RELATIVITY:
SYNCHRESIS IN ART AND APPLIED SCIENCE

A Critical Engagement Paper
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Garry Wasyliw, candidate for the degree of Master of Fine Arts in Interdisciplinary Studies, has presented a thesis titled, *Relativity: Synchresis in Art and Applied Science*, in an oral examination held on November 8, 2017. The following committee members have found the thesis acceptable in form and content, and that the candidate demonstrated satisfactory knowledge of the subject material.

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*via SKYPE*
Abstract

This critical engagement paper outlines the technical details and theoretical support for my Masters of Fine Arts final project titled *Relativity*. This project explores philosophies of perception through associations between art and science within an interdisciplinary study of sound art and expanded cinema. These theories are developed through an interpretation of quantized, binary systems in their relationship to natural, continuous forms. The study of relativity is seen a method to reconcile binary positions in thinking, to cross boundaries between art and science, and to serve as a metaphor for hidden knowledges and a movement from polarities to spectrum states of knowing.

My project is an installation of an indeterminate system of a double-sided screen with video projections; situated between two wood, sound resonating panels. The visual imagery and sound will evolve in time, between that of clear depiction, and that of abstracted forms through digital effects processing.

In preparation for this project, I have employed methods of experimental art, as well as a focus on practice based research. I have been influenced by the writings of art and science theorists, as well as by studies of contemporary art works and theories. The philosophies of scientific research, as well as my own experience in the applied sciences, provides the background for the comparisons with science based methodologies.

This project has been informed by postmodern philosophies influencing personal interpretations of perception as developed in contemporary art theory. These theories are supported by the basis of the theory of relativity: that observation is interpreted relative to the context of the viewer.
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CHAPTER ONE: Introduction

This Masters of Fine Arts project examines the concept of relativity as a basis from which to make connections between scientific and artistic understandings of observation and argues that examination of the territory between the continuous and quantum can be fruitful territory for innovation in thinking about art and culture. I have been working within a creative technologies framework, focusing on Sound Art and Expanded Cinema in the Interdisciplinary Studies Program, in the Faculty of Media-Art-Performance. The supervisors for my program are Dr. Rebecca Caines (Interdisciplinary Studies) and Dr. Christine Ramsay (Film). My practice-based research in creative technologies has been supported by my prior studies in the natural sciences, acquired through an undergraduate degree, and subsequent career, in structural engineering. My arts background has been formed through personal and professional development, as well as a portfolio of works, in music and sound art related activities, which will be further discussed later in this paper.

My MFA final project, *Relativity*, is a metaphysical inquiry into the evolution of human perception of the world, as it is seen in contemporary culture though the methodologies of art and applied science. Metaphysics is most simply defined as “a study of what is outside objective experience”.¹ Historically, observations in science disrupt former truths, and lead to practical applications in the development of new technologies. I argue, that when these developments evolve from the metaphysical, to a practical application, supported by common adoption and economic democracy, they can be the basis for a technological shift *and* a new paradigm in culture. A paradigm is

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defined as “a philosophical and theoretical framework of a scientific school or discipline within which theories, laws, and generalizations and the experiments performed in support of them are formulated”. My research has been in exploring examples of questions from metaphysical theory, to scientific exploration, that result in this type of a paradigm shift. In contemporary times, these developments result in technologies that have impacts on all cultural groupings. This idea is supported by Murphie and Potts as they state in *Culture and Technology* (2003), “it is difficult to conceive of any contemporary pursuit untouched by developments in technology”. I find comparisons between these scientific theories and the theories of art methodologies, and believe that these concepts may have the ability to cross-inform one another.

For my main project, I have researched examples of paradigm shift that have emerged from the interface of quantum and continuous states found within the natural world. My research has not endeavored to engage with the more esoteric explorations of theoretical physics, but rather to consider the implications of the proven, repeatable principles as demonstrated in applied science. Quantum scientific theories define nature as being comprised of the interaction between discrete particles and can be observed in the building blocks of matter that arrange themselves in complex ways to shape the processes of the observable world. This can be seen in the formation of planetary bodies, in the ways atoms act as the building blocks of matter, and in digital technologies. Continuous state theories define nature as originating with energy waveforms which can

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3 Andrew Murphie and John Potts, *Culture & Technology* (Houndmills: Palgrave MacMillan, 2003), 1.
be observed in examples such as the color spectrum, the motion of physical bodies, and sound waves. Interestingly, the nature of light is still not fully understood by science and exhibits qualities of both particle (quantum) behavior, as well as that of waves (the continuous). This interface provides one common example of a requirement for further inquiry and suggests that our contemporary scientific paradigm still needs further refinement and will, in itself, be disrupted in the formation of a further level of understanding in order to explain this paradox of the natural world. I will be focusing on practices using sound and image technologies that can be explored by working at the interface of quantum and continuous phenomena that, under observation, shift interpretations of the work. I will also explore ways in which the development of these technologies has shifted paradigms as they progress from models of the continuous to quantum phenomena of the natural world. This is considered in the progression from analog to digital forms of reproduction in audio as well as image processes.

One example of a shift in paradigm can be seen in the history of the research for binary based systems. These systems exemplify significant advancements in knowledge that have altered human perception of the natural world. The simple quantum system of two discrete states, developed to model observations of the continuous, has resulted in some of the most complex contemporary technologies, based in digital systems of computing and seen in the emerging field of virtual reality computing. In visualizing technologies developing into their present forms, Michael Heim stated in *Virtual Realism* (1998) that “Contemporary culture increasingly depends on information systems, so that we find virtual reality in the weak sense popping up everywhere, while virtual reality in the strong sense stands behind the scenes as a paradigm or special model for many
things”. My research has considered this co-existence of the quantum and the continuous as a place to study how the interpretations of observation inform scientific development as manifested in technologies. I then use this as a basis to make philosophical comparisons to the theories of observation that have been explored in the arts through postmodern methods in a search for connections between the progress of these fields.

I have engaged in this research through an interdisciplinary approach to sound art and expanded cinema. I view both of these art disciplines as an expansion from the theories of their traditional forms of music and cinema. Art forms generally evolve their methods in respect of historical lineage and, in this regard, post-modern theories provide one alternative to develop theories with the objective of expanding thinking on art forms and their mediums. For myself, the study of these theories has provided ways to question assumptions as to what is being observed, what can be seen as reality, and the relationship between the artist and the observer of the work.

“Sound Art” is most easily defined as an artistic discipline in which sound is used as the medium. While this can include the traditional arts of music, it also encompasses all experimental arts involving sound. In “Sound Art: Origins, Development and Ambiguities” (2009), Alan Licht states that “Sound art holds the distinction of being an art movement that is not tied to a specific time period, geographic location or group of artists”. Licht traces the development of the composers, film makers, and installation artists that led to wider recognition of the art form. He references examples of important

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earlier works such as Luigi Russolo’s *The Art of Noises* Manifesto and sound works (1913), Pierre Schaeffer’s *Musique Concrète* tape processing (1940’ – 1950’s), and Karlheinz Stockhausen’s *Gesang der Jünglinge* (1956) work for tape and specialization but identifies the specific term “Sound Art” as originating with an exhibition produced by William Hellermann in 1983. He then goes on to detail connections to popular artists of that time; such as Brian Eno, Christian Marclay, and Laurie Anderson; who became influenced by this art as it developed.

My interest in this art began through discourse analysis of the writings and recordings of these later artists which, in turn led back to a study of the origins described in Licht’s writing. Today, examples in the field of sound art include performance art, experimental music, noise music, field recording, soundwalks, soundscape compositions, sonic ecology, data sonification, and gallery installation. These works may be purely sound based or they may be one of the elements in intermedia works.

Similarly, “Expanded Cinema” can be considered as an artistic discipline in which animated light is used as the medium. This commonly involves the use of the tools of narrative based cinema, but in alternative forms of content and display. While artists have been noted to have worked with these ideas from the early origins of film technology, cinema has been far more recognized for its development of the techniques of narrative based, single channel presentations. Gene Youngblood originated the term “expanded cinema” in his 1970 book by that name. Youngblood outlines a philosophy

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6 Ibid., 4,7.
7 Ibid., 3.
8 Ibid., 3-4.
in which the traditional cinema techniques are viewed as only one possibility in moving image art. He comments that “Expanded cinema isn't a movie at all: like life it's a process of becoming, man's ongoing historical drive to manifest his consciousness outside of his mind, in front of his eyes”.\textsuperscript{11} He then continues to outline several options for alternate explorations, presenting several examples of artists from that era. Much of this thesis is based in the democratization of image production that was being introduced through the -then newly developing - technologies of analog video tape and computers. While the technologies he describes are very archaic by today’s standards, the philosophies of this work continue to inspire new interpretations and research through the art and technologies of today. Youngblood’s theories were based in the advancement of technology and established a basis for artists in the United States; however, Annabel Nicolson developed similar artistic theories in England, exploring the nature of the view of the moving image through a critique of British experimental cinema. Her 1978 essay, “Artist as Filmmaker: A Perspective on Avant-Garde Film”, is an important document developing the theories for artists using the tools of traditional cinema in new forms of artistic exploration.\textsuperscript{12} Contemporary, expanded cinema encompasses many forms of the moving image including light sculpture, film manipulation, live performance, and gallery installations.

I am most interested in how the techniques of sound and animated light have had a recognized association through their traditional forms of music and cinema, and continue to demonstrate a synergy within their combined, expanded forms. The French

\textsuperscript{11} Ibid., 44.
\textsuperscript{12} Annabel Nicolson, \textit{Artist as Film-Maker: A Perspective on English Avant-Garde Film} (London: Hayward Gallery, 1978), Exhibition Catalog.
avant-garde composer, Michel Chion defined the theory of “synchresis” as “The spontaneous and irresistible mental fusion, completely free of any logic, that happens between a sound and a visual when these occur at exactly the same time”. I am interested in works of sound art and expanded cinema that explore a relationship between sound and visuals in an equal emphasis. For the purposes of my research, I have explored methods, through an interdisciplinary approach, that develop corresponding theories within each medium. I wish to produce works that engage audience response with personal associations to the work. I have been inspired by many of the works of the earlier theorists cited above as well as by examples of a return to these ideas by contemporary artists.

This thesis explores my interest in finding connections between theories of art and science. I have used the concept of relativity to examine interpretations of observations as it applies to the formation of scientific paradigms, relative to the observation of the scientific researcher, as well as some of the principles of art theory as they relate to the relative cultural base of observation by the viewer. I have used an examination of phenomena between the continuous and quantum as a basis to model my arguments.

In my studies, I have also made connections between science and art through the practice of creative technologies as an art form. In this regard, the technologies themselves can be viewed as an object of contribution to the work. It is thus necessary to study the cultural specifics of technologies, either from a past era for their cultural use and methods of that time, or as contemporary technologies through their statements on the future. Technologies influence the outcome of art works and the practicing artist.

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needs to also incorporate research into the paradigms that have been established by expression through these tools. This is a consideration of technology as the medium of art. In this regard, Murphie and Potts state “All art employs technology of some kind, whether the materials of visual art, or the instruments used to create music, or the structures and materials of architectural, the art most readily associated with the shaping of technological form”.14

The progression of ideas through evolving technologies is described as “remediation”. Bolter and Grusin discuss their view of this in their essay “Remediation” (1996) as “we call the representation of one medium in another "remediation," and we will argue that remediation is a defining characteristic of the new digital media. What might seem at first to be an esoteric practice is so widespread that we can identify a spectrum of different ways in which digital media remediate their predecessors, a spectrum depending upon the degree of perceived competition or rivalry between the new media and the old”.15

This research establishes a relationship between theory and technique. The work of historical artists can be studied with a conscious goal of employing their techniques in contemporary methods through transferability. Remediation and transferability can be expanded through a consideration of post-modern theories of personal interpretation and may be applied to thinking through the methods employed by innovators in art whether or not they have specifically acknowledged their underlying interpretation of transferability. For example, in my work, older analog mediums in sound and image, are being used as a model for a contemporary work, but updated within digital processes. Bolter and Grusin

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14 Murphie and Potts, Culture & Technology, 39.
describe this as a desire “to emphasize the difference rather than erase it. In these cases, the electronic version is offered as an improvement on the older version, although the new is still justified in terms of the old and seeks to remain faithful to the older medium's character” and “The new medium remains dependent upon the older one, in acknowledged or unacknowledged ways”. Thinking through transferability allows for substantially different methods, and facilitates a contemporary reading on the final work. This is not simply a focus on the ease of use of the newer technologies, but suggests that new processes produce different art forms. For example, with digital audio, music styles that utilize sampling and processing are able to produce pieces of a complexity beyond that of which was realized in the analog medium of tape splicing and looping. This facilitates new methods for live, improvisational sound works using current computer technologies. Another specific example can be seen in the making of the independent film *The Sabbatical* (Brian Stockton 2015). The director has articulated how his use of new technologies have facilitated methods that add to his practice of film techniques. Rather than working from a prepared script, the dialog for this film has been improvised over many evolving takes. The final version is edited from the instant recall, random access, digital storage medium. This provides an efficient and economical method to work with improvisation in film and has resulted in a work that has a different style of character interaction that can be directly related to considerations of access to the newest video technologies. I have engaged in my practice through a constant investigation of

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17 *The Sabbatical*, directed by Brian Stockton (2015; Regina: Autumn Productions Inc.), Video.
technology as the medium, which has resulted in practices that are informed through theories of transferability and remediation.

This chapter has introduced the ideas that inform my MFA final project. In Chapter Two, I will present a description of the project itself. Chapter Three describes the methodologies that inform my practice and, specifically, this project. In Chapter Four, I will explore the theories that support my arguments for this project. Chapter Five summarizes my conclusions for the work.
CHAPTER TWO: Project Description

This thesis presents the basis for the theory, design and defense of my final Masters of Fine Arts degree project, titled “Relativity”. This project will involve the construction of a gallery installation piece that will provide an artistic experience for viewers based in the results of my research. I have developed this project in terms of it being, what Catherine Richards has titled a “philosophical machine” (as quoted in Dyson)\(^\text{19}\) in that the intention is that it be viewed as a basis for the reading of a philosophical discourse between technology, art, and consciousness. The writings of Murphie and Potts have provided a basis for a cultural interpretation of the technologies employed in this project.\(^\text{20}\) The common, recognizable technologies are to be viewed as the medium of the work. The installation presents a scene comprised of a quantum particle of potential knowledge, located within the white expanse of the gallery, a space for the viewing of expanded cinema and sound art. The components of this machine will be made visible for examination as aesthetic objects of interpretation in themselves. A selection of digital media devices will be seen to represent familiar, economically democratized technology, that has been developed from the continual refinement of the originating complex, binary mathematical theories. This presents a shared cultural reading of human creativity through technology and art, and raises considerations of the contributions of science in the past and future in shaping of human expressions of ‘reality.’ This work is the basis for a contemporary paradigm of interpretation, based on

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\(^{19}\) Frances Dyson, *Sounding New Media: Immersion and Embodiment in the Arts and Culture* (Berkeley: University of California Press, 2009), 162.

\(^{20}\) Murphie and Potts, *Culture & Technology.*
the relative philosophical view of the observer at this moment in time; hence the title “Relativity”.

The theoretical underpinning for this project is found at the intersection of art and science; in an exploration of states of binary opposition and in the ways in which these systems can be seen as the basis for new paradigms, or interpretations of reality. The development of binary systems has been the inspiration for an advancement in knowledge that has added further layers to human perceptions of the natural world. These developments do not necessarily replace former structures, but rather present an evolved understanding relative to a new viewpoint. These principles can be seen in the patterns of information systems and have frequently been used as models for development of new technologies. This is most commonly demonstrated through contemporary digital based media tools. My original entry into this discourse has been through considerations of the contrasts between the tools of digital and analog sound reproduction. Within these technologies, binary mathematics is the basis for audio systems that create continuous, analogue wave sounds. Further to this research, I have been influenced by Curtis Roads’ writing on microsound technologies. Roads describes systems by which sound waves are granulized into particles of durations below that of normal perception, such that a new layer of aesthetic meaning is produced.²¹ These techniques allow for additional layers of perception to be read from the original content. This is a basis for discourse on meta-layers of perception as well as on the contribution of chaos to the formation of systems of knowledge. The imagery of this technology, and the sound world it produces, raise consideration of principles that describe the relationships of support and opposition found

between binary polarities. As a sound art theory, the technologies of digital sound and granular synthesis are being utilized in this project as the aesthetic object of view for their production of a continuum sound world. The visual, expanded cinema elements present further contributing components to this discourse through progressive abstraction, quantum particalization, and chaos based indeterminacy. These elements form the whole of a system originating in binary complexity, that is open to personal interpretation by an observer in the gallery setting.

As mentioned above, this project will be based in a study of quantum manifestations through the mediums of sound art and expanded cinema. “Figure 1: Relativity” shows the layout for the pieces of this philosophical machine. The audio elements will be projected through a system of finished wood panels that have been fitted with surface resonator devices. This construction is being undertaken to provide a contrast to the common presentation of sound originating from speakers. In this regard, Relativity will present the audio work as originating in discrete digital information and then emanating through the vibrations of natural, organic elements. The panels will be braced and finished in a manner referencing the form of acoustic musical instruments. In effect, the quantum bits of common technology will be the performer in a traditional form of music presentation. The programmed sound elements will be based on recorded performances that center their root tone on a lower octave of the frequency of the chemical state of the hydrogen atom. This frequency is produced by quantum activity between a proton and electron of the first, and most common, element in the universe, it being the first step in the manifestation of all further atomic elements. This frequency is standardized at 1420 MHz which is a higher octave of the note E +46 cents. The
performances will, in turn, be processed through granular synthesis techniques such that the original sound will morph between quantum and continuous sound technologies.

The expanded cinema portion of this installation will be comprised of a video system with two projectors directed towards an opaque panel centered between them. Each projector will present an independent video program that contributes to the total imagery formed within the viewing area. This theory is based on the techniques of layering effects that are seen in the rendering processes of digital video editing software. The video clips will be created from performed scenes, and then processed in and out of abstraction using further layers of video editor effects. This will result in the formation of imagery in a continuum, made up of the processing of many individual, overlapping pixels of light. In this manner, the presentation of the light and sound imagery can be seen to be in support of the same themes of perception and transcendence.

Several different sound and image media files will be observed simultaneously in this work. They will play without synchronization in a system of indeterminacy. This ever-changing combination of sound and image will be a basis for individual readings based on the time of viewing and the unique personal associations of each observer. The media files of both sound and image will be selected through a random looping process from each of the media players, creating a system of presentation based in chaos. The combinations of any one viewing session will be a part of the larger, total group of possible permutations; however, there will not be a need for any one person to experience the whole of the media patterning possibilities. An observer will make a personal reading of the installation based on the elements they experience for the portion of time they are present. It is hoped that through this contact, the piece is installed, and takes hold, in the imagination of the observer such that they will continue to reflect upon and further
interpret their experience with the installation. This theory is the basis by which the work intends to disrupt the observer’s sense of linear time and function as a “philosophical machine.”

The specific physical layout for this installation can be seen in Appendix A, Figure 1: “Relativity, Project Layout”. The audio elements will be comprised of two, four feet by eight feet sheets of finished plywood (“Audio Resonator 1” and “Audio Resonator 2”). Electromagnetic resonator devices will be attached to these pieces and driven by audio amplifiers, receiving their input from digital music audio players. The volume is not proposed to be very loud, addressing potential issues of sound bleed into other gallery areas. Two video projectors (“Projector 1” and “Projector 2”) will direct imagery towards the central screen (“2-Sided Opaque Image Screen”) from either side. Each projector will receive its signal from its own media player. These pieces are to be installed in the configuration shown in the plan view drawing. It is proposed that the objects be hung from the ceiling of the space, to visually free them from any associations with a base of support and to establish an esthetic of this quantum particle being suspended in a theoretical space, within an expanse of white gallery. These components are each very light in weight, which should facilitate the hanging presentation. They will be hung with clear nylon line, attached to standard ceiling track clips, adding to the sense of floating particles. Power cords will need to be run to each of the media player locations and visually minimized. A vinyl lettering sign, including an artist’s statement, will be installed on a wall in proximity to the installation space.

This project is informed by my career as a professional engineer in the building industry, as well as a practice in music. As engineering is the discipline of applied science, I have based my theories in research that has practical application in the
development of technologies. While the principles of relativity and quantum physics have led to many thought-provoking theories, I am focused on the original findings of these models, which have provided a practical basis for the development of common use technologies.

My practice in sound has been self-informed through experience playing in improvisation bands as well as producing computer-based music for television and dance. This has included playing keyboards for ten years in the Miscibles Band, producing music for two seasons of the Landscape as Muse television series, and music composition for Youth Ballet and Contemporary Dance of Sask. productions. I have built instruments, taught a guitar making course, and have extensive experience in digital sound technologies. I have been involved for the past ten years in electronic improvisation music performances with Regina’s local chapter of Dorkbot. I have studied art and cultural based music theories, leading up to my present MFA studies at the University of Regina. In my recent study classes, I have completed projects in expanded film, designed visual improvisation scores, and developed a glove sensor system for modular synthesizer control. I have travelled to Europe as a directed studies class where I attended the Geneva Mapping Festival and researched expanded cinema installations in several museums.
CHAPTER THREE: Methodologies

My final MFA project has been developed through the study and practice of several research methodologies, both individually as well as in mixed methods. I would identify the main focus of these methods as being in artmaking and practice-based research. I have also been inspired by the methods of discourse analysis and scientific research and, while I have expanded on these in my description, I have utilized them more in a general approach for the development of my work in the studio. I also reference some of the basics of interdisciplinary research in support of my study of audio and visuals as well as the arguments of my thesis that explore connections between art and science.

I have also been inspired by studying contemporary examples of work combining sound art and moving image. One example of this study has been through my graduate placement as the technician on the Atom Egoyan: Steenbeckett (2016) film installation. This provided me with a rich basis for learning in image, sound, and gallery lens-based installation work. The analysis of many of the contemporary installation and performance works of other artists, has also formed an important basis for my final project. I have based some of my methods for imagery in video on writings and works based in past theories of photographic still images. For this project, the theories for my work in sound are examined through the emerging field of granular synthesis.

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3.1 Experimental Art Making as a “Grounded” Method

Within my course work, I have studied the theories of experimental art and have applied these theories to the making of art, but also to the study of art methods themselves. Like many artists, the results of these experiments have then been a basis of analysis for further refinement of the processes. This facilitates an analysis and refinement of processes initially discovered through spontaneous acts or processes of improvisation.

I would argue that the term “experimental”, in its adoption for art, has a different connotation than in its original use in science. The experimental artistic method is defined by John Cage in his book *Silence* (1961) as “an action the outcome of which is not foreseen”. 23 This type of experimentation is a way to facilitate spontaneous acts in art and differs from the search for factual proof in the fields of science. The outcome of art processes, once set in motion, stand complete without alteration as qualified by Cage when he said: “Value judgments are not in the nature of this work as regards either composition, performance, or listening”. 24

The types of experiments being proposed by the discussion of this mixed method methodology involves a combination of the terminology from both science and art. I take aspects of qualitative methods and apply them to my art-making. Experimental art processes are employed to produce works, the results of which, are to be analyzed for their outcome within the specific methods being tested. This introduces a form of assessment to spontaneous outcomes. In *Doing and Writing Qualitative Research*,

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24 Ibid., 59.
Adrian Holliday describes the qualitative social science method of Grounded Theory Research as “theory that is grounded in data systematically gathered and analyzed” and that demonstrates “continuous interplay between analysis and data collection”\textsuperscript{25}. I see my experiential art practice as similarly based in the grounded interplay of art and analysis. This combination provides a method for analysis in response to the results of the research being collected; in this case the outcome of art production. I have studied the methods of John Cage to gain a better understanding of the theories of experimental art practice. I have found an experimental approach to working useful, however based on the types of outcomes I have envisioned, the final work has been examined for reworking in a manner that may not occur within a strict reading of Cage’s definitions for experimental art, quoted above. This examination has certainly been the method used in my past practice when working in sound for television as well as dance.

I have also been influenced by the methods articulated by Brian Eno when he says in an interview with Paul Tingen “Brian Eno Recording Another Day on Earth” (2005) that “Nearly everything I do starts as an experiment anyway, and the vast majority of things never make it on record. They're failures because they're not interesting pieces of music, but they teach me something”.\textsuperscript{26} While Eno’s comments may be a bit severe in the judgement of the outcomes of experimental processes, I have previously found value in this type of iterative art method. I tend to work with improvisation methods, from which the outcome is examined for its merit. There is a value to be found in the progression through these processes when, as Eno says, the learning is acknowledged.

This methodology describes a process of first defining an experimental proposal, execution of that process, and then following with an analysis of the outcome for feedback to the original proposal. I have tested this method for class projects, producing works that begin from a series of experimental premises that were then repeated, with refinements each time, informing the next iteration.

3.2 Artistic Research and Practice-based Research

There is variation in the scope of defining this methodology between scholars. In *Artistic Research* (2005), Mika Hannula states that: “Artistic research means that the artist produces an art work and researches the creative process, thus adding to the accumulation of knowledge”. This is a systematic use of the artistic process, in various mediums, as a way to examine engagement with artistic creation itself. Hannula defines several priorities for artistic research as “the art work being the focal point”; “experientiality being the core of the research”; “research is self-reflective, self-critical, with directed communication”; “it is located within a historical and disciplinary context”; “it includes diversified methods and group dynamics”; and it is “based in thoughtful interpretation and reflection”. In “Practice as Research: A Fine Arts Contextual Study” (2013), Suze Adams states that “Practice becomes a critical and creative developmental tool not aimed at any definitive or predetermined outcome but instead a means through which to explore multi-sensory understandings and to address the efficacy of cross-

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28 Ibid., 20-21.
disciplinary methodologies and the theoretical concepts that underpin them”.\(^{29}\) While both of these scholars identify a broad focus for their research, and include descriptions of interdisciplinary methods, I have concentrated on the ideas of Adams that “inform and transform practice”\(^ {30}\) in itself when, “as a result, valuable new insights are produced and become embedded within the artworks”.\(^{31}\) The methods employed within this methodology can be creative acts in interdisciplinary mediums, to be reviewed for inspiration and the creation of meaning and associations with the work. In “Research-Creation: Intervention, Analysis and Family Resemblances” (2012), Chapman and Sawchuk state that “Creation-as-research involves the elaboration of projects where creation is required in order for research to emerge. It is about investigating the relationships between technology, gathering and revealing through creation, while also seeking to extract knowledge from the process” and “It is a form of directed exploration through creative process that includes experimentation, but also analysis, critique, and a profound engagement with theory and questions of method”.\(^{32}\) This research can be performed by the artist assuming the key role for self-analysis, but is also supported through group processes. Self-directed creation, followed by responses to subsequent critique and discussion by a group of like-minded artists or, even researchers from outside of the arts, is a method employed by many artists as a group establishes itself around successful discoveries, whether or not it has been identified or formally directed by all of the principles of this methodology.


\(^{30}\) Ibid., 218.

\(^{31}\) Ibid., 221.

Some arts based research may be seen to be at odds with contemporary theories in its judgement of outcomes and in consideration of experimental practices. The study of postmodern theories has allowed me to examine the balance between that of the work being guided by the will and interpretation of the artist, versus leaving the work free for interpretation by the viewer. I have found value in arts based practice research for a reiterative examination of the results of several of my video and audio based MFA projects and have concluded that the most practical position is to consciously employ a mix of these methods.

3.3 Transferability and Context in Text Analysis

I have identified discourse analysis as an inspiration for some of the learnings in my MFA course studies. While I do not profess to have utilized the full depth of this method, I think that it is important to acknowledge the study of the texts and works of prior theorists and artists, and to attempt to analyze these records within the context of their original cultural connotations. This is especially important when considering texts across disciplines. Discourse analysis is a methodology based on the analysis of existing communications associated with the subject of research. In The SAGE Encyclopedia of Qualitative Research Methods (2008), Kay E. Cook says that “Discourse, in the most general sense, is the study of language as it is used in society expressed either through conversations or in documents”.

While Jonathan Potter identifies discourse analysis as a cluster of methods for studying language and its role in social life, I have focused on the parts of the method that “studies language use with a particular interest in its coherence

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over sentences or turns, its role in constructing the world, and its relationship to context”. The theories for my project include the study of ideas in art and science, which in both cases, includes the examination of language communications. I have also examined musical scores, technical designs, and past works of art presentation. This analysis can be the source of much valuable information on a research topic, especially in consideration through on-line access to such wide selections of written, image and sound based material; however, these types of sources must include obvious precautions in verifying their authenticity. While my studies do not encompass the full cultural complexity of these methods, I cite them as a way to acknowledge the importance of studying the work of past theorists and artists that have contributed to knowledge, while interpreting their ideas within contemporary methods.

My main application for this method, is in foregrounding the context sensitive nature of many sources and the idea of information transference from one area to another. Again, in The SAGE Encyclopedia of Qualitative Research Methods, Martyn Hammersley states that: “human actions, of whatever kind, can be properly understood only in context—that by their very nature they are situated”. In researching the recorded discourse of past scholars, it is important to consider the transferability of their information. Again, in The SAGE Encyclopedia of Qualitative Research Methods (2008), Devon Jensen notes that “Transferability implies that the results of the research can be transferred to other contexts and situations beyond the scope of the study context”. A useful term in which to ensure transferability is “thick description” as has been discussed

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34 Jonathan Potter, The SAGE Encyclopedia of Qualitative Research Methods, 217.
35 Martyn Hammersley, The SAGE Encyclopedia of Qualitative Research Methods, 122.
36 Devon Jensen, The SAGE Encyclopedia of Qualitative Research Methods, 886.
by Clifford Geertz, in his essay on anthropology, “Thick Description: Toward an Interpretive Theory of Culture” (1973). This is an inquiry beyond the surface understanding of the researcher, into the cultural significance that informs their observations, “sorting out the structures of signification” and “determining their social ground and import”. In light of this understanding, Jensen identifies that transferability is enhanced by discourses that demonstrate the principle of “thick description”, adding that “Thick description means that the researcher provides the reader with a full and purposeful account of the context, participants, and research design so that the reader can make their own determinations about transferability”. In researching art theories, it is useful to carefully consider the appropriateness of transferability to contemporary thinking. This is generally deemed important in order to avoid misinterpretations based on a reading through different cultural paradigms.

A main consideration for me has been that context-sensitive analysis must always be examined in the study of significant texts that may have been written in different cultural periods. It is important to first analyze a document from the perspective of the originating source, within its historical context. Jean J. Schensul notes in *The SAGE Encyclopedia of Qualitative Research Methods* that, “Historical context refers to past conditions, which influence the present” and “To understand these broader factors, which are influential in the present, it is important to know how they evolved and what shaped them.” From this perspective, a researcher can analyze discourse in light of its

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influence on contemporary development. For example, the term “Expanded Cinema” is generally attributed to Gene Youngblood from his 1970 book by that name.\textsuperscript{40} Youngblood outlines a philosophy that views the common narrative-based cinema techniques as only one possibility for moving image art, followed by several options for alternate exploration, including examples of artists from that era. Much of his thesis is based in the democratization of image production that was being introduced through the, then newly developing, technologies of analog video tape and computers in the 1950s and 60s. This is an instance of where the description must be regarded within its cultural setting in that the technologies being described are very archaic by today’s standards, and that the use of technology is now so ubiquitous. These ideas must also be considered within the expanding politics of this period. The principles of this discourse, however, continue to inspire new interpretations and research within the art and technologies of today. In Janine Marchessault and Susan Lord’s anthology \textit{Fluid Screens, Expanded Cinema} (2007), Youngblood offers an updated, future view to artists’ use of technology. In “Afterword: What We Must Do”, he makes reference to the not yet fully developed potential of the Internet: “The possible realization of humankind’s ultimate utopian dream – a global democratic sphere – is in our hands”.\textsuperscript{41}

\subsection*{3.4 Scientific Research}

The methodologies employed in the arts tend to be based in qualitative research methods, however, quantitative, scientific research provides much of the basis for my

\footnotesize{\textsuperscript{40} Youngblood, \textit{Expanded Cinema}.  
\textsuperscript{41} Gene Youngblood, “Afterword: What We Must Do”, in \textit{Fluid Screens, Expanded Cinema}, eds. Janine Marchessault and Susan Lord (Toronto: University of Toronto Press, 2007), 323.}
project within the creative technology arts I am exploring. While I have not directly conducted scientific research for this project, it has been important to study scientific philosophies of knowledge to support my theories. The focus of the work in my undergraduate engineering degree was on analysis and proof through scientific experimentation of the contemporary, practical scientific principles of use for the commercial application of applied sciences. Further to the description of the “experimental” in art above, in application to science, Thomas Kuhn identifies in “The Structure of Scientific Revolutions” (1970), three foci for scientific experimental research as:

1. “Factual determinations” – the constants of measurement of the physical, which can include freezing limits of liquids, rotation time of planets, electrical conductivity of metals, etc.

2. Comparisons with “predictions from the paradigm theory” – the testing of outcomes to determine if alterations are required to the paradigm, such as testing properties of elements to the periodic table, measuring the properties of light, probes to test the temperature of planets, etc.

3. “Fact-gathering activities of normal science” – the testing of a researcher’s hypothesis of a scientific outcome, the most common type of experimental activity, used in establishing formulas, constants, and scientific laws within the paradigm of exploration.42

My former scientific training should be considered within the contemporary scientific paradigm of our culture. In relation to applied science, Kuhn notes that “when the paradigm is successful, the profession will have solved problems that its members could scarcely have imagined and would never have undertaken without commitment to the paradigm”.43

In addition to the study of general scientific philosophy on observation, I have also included research into the neurological basis for some of the methods I have employed. In "What Does the Brain Tell Us About Abstract Art?" (2014) Vered Aviv has documented research that identifies unique forms of brain activity within individuals when viewing abstract based imagery.44 This adds a practical understanding of visual imagery that has not been articulated through qualitative descriptions and will be expanded in the following theory section. Kathrin Fahlenbrach researches aesthetics in the viewing perceptions of various media and questions the properties of the medium as related to the sense organs of the viewer. This raises inquiries as to the effects of the development of media on the viewer as the media evolves. In "Aesthetics and Audiovisual Metaphors in Media Perception" (2005) Fahlenbrach identifies results of the brain processing multi-sensory data as “transferring meaning across the various senses in a metaphoric process, creating new meanings or sensations”.45 She also outlines connections from her work to the research of Marshall McLuhan46, as well as Michael

43 Ibid., 25.
44 Vered Aviv, "What Does the Brain Tell Us About Abstract Art?" in Frontiers in Human Neuroscience, vol 8, article 85 (February 2014).
46 Ibid., 3.
Chion\textsuperscript{47}, the researcher who originated the term “synchresis”. While the work of these researchers is complex, it demonstrates the possibility for an understanding of abstraction in imagery as well as the principles of semantic interpretation in postmodern theory of creative technology based arts, as analyzed through neurological based sciences.

3.5 Interdisciplinary Research and Synchresis

My studies leading to my final project began with the identification of an interdisciplinary study in the artistic mediums of sound art and expanded cinema. The focus of combining these two fields remains as a study of the effects of synchresis when presented in a combined form. While this research has been effective as an examination of artistic methods, the philosophical basis for my project has evolved to a study of the congruence between art theory and that of applied science. This larger interdisciplinary focus has provided me with a basis in which to personalize my work in studies of art at a graduate level, and within my background as a practicing professional engineer.

For this research to have significance, the interdisciplinary approach must be seen to enhance the outcome of the project rather than merely add discussion or highlight complexity. In their article “Definitions of Interdisciplinary Research: Toward Graduate-Level Interdisciplinary Learning Outcomes” (2010), Maura Borrego and Lynita K. Newswander emphasize the integration of interdisciplinary insights as being seen in the advantage of a combination of perspectives, in gaining an understanding that is more than the sum of the individual disciplinary parts. They state that “integration lies at the heart

\textsuperscript{47} Ibid., 7.
of interdisciplinarity, and variations are present in most discussions of interdisciplinary learning outcomes”.  

This becomes important in judging the merit of introducing an interdisciplinary approach to a research topic. The authors also observe that “humanities literature operationalized integration through critical awareness, while engineering and science proposals operationalized it as teamwork”

and that “critical awareness is the outcome around which humanities scholarship can most extend engineering and science conceptions of interdisciplinarity”.  

I support the validity of these observations from both my experiences in engineering team projects as well as in my current studies in critical awareness through research in the arts. I see the basis of my final project as an exploration of bringing a study of art and science together, both in their philosophical theory, as well as in their approaches to considerations of interdisciplinarity.

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49 Ibid., 80.

50 Ibid., 78.
CHAPTER FOUR: Theory

The following section outlines the theoretical basis for my final MFA project, Relativity. These ideas have been researched through my studies to date and represent the underlying philosophy for this project.

4.1 Postmodernism

A significant insight of my MFA studies has been in the research of contemporary art through the theories of postmodernism. In the twentieth century, the movement of modernism challenged many traditional philosophies. This was in response to a social environment of industrialization, urbanization, and the world wars. In this era, artists pushed many boundaries of the traditional lineage of art philosophy in search of the new. They were notes for devoting much of their theory to exploring the specificities of the mediums of art. Arthur C. Danto, in his book After the End of Art (1997) has said that “the conditions of representation themselves became central, so that art in a way becomes its own subject.”\(^{51}\) While this upheld the basis for prior art theory, it also highlighted distinctions between disciplines, segregating them even more than before, thus solidifying conceptual boundaries between expressions in the different artistic mediums.

Beginning in the 1960’s, many modernist theories began to be challenged. John Storey describes, in Cultural Theory and Popular Culture: An Introduction (2015), the cultural beginnings of postmodernism as a “revolt against what is seen as the cultural elitism of modernism.”\(^{52}\) He identifies this as a breaking down of the divide between the

high and low, or elite and popular culture. New, disruptive explorations emerged along with that of the continuing of work within the philosophies of modernism such that, as Danto identifies, “the distinction between the modern and the contemporary did not become clear until well into the seventies and eighties.” This was a time of challenging many of the binaries associated with race, gender, sex, and structures of meaning. Storey further explores this melding of “high” and “low” culture as being developed through the art of the “found object” as well as pop art. Prior assumptions about the nature of art and the role of the artist were questioned. This was seen in works of collage, appropriation, and conceptual art. The mixing of styles and media (intermedia, remediation) became common, arising from works that did not adhere to historical theories of artistic mediums.

In Ihab Hassan’s essay, “Representing the Postmodern” (1993), he lists several of the key developments in postmodern art theory as: “Antiform, Chance, Process, Participation, Deconstruction, Dispersal, Combination, Anti-narrative, Indeterminacy, and Immanence”.

I have also viewed the development of these theories as being synonymous with the contemporary advancement of creative technologies as artistic tools and the associated tendency to view these technologies as postmodern mediums. As Murphie and Potts say in Culture and Technology (2003), “Contemporary artists are quick to explore the potential of new technologies, which are often used in surprising ways” and “the history of art is, after all, also a history of technology.” Furthermore, technology is

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53 Danto, After the End of Art, 11.
54 Storey, Cultural Theory and Popular Culture: An Introduction, 194.
56 Ibid., 39.
now commonly incorporated in art such that its prominence must be seen as contributing to the interpretation of the work and, thus, becomes an object of view in itself. It may not be clear just how much of this emerging theory directly influenced Gene Youngblood in the time of his writings, but it is apparent that these progressive changes in art paralleled the development of expanded cinema. As cited from Licht’s work above, the term for “Sound Art” can also be viewed to have been established within the time of evolution of the theories of postmodernism.

My study of postmodernism has been mainly through the cultural based writings of the scholars I have cited, and the associated influence on visual arts. These ideas have assisted me in developing methods for my own art practice. Murphie and Potts caution that “It is important to acknowledge that the division of cultural history into discrete periods – such as modern and postmodern – has theoretical disadvantages as well as advantages” and “different art forms have different timescales, which makes a generalized account of the shift from modern to postmodern difficult”.

What has been important to my research has been the study of these postmodern theories as a method to advance my practice toward a way of creating and interpreting works with concepts that support a more clear understanding of contemporary art practice. This has led to considerations of the role of the artist in their work. The traditional role of the artist has been that of a renowned thinker who articulates their vision to the viewer through great skills in craft. My studies in postmodernism have caused me to question the role as well as the authority of the artist. Prior to these contemporary theories being articulated, the work typically began with the creation of a central message, which was determined and

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57 Murphie and Potts, Culture & Technology, 39.
controlled by the artist. It was frequently based in a history of art theory and analyzed through cultured symbolic coding. The study of postmodern theories allows the artist to consciously employ methods that remove them from controlling the interpretation and further facilitate a personal engagement with and interpretation of the work for the viewer. In this manner, the artist is seen to relinquish at least some of their power of interpretive control over the work to the viewer. This is supported through the ability of the individual mind to form personal associations with the signs embedded in the art through conscious and subconscious responses based on prior, personal experience. While the conceptual ideal may be difficult to logically quantify, a work can be seen to be successful in this regard if it facilitates multiple, overlapping readings by an audience of viewers. In this manner, the work is not complete until activated by viewers through their individual associations.

I have approached this research through a study of Object Relations theory. I note that, while the artist may have full expectation for a personal interpretation of their presentation, there must also be an aspect of the work that suggests this to the viewer. Elia Goldhahn offers several insights into this process in her article “The Pleasure of Finding: A Perspective on Acts of Finding in Movement and in Visual Art Informed by Object-Relations Theory” (2011). She comments on the selection of art objects: “once the prerequisite of finding is fulfilled, an object can be changed, manipulated, and made one’s own.”

Goldhahn adds that “This is a relevant message both to the self and to others. As marks become recognizable signatures of belonging, the individual who

created them imbues them with meaning.” 59 I continue to study this process through further practice to reveal principles for practical working methods.

As stated from perspective of object relations theory, art allows personal association with the object of focus. Culture forms as observations of the object become shared interpretations. This can be an ethnic based culture, membership in a local place or scene, or any other shared association. This sense of agreement does not present as an absolute phenomenon within any one art form, and can be seen commonly established within works of pure entertainment. In regards to a key relationship between object relations theory and postmodern art, in Psychoanalysis & Synchronized Swimming (1991), Jeanne Randolph states: “Implements, devices, functional things, from guns to butter, would, by the Object Relations definition of illusion, remain literal objects until someone presented them as a metaphor to someone else who was in a position to toy with the metaphor.” 60 These many potentially overlapping readings through new, mixed mediums is especially multifaceted when consideration is given to viewer’s associations with many mixed, technical mediums.

4.2 Relativity

Relativity has been based in a study of philosophies that question assumptions around interpretations of the foundation of observation. As illustrated through the discussion of postmodernism above, these theories have been explored by philosophers, the social sciences, and contemporary artists; however, I have viewed this research as a

59 Ibid., p70.
basis for extending thinking to include that of the natural sciences. I endeavor to establish a philosophical connection between these two disciplines of human research that facilitates a discourse into the structure of consensus around the relativity of all forms of observation. This can be considered as a middle ground argument, connecting the metaphysical with scientific methods of pure logic.

As stated for the arts, much of the discourse for this theory can be understood through postmodernism. This has been a method that I have cited for its study of the relative interpretation of a presented image and the differing meanings for each observer based on their experiential and cultural background. The early influences for postmodernism in the arts may be traced back to the ideas of artists such as Marcel Duchamp, which provided influences for the works of conceptual art in the 1960’s. In “Understanding Art Objects: Thinking Through the Eye” (2009), Eugene Tan identifies Joseph Kosuth’s work “One and Three Chairs” (1965) as “one of the most iconic works of conceptual art”61 (Appendix B, Image 1). This work originated as a set of instructions for a process to obtain and photograph a chair. The chair, its photograph, and the dictionary definition of “chair” are then to be placed together for exhibition. Through this work, Kosuth was seen to challenge prior conventions for meaning in art. It is a comment on a linguistic basis for visual art but, more importantly, questions the personal interpretation of a common object. While Kosuth’s work probed the conventions of art, Tan also highlights that “This questioning of art, therefore, was for Kosuth intimately tied to the questioning of meaning”.62 Each rendition of chair, through the photograph, the

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62 Ibid., 55.
object, and the definition; typically represent the chair individually, but when placed
together, deconstructs its interpretation. As Tan adds, this piece of early conceptual art
“has been significant for the way that art practice subsequently developed” and can be
viewed for its contribution to the later philosophies of postmodernism.

The ideas above are predicated mainly on theories developed within the visual
arts. Sound facilitates an alternate view of observation as articulated by Frances Dyson
in *Sounding New Media: Immersion and Embodiment in the Arts and Culture* (2009):
“Sound Surrounds. Its phenomenal characteristics – the fact that it is invisible,
intangible, ephemeral, and vibrational – coordinate with the physiology of the ears, to
create a perceptual experience profoundly different from the dominant sense of sight.”
An installation of sound focusses additional attention on the space as well as the flow of
time. In “Sound Art: Site-Presence-Interaction-Situation” (2010), Helga de la Motte-
Haber writes that “Sound installations incorporate us in a shifting, dynamic field, the
static and fluidity varying conditions of which we, by the act of perceiving, take part in
creating”. In “The Singuhr for Latecomers” (2010), Catherine Nichols describes sound
art as: “dematerialization of the art object, completed in the mind of the viewer”. This
places sound art in a position of support with conceptual visual arts theories and creates
an interesting interplay of theories of interpretation when combined with the visual focus
of expanded cinema.

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63 Ibid., 60.
64 Dyson, *Sounding New Media: Immersion and Embodiment in the Arts and Culture*, 4.
While these philosophical examinations are familiar in art theory, it may not be understood as common discourse in science. Within contemporary understanding, science prides itself on the admission of only pure logic to establish “laws of nature”. For my project; however, I am questioning this assumption, and furthermore, suggesting that there is a demonstration of parallels between the philosophies of art and science in this regard. In “The Structure of Scientific Revolutions”, Thomas Kuhn discusses the effect of historical of scientific discovery as being bound in perception by the prevailing paradigm of understanding, describing this as “an attempt to force nature into the preformed and relatively inflexible box that the paradigm supplies”. Kuhn adds that “Other problems, including many that had previously been standard, are rejected as metaphysical, as the concern of another discipline, or sometimes as just too problematic to be worth the time”. This is an articulation of the shortcomings of observation in historical and, by projection, any future, interpretations of the natural world, even as “proven” through applied science. An alternative philosophy has been articulated in the most basic findings developed from Einstein’s Theory of Relativity, in that observation can only be interpreted as being “relative” to the state of the observer. The scientific theories that have developed from this work have challenged many basic assumptions of the nature of space and time. Kuhn says that “This need to change the meaning of established and familiar concepts is central to the revolutionary impact of Einstein’s theory”. This suggests that an observer cannot actually know all factors contributing to their personal state, whether it be motion, position, or place in time. This consideration

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68 Ibid., 37.
69 Ibid., 102.
questions the interpretation of the observer in the same ways as the theories of postmodernism in art do for personal states of place, culture, and time.

To make scientific comparisons with the art theories in Kosuth’s work above, I have considered a photograph of the surface of Pluto, taken by NASA’s “New Horizons” imaging spacecraft (Appendix B, Image 2). The examination of Pluto has undergone several significant alterations in contemporary perception. The existence of Pluto was only established through observation in the early twentieth century as a result of advancements in optical technologies. Pluto later lost its status as a planet due to the presence of other bodies of larger size being discovered in its general orbit range. The recent NASA probe images of Pluto have, however, established a very tangible sense of its reality for viewers. An observer may assume that the mediation technologies employed for this scientific photograph of the object provide the most realistic experience with the view of Pluto. It must be noted, however, that this photograph has been prepared from several color enhanced, infrared images.\textsuperscript{70} This technique is necessary as the surface of this planet has very little illumination from the sun at its orbital distance. In addition to the low light, this great distance from the sun results in the temperature of Pluto being about 2 Kelvin (-270C). When this image is interpreted through the many personal understandings of its nature, we can see that there can be many variations in the observation of Pluto.

My project is a consideration of the commonality in philosophies between the social and natural sciences in recognizing relative interpretations of observation as being formed through the relative circumstance of the individual observer, hence the title

“Relativity”. Interpretation can be viewed as an evolution of cultural observations moving along a time line. This view begins with the postulate of a metaphysical hypothesis; progressing to theoretical development; contributing to a shift to a new paradigm of thinking, incorporating the previous understandings in a new model; developing into general acceptance as “scientific facts”, and proof in its manifestation of applied science, social discourse and economic development; and ending with a fading of theories into history such that the cultural anchors of understanding and basis for the original paradigm are displaced by contemporary thought. In this way technology, as an object of observation, is interpreted through a general relationship to history and time. Popular media, through marketing, presents a static view of time, in that it is locked to the present. In fact, this frame is constantly in transition and the present only represents a portion of the whole view.

4.3 The Quantum and the Continuous

The study of social sciences highlights the interconnections between binary states, whether it be through examinations of economics, race, or gender. Binary attributes can be considered as conflict or, alternately as equal contributors to an integrated culture. These perceptions have analogous forms in science through studies of quantum versus continuous states. A basic example of this is that of particle behaviour as compared to that of wave phenomena. This is illustrated in the study of light, for which both behaviors can be demonstrated simultaneously. While this dichotomy has been attributed to a lack of scientific understanding specific to the properties of light, there are in fact other examples of this ambiguity. Sound research also illustrates that there may be an alternate paradigm for our knowledge of these energies that must be observed in order to
understand the quantum and the continuous as co-existing parts of the whole of the natural world.

A significant path of the interplay between these two attributes can be traced through the science of digital technologies. Gottfried Leibniz, a German scientist and philosopher (1646-1716), was a key figure in the origins of this research. In *Leibniz, A Biography* (1985), E. J. Aiton notes, among Leibniz’s many discoveries, his contribution to algebra\(^1\) as well as calculus\(^2\), a mathematics that enables the quantification of infinite degrees of continuous change. Leibniz also developed a system of binary mathematics and mechanical computing machines\(^3\), the theory of which has formed the basis of binary technology in contemporary computer technology. Leibniz’s research continues to develop towards future technologies of virtual reality whereby the natural world will be experienced within the interplay of discrete, binary mathematics. Leibniz’s inspiration for his mathematical system can be traced back to contacts he made with Daoist scholars of the I Ching.\(^4\) This Chinese system of binary calculation has, in turn, been attributed to the study of processes in nature. This history documents one strand of imagery for an interpretation of the interplay between quantum and continuous states through time. In commenting on contemporary theories of technical representation, Frances Dyson has said in *Sounding New Media: Immersion and Embodiment in the Arts and Culture* (2009) “Mediation does not destroy ‘nature’ but is part of it; it is an extra set of folds, a surface complication, codifying and altering nature, and contributing to its own materiality”.\(^5\)

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\(^2\) Ibid., 57-59.
\(^3\) Ibid., 104, 243-245.
\(^4\) Ibid., 245-248.
\(^5\) Dyson, *Sounding New Media: Immersion and Embodiment in the Arts and Culture*, 137.
My own research into this idea was through the technologies of analog and digital sound. These tools represent two different ways of understanding sound energy as either quantum/digital or continuous/analog. In music audio theory, sound tends to be interpreted as a continuous, analog wave phenomenon; and digital sound is viewed as an artificial, technical approximation. In fact, there is a natural counterpoint to digital sound in that sound is a wave propagated through a medium, typically air, which can be described through a discrete function of air molecules colliding. In this regard, Max Planck determined a constant for the most infinitesimal natural event that can occur in time which Curtis Roads describes in *Microsound* (2001) as “the Planck time interval, a kind of “sampling rate of the universe,” since no signal fluctuation can occur in less than the Planck interval”. High sample rates of digital sound can theoretically describe continuous events at the level of the Planck interval. Digital sound theory can be understood as a reading of amplitude in time, without a record of the associated frequency components.

Another paradigm for the expression of sound came with advancements in computer technology along with refinements to Fourier Transform mathematics. This model captures the frequency spectrum of sound in small, discrete packets. This alternate theory of sound facilitated the MP3 file format along with several processes for sound manipulation. In *Applied Fourier Transform*, Kiyoshi Morita says that, “From a mathematical point of view, the Fourier transform has no concern directly with time”. This is a description of frequency wave sets within constant packets of time.

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In addition to these known theories of sound representation, there is yet another emerging model known as microsound or granular synthesis. Roads writes: “A grain of sound is a brief microacoustic event, with a duration near the threshold of human auditory perception, typically between one thousandth of a second and one tenth of a second (from 1 to 100ms). Each grain contains a waveform shaped by an amplitude envelope”.\footnote{Roads, \\textit{Microsound}, 86.} Many of these small grains flow together into a continuous sound much like the phenomena of persistence of vision in film.\footnote{Ibid., 56.} While this view of sound may not seem to be representative of natural processes, Roads suggests that, in fact “Microsound is ubiquitous in the natural world”. “We experience the interactions of microsounds in the sound of water droplets on a rocky shore, the gurgling of a brook, the pitter-patter of rain, the crunching of gravel being walked on, the snapping of burning embers, the humming of a swarm of bees, the hissing of rice grains poured into a bowl, and the crackling of ice melting”.\footnote{Ibid., 21.} The processes of granular synthesis tend to produce sounds of natural phenomena such as waves, wind and trees. These soundscapes are built from very short, acoustic quantum events of an alternate underlying sound information. This research is reaching the state where, in the reverse manner, a common sound, such as speech or musical tones, can be analyzed to be created from a stream of layered micro-sound events.

In contrast to the systems of analog waves and the digital quantum, granular sound defines both the time and the pitch of the sound event.\footnote{Ibid., 87.} If we consider the duration of these events to approach the Planck Interval, this theory may be the most
accurate model available within our contemporary scientific paradigm that offers a theory for the co-existence of particle and wave behavior. This may also have parallels in understanding the enigma of the properties of light. My interest in granular synthesis is as a way to raise further questions in our understanding of the relativity of interpretations within paradigms of observation. When we observe natural phenomena, at what meta-level does meaning reside and what information is imbedded that may have been previously viewed as meaningless noise? Observing the interplay between the quantum and the continuous thus provides a vantage point from which to view the relativity of knowledge.

My use of wood as the resonating medium for digital sound is to be read as a comment on a common binary view that separates nature and technology. As Laura U. Marks states in “Enfolding-Unfolding Aesthetics, or the Unthought at the Heart of Wood” (2014), “In practice, digital media are always and entirely physical. Those numbers, or on-off impulses, are usually carried by electrons, which are as physical as can be and rife with unpredictable effects.” The discrete electrons of digital data are the same building blocks of natural phenomena, including that which science has not yet adequately described as being the underlying “laws” of nature.

4.4 Methods of Abstraction

In creating Relativity, I have studied methods of abstraction for both image and sound. Abstraction can be the process of altering the form of an existing object, but also

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includes the representation of concepts that do not have physical counterparts. In my research, I am interested in questioning the conventional reading of a subject or, as in the definition in the Merriam-Webster Dictionary “expressing a quality apart from an object”.\(^\text{83}\) This is based on the view and re-interpretation of an attribute, that is altered from the original, to bring alternate associations to its observation and interpretation.

Abstraction in painting has been subject to much analysis, including the well-known period of the American abstract expressionists of the 1950’s and 1960’s. In “Abstraction, 1910-1925: Eight Statements” (2013), Hal Foster identifies influences on abstract expressionism such as the motion in dance, as well as the then newly forming theories of modern physics. The theories of this time became almost circular as the artists are found to consider their art as being a more encompassing representation of reality.\(^\text{84}\) While the medium of painting provides some basis for my research, the objective here will be to refocus analysis on the contemporary visual mediums of photography and video, as well as sound art as mediated through digital processing techniques.

In addition to art theory, it is significant to note that modern neuroscience research may have provided some insight into unique attributes of these methods. Aviv identifies in "What Does the Brain Tell Us About Abstract Art?” (2014)\(^\text{85}\), the observation of unique forms of brain activity when individuals are viewing abstract based images as compared to pictorial images. The brain commonly recognizes real images,


\(^{85}\) Aviv, "What Does the Brain Tell Us About Abstract Art?", 1-4.
beginning with processing by the visual brain centers, followed by localized activation of memory and pattern recognition, and then moving to areas of category specific analysis. Abstract imagery is found to activate the visual processing centers for longer, does not activate the localized pattern recognition centers, but then moves to a process of forming new neural associations for analysis. Studies of eye movement show that the gaze tends to focus on the objects within a realistic image, but with an abstract image, the gaze is not focused at any one spot and tends to take in the whole image. This is significant in that it seems to provide scientific support for some of the factors that were articulated by the earlier painters in describing their work.

For the expanded cinema portion of my project, I have viewed the video imagery through the theories of photography, with an addition of the element of time by the addition of movement. Canadian Jeff Wall is recognized for his influential theories on contemporary art photography and, in his essay “Marks of Indifference” (1995), describes the progression from an emulation of painting, to photojournalism and other forms of staged scenes, performance, as well as parody. Wall works with carefully staged scenes that record a clear view of common scenes (Appendix B - Image 3). As a result of the history of the development of art photography, Wall concludes that “Photography cannot find alternatives to depiction, as could the other fine arts. It is in the physical nature of the medium to depict things. In order to participate in the kind of reflexivity made mandatory for modernist art, photography can put into play only its own

86 Ibid., 2.
necessary condition of being a depiction-which-constitutes-an-object.” The arguments that established this status for art photography were supported by very influential and articulate writers and are still seen to hold strong importance. Photography was held to a binary position of being a strict reproduction of the viewed scene and thus could not engage in the creation of abstract imagery.

There obviously had to be some push back to this dominant interpretation of photography that would establish a basis for methods of abstraction in its art. Luke Skrebowski, in “Productive Misunderstandings: Interpreting Mel Bochner’s Theory of Photography” (2010), discusses the work of Mel Bochner, a conceptual artist working with language and sculpture in the late 1960’s. Bochner began a study of the critical writings on art photography when he encountered problems with the photographic process in documenting his sculptural work. Bochner’s theories provide a way to widen the scope of analysis, back at the time the prominent theories of art photography were being established. Bochner’s first piece in this theme, “Photography Cannot Record Abstract Ideas” (Appendix B – Image 4), produced in 1969, establishes the existence of a counter dialog for that time. While Bochner’s pieces are notable for their humor and conceptual insight, the main point to be noted here is that the work arises from Bochner’s main assertion that photography is not accurately depictive and is in fact quite capable of presenting the abstract.

88 Ibid., p32.
90 Ibid., p92.
In his book, *The Edge of Vision: The Rise of Abstraction in Photography* (2009), Lyle Rexer observes that photography did not parallel painting in its development of abstract expressionism, but rather has found this specificity on its own terms.⁹¹ Painting is based in a process of building and organizing form, allowing for adding as well as omitting, while photography is based in a process of balancing what is seen with what is understood about that which is seen. Photography is always held to a question of “What is it really?”⁹², while any discrepancy between what is shown and what may exist is not questioned in painting. Rexer concludes that, “issues of disclosure, ambiguity, and abstraction are intrinsic to photography”⁹³.

Taking into account the analysis of all of the theories above, it can be argued that photography can neither represent a definitive record of an object nor can it create an entirely abstract image. In this way, the artist can use this medium to represent a concept within a relative view, thus leaving room for alternate interpretation. As stated above, this idea has informed my approach to video methods in that the imagery can move from pictorial to abstract in time. This is also the basis for my research of granular synthesis in sound. Nichols identifies sound art as the “dematerialization of the art object, completed in the mind of the viewer”.⁹⁴ Without the visual, sound can already be considered as a very abstract medium in its origin. In my research, the techniques of granular synthesis have provided a method to move from the original performance, to effects of abstraction, and then through to another reality of nature sound. While the visual provides much of

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⁹² Ibid., p17
⁹³ Ibid., p18
the theory, it may be more completely realized within the sound art elements. There is an enhancement of these theories in the combination of sound art and expanded cinema.

The theory of comparing a method of abstraction of an existing idea to that of an unformed creation has an analog to comparisons of chaos versus random manifestations in science. Chaotic systems are comprised of logical parameters, but of such a complex combination that they cannot yet be described by scientific models. Random manifestations are those that are defined to not demonstrate a determinable underlying order. In technology, this is a comparison between signal and noise. What observations of noise phenomena actually contain a signal for which we are currently not observing the necessary paradigm for its interpretation? By moving the view of a subject between an apparent depiction and an abstraction, my purpose is to question where the interpretation of the object is being formed. My project raises this question through the theories of abstraction outlined above.
CHAPTER FIVE: Conclusions

I have conducted the practice-based research for my Masters of Fine Arts degree through an interdisciplinary study in the Creative Technologies program. I have endeavored to establish myself personally within this research, resulting in a discourse that explores connections between my practice and study in the arts, with that in applied science based in engineering. Through my MFA studies, I have gained an appreciation for the significant disruption to the history of art theory that has occurred within contemporary times, and have used this insight as a model for an exploration of philosophical connections with the history and ongoing developments in science. I have taken this approach in resistance to traditional ideas that view these two areas of research as noncongruent. This is an effort to establish a continuum of observation between these interpretations of perception. I have presented these theories through a comparison of the postmodern in art to that of paradigms in science. Within any field of research, it is important that ideas do not become entrenched within any one paradigm. Postmodernism provides a basis to critique a past paradigm of western culture for its focus on elitist arts as being superior to popular culture. In this regard, my thesis is an observation of the relativity of human observation, and the resultant interpretations and applied implementations.

While critically regarded as being within the lineage of modernism, the work of the abstract expressionists introduced new methods that influenced later art theories. Abstraction is a method that asks, “are there true random noise phenomena in nature, or are there merely chaotic systems that science has not yet quantified?”

In my research, I have viewed the history of scientific development with the suggestion that contemporary technology will yet again be eclipsed by not yet envisioned
theories of science. The significance of any development can be lost in light of the next, more influential shift in culture. This is seen in contemporary times in the rapid displacement of media technology formats. As disciplines of research become more complex, such that specialization is required for further effective progress, methodologies stagnate into fixed views. The shift from this state may then need to be inspired from outside of the field.

The emerging discipline of creative technologies is recognised for enabling new mediums for exploration by contemporary artists, as exemplified through such examples as the study of coding by artists. In a reciprocal manner, art theory will need to be recognised for making contributions to engineering development. This will be found in the study of both of these fields, at their elemental level of perception, to make connections where they can be interpreted as one continuous human endeavor. As Kuhn writes, “like artists, creative scientists must occasionally be able to live in a world out of joint” 95. This is a comment on the interpretation of uncertainty and recognizes the creativity within both art and science by highlighting the importance of connecting the relative interpretation of observation within these fields.

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95 Kuhn, “The Structure of Scientific Revolution,” 79.
BIBLIOGRAPHY


APPENDIX A: Relativity, Project Layout

Figure 1: Relativity, Project Layout
Overhead Plan View
Image 1: Joseph Kosuth – One and Three Chairs (1965)
© Joseph Kosuth / SODRAC (2017)
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Credit: NASA/JHUAPL/SwRI
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https://www.nasa.gov/image-feature/the-rich-color-variations-of-pluto
Image 3: Jeff Wall - *The Vampires' Picnic* (1991)
Transparency in Lightbox 229.0 x 335.0 cm
Image courtesy of the artist

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http://www.twopalms.us/artists/mel-bochner/archive/18