968-1990*. Cambria Press.

Merriam, S. B. (2009). *Qualitative Research: A Guide to Design and Implementation*. San Francisco, CA: Jossey-Bass.

Meyer, C. & Meyer, T. (2005). *Creating Motion Graphics with After Effects: Advanced Techniques*. MA: Focal Press.

Mondloch, K. (2010). *Screens: Viewing Media Installation Art*. Minneapolis: University of Minnesota Press.

NAC Image Technology. (2007). *Major Project Participation*. Retrieved 2 May, 2013, from <http://www.nacinc.com/about/major-project-participation/>

Nasca Octavian PAUL. (2011). *Paul's Extreme Sound Stretch*. Retrieved 31 October, 2012, from <http://hypermammut.sourceforge.net/paulstretch/>

NPR Music. (2010). *How It Works: The Art Of Time-Stretching Bieber*. Retrieved 9 November, 2012, from <http://www.npr.org/blogs/therecord/2010/08/18/129283985/the-art-of-a-time-stretch>

RE:Vision Effects. (2013). *Products: Twixtor*. Retrieved 14 November, 2012, from <http://www.revisionfx.com/products/twixtor/>

Reiss, J. H. (2001). *From Margin to Center: The Spaces of Installation Art*. Cambridge, MA: MIT Press.

Ribrant, G. (1999). *Style parameters in film sound*. Sweden: Stockholms University Press.

- Rosenthal, M. (2003). *Understanding Installation Art: From Duchamp to Holzer*. Munich: Prestel Verlag.
- Rydstrom, G. (1994). "Gary Rydstrom." In: V. LoBrutto (Ed.). *Sound-On-Film: Interviews With Creators of Film Sound*. (pp. 227-247). Greenwood Publishing Group.
- Schafer, R. M. (1969). *The New Soundscape: A handbook for the modern music teacher*. BMI Canada.
- Schafer, R. M. (1977). *The Tuning of the World*. New York: Alfred A. Knopf.
- Schafer, R. M. (2004). The Music of the Environment. In: C. Cox, & D. Warner (Eds.). *Audio Culture: Readings in Modern Music*. (pp. 29-39). New York: The Continuum International Publishing Group Inc.
- Scrivener, S. (2000). Towards an Operationalisation of Design Research as Reflection in and on Action and Practice. In: D. Durling, & K. Friedman (Eds.), *Doctoral Education in Design – Foundations for the Future*. Proceedings of the La Clusaz Conference. (pp. 387-394). Staffordshire: University of Staffordshire Press.
- Sexton, J. (2007). *Music, Sound and Multimedia: From the Live to the Virtual*. Edinburgh, Scotland: Edinburgh University Press.
- Sisario, B. (2004). *MUSIC: HIGH NOTES; Beethoven's Ninth Around the Clock*. Retrieved 16 March, 2013, from <http://www.nytimes.com/2004/04/11/arts/music/11HIGH.html>
- Sonnenschei, D. (2002). *Sound Design: The Expressive Power of Music, Voice and Sound Effects in Cinema*. Michael Wiese Productions.
- Stake, R. E. (2010). *Qualitative research: Studying how things work*. New York, NY: Guilford Press.

Sterne, J. (2003). *The Audible Past: Cultural Origins of Sound Reproduction*. Durham, NC: Duke University Press.

Sturken, M. (2000). The Space of Electronic Time: The Memory Machines of Jim Campbell. In: E. Suderburg (Ed.). *Space, Site, Intervention: Situating Installation Art*. (pp. 287-297). Minneapolis London: University of Minnesota Press.

Suderburg, E. (2000). Introduction: On Installation and Site Specificity. In: E. Suderburg (Ed.). *Space, Site, Intervention: Situating Installation Art*. (pp. 1-23). Minneapolis London: University of Minnesota Press.

The Longplayer Trust. (2013). *Longplayer - An Overview*. Retrieved 16 March, 2013, from <http://longplayer.org/what/overview.php>

Truax, B. (2000). *Sound Escape - Soundscape Composition as Global Music*. Retrieved 23 March, 2013, from <http://www.sfu.ca/~truax/soundscape.html>

Truax, B. (1984). *Acoustic Communication*. (2nd ed.). Norwood, NJ: Ablex Publishing.

Truax, B. (1996). Soundscape, acoustic communication and environmental sound composition. *Contemporary Music Review*, 15(1), 49-65.

Zettl, H. (2008). *Sight Sound Motion: Applied Media Aesthetics*. (5th ed.). Wadsworth Cengage Learning.