The Electronic Image: An Object of Time and Energy

Cailean Finn (15147029)

Supervisor

Robin Parmar

Thesis

MA/MSc Art and Technology

Computer Science & Information Systems

University of Limerick

2021

Authors Declaration

I, the undersigned, hereby declare that this submission is entirely my own work, in my own words, and that all sources used in researching it are fully acknowledged and all quotations properly identified. It has not been submitted, in whole or in part, by me or another person, for the purpose of obtaining any other credit/grade. I understand the ethical implications of my research, and this work meets the requirements of the Faculty of Computer Science and Information Systems' Research Ethics Committee.

Student Name: Cailean Finn

Student Number: 15147029

Signed

Acknowledgements

I would like to take this opportunity to extend gratitude to my Supervisor, Robin Parmar, who encouraged me to work on this topic and without whom this thesis would not have been fully realised. Thank you for all the insight and time and most importantly for introducing me to the works of Steina and Woody Vasulka.

I would also like to thank my parents for being a constant source of support for me through this journey and for all that they do for me.

Special gratitude is due to my dear friend, Ruhi Anand, for helping me edit and compile the thesis, and for always bringing me coffee in the toughest of times.

Lastly, I would like to thank all the scholars whose works I have referred and also all the artists who have inspired me over the years.

Table of Contents

Abstract

"Emphasis has shifted towards recognition of the time/energy/object and its programmable building element – the waveform" (Vasulka, 1975).

This study investigates how the visual language of the electronic signal has developed since the 1960s. In order to do so, the study situates video in an aesthetical, technological, and cultural context to acknowledge and understand the key stages of development that propelled video from a technology to a creative medium. This development of the medium was inspired by cultural theories and influenced by aesthetical concerns pertaining to the materiality of the electronic image and signal. The technological advancements also enabled artists to experiment with numerous imaging tools which further helped them fabricate unique instruments to support their creative endeavours through Signal and Image Processing. The works of Steina and Woody Vasulka are highlighted in particular, given their pivotal contribution to the development of the electronic language. Through systematic deconstruction and reconstruction of the electronic image, they were driven to formulate a "lexicon of electronic vocabulary" (Spielmann, 2004) and to establish the capabilities of the technology to understand its potential as a medium for creative expression.

To further appreciate these developments, the inherent characteristics of the electronic signal are explored in this study. This is done to gain insight into the significance of the various experiments carried out by artists that were concerned with the aesthetics of the technological limitations of the electronic medium. Through the process of the three video studies, namely "Embedded Energy", "Electronic Phase", and "Omnidirectional Objects", the understanding that the electronic image is an object of time and energy is achieved.

The video studies utilise a particular set of codes embedded in video to showcase the key discoveries made to enhance the general understanding of the processes responsible for the construction of the electronic "image".

Didactic Approach to Video

Introduction

This chapter aims to answer the question, that is, 'How the visual language of the electronic signal was developed?', to gain an insight into the techniques, processes, and central ideologies responsible for the formation of this electronic dialect. To achieve that, this project aims to observe the development of the visual language discovered by pioneers in the medium of video, especially in the areas of Image Processing and Signal Processing. This chapter opens by expanding the medium of the video within a cultural and technological context. The main focus of this chapter is to explore the changes that occurred in video's formative years by observing how the proliferation of technologies during this period influenced the development of the medium moving forward, while also addressing the various cultural theories such as information theory and cybernetics that were adopted by artists.

The next section introduces the various artists, known as the 'Image Technicians', that played an integral part in the evolution of the medium as they were intrigued by the exploration of the inherent properties unique to video – the electronic signal. Artists such as Nam June Paik, Dan Sandin and David Hall, to name a few, adopted a variety of experimental approaches to further develop the frontiers of video. The tools and techniques used by these artists for their creative explorations of the medium will then be explored, and how their discoveries, and in particular that of the Vasulkas led to the evolution of the visual vocabulary that they were driven to form. In doing so, detailing the most significant experiments that were carried out in the video that had a major influence on the language's development and how that opened up further dialogue into a more coherent understanding behind the construction of the "image" and the electronic signal. It is also important to consider the inherent properties of video and how they were discovered and used to display the potential that the medium offered and what qualities these properties exhibited across the various works developed by artists that were concerned about the aesthetics of the technological limitations of the electronic medium.

Hence, my research seeks to dissect the various works created by the Image Technicians, specifically Steina and Woody Vasulka, that highlight key stages in the development of video from technology to medium. Ultimately, to understand the

semiotics of the electronic signal and to exhibit this understanding through numerous video works.

The study then closes by drawing some conclusions and by answering the research question at hand.

Cultural and Technical Background

In the early 1960s, the genesis of a new art form developed with mass adoption by artists from a variety of disciplines (Andrews, 2006). This art form was called ' Video Art ' and it led to the creation of a new genre. Video art found its place within the temporal arts of music, theatre, dance, literature, and cinema (Andrews, 2006). The medium's formative years were heavily influenced by radical changes in the political, social, and cultural landscapes that were bubbling through the 1950s and 1960s. Artists who were influenced by this shift in their surrounding environment, in turn, inspired the genesis of new art movements and concepts, such as Fluxus, conceptual art, performance art, experimental film, and minimalist sculptures. Video art itself may be further divided into a wide array of contrasting genres, however, it still shares a universal technology, especially in terms of how an image is presented and perceived, further creating a complex and diverse relationship between each sub-genre (Andrews, 2006).

The proliferation of video and imaging tools in particular by artists from the 1960s happened due to the technological transformation that occurred during this period (Andrews, 2006). In the 1960s the Vietnam War was still ongoing, and a resultant was a need for more advanced technologies to enhance military operations (Elwes, 2005). This drive fuelled the technological growth that occurred as a result of the industrial and military technologies being forced to evolve. This enhancement in technologies heavily focused on future research being funded to further strengthen surveillance technologies to make them affordable, inexpensive, and highly portable. This rapid technological advancement led to more equipment being readily available to the general public. This then allowed for a harmonious and culturally diverse proliferation of projects which presented artists with the opportunity to experiment with the new tools available to them (Andrews, 2006).

Until the 1990s there was an extraordinary level of growth observed in the field of electronic and digital imaging technologies as demand from the consumer market and

coinciding computer technologies began to rise tremendously. At this point, advances in the field had completely transformed video and had moved away from the cumbersome techniques that were previously needed to operate crude and inaccurate devices, and towards accessible and easy to operate tools (Elwes, 2005). This displaced the tools previously only used by broadcasters and large corporations into the hands of any and every layperson seeking it.

An understanding of the relationship between technological change and video art is crucial when studying the evolution of the medium. Such an approach offers an insight into the dynamics of this relationship between technology and its cultural form. It also enables us to identify the point of entry that the artists discovered through this approach and how video has inevitably become a far more ubiquitous medium for moving image works. It is interesting to note that in the formative years of the medium, an inherent relationship between technology and video art was developing. This growing relationship is evident in the works of the artists of that time and was supplemented by a period of rapid growth and change in technological capabilities. At this juncture, it may be important to highlight that an artist's attempts at the visual and creative expression of their work is governed by the limitations of the medium's technology and our understanding of it (Marita Sturken, 1990).

In the 1960s, new devices such as the Sony Portapak became available to the general consumer. The Portapak was a portable recorder and camera created by Sony which was brought to the general public in 1965 and was seen as one of the most revolutionary breakthroughs in media since Gutenberg[1] (Lopate, 1974). It enabled the artists to take on the role of the producer, director, and cameraperson for the production of a videotape. The accessibility of this simple to operate device was the initial driving force behind the recapture of video as a creative medium by artists as it exhibited the immense potential to challenge the information structures in America, that were controlled by various institutional organisations and their ideologies (Boyle, 1992) (Elwes, 2005). Artists during this period of time saw video and television as an instrument for political and social change by using this medium of communication to present and distribute new ideologies and concepts to the masses (Elwes, 2005). Their objective was to awaken a new social and political consciousness, dismantling social

[1] Gutenberg introduced printing to Europe with his mechanical moving-type printing press.

structures and norms that were propagated by mainstream media which was governed by commercial, political, and military interests. Nam June Paik, one of the first artists to acquire the Portapak, operating independently on television networks, while purposely distancing himself from the hegemonized industry of film (Elwes, 2005). However, even though early pioneers in video art were focused on transforming both society and the conventions of the high art establishments using this new form of communication, some were also interested in exploring the unique properties of the medium. While many saw video as a tool for capturing reality, a small subset of artists was fascinated and intrigued by the artificial electronic space inside their monitors (Marita Sturken, 1990). Sturken has pointed out that this exploration of the mediums unique properties was partially to distinguish itself from traditional fine art practices such as film and painting, as well as these properties aligning with the concerns of that period – such as conceptual art, minimal sculptures, and structural works (Marita Sturken, 1990).

Media Theory applied to Video Art

A set of Cultural Theories inspired and motivated many new artists during the 1960s to explore and understand the structure, constraints, and possibilities behind the complex relationship between technological systems and human communication. Theories such as Cybernetics and Information Theory may be categorised as what is being referred to as Cultural Theories.

This new perspective that many artists gained empowered them to critique the televisual image. Marshall McLuhan's ubiquitous slogan, "The Medium is the Message"[2] , has been perceived as a perspective, one that became highly attractive to video artists that worked in the medium during this period. McLuhan's ideas, especially the ones behind broadcast television and its idiosyncratic properties, were quite influential at the time. It is interesting to see how Marshall goes a step further to detail those properties and their influence on the programme content and the rudimentary message (Andrews, 2006). The medium could be used and would be explored using the language and insights both cybernetics and information/communication theory had to offer – bringing new ways to engage and experiment with the technology. Marshall McLuhan and his prevalent idea of the time played a crucial role in influencing this

[2] McLuhan, M. (1964). *Understanding Media.* London: Routledge and Kegan Paul.

transformation. McLuhan argued that television was "our most recent and spectacular electronic extension of our nervous system" as it would allow us to utilise our vision like we would use our hand to create an "inclusive image, made up of many moments, phases and aspects of the person or thing" (McLuhan, 1964). In McLuhan's book titled '*Understanding Media*', he examines the medium and talks about the concept of a 'Global Village' that would arise from the development of electronic communication networks (McLuhan, 1964).

McLuhan also stated how the transformation in communication technologies would change the role of the artists entirely, inspired by the ideas and concepts propagated by Claude Shannon and Norbert Weiner surrounding Information theory and Cybernetics (Andrews, 2006). Weiner defined Cybernetics as the study of communication and control in both animals and humans. Today, this can be seen in a diverse number of fields such as artificial intelligence, artificial life, and information theory (Ilfeld, 2010).

Artists who recognised the direct effects of these new concepts when applied to communication systems in our society, began to separate themselves from the governing mode and role of representation when it came to video. In doing so, establishing the video as a self-reflexive practice (Marshall, 1986), identifying that it was not the machine or technology, but what one did with the machine or technology was in fact its meaning or message (McLuhan, 2003). McLuhan also highlights how easy it is for people to be illusioned by the content of the medium which often blinds them to the true character of the medium (Federman, 2004). The influence of this theory is apparent and aligns with the beliefs of the Vasulkas. McLuhan's influence is evident in Woody Vasulka's discussion of the Vasulka's approach to understanding the medium of video. Woody defines his interest in exploring the language of previous media within the new medium (Spielmann, 2004), which overlaps with McLuhan's belief that the content produced by any media consists of various languages from a variety of different mediums (McLuhan, 2003). Artists such as the Vasulkas, Nam June Paik and others who were known as 'Image Technicians', worked to discover unconventional methods of representation. Through the exposure to these cultural theories, they were driven to discover the potential that laid in the image and its underlying structure (Spielmann, 2004).

Experimental Video and The Electronic Signal

The development and evolution of the medium are inextricably linked to developments in technology (Andrews, 2006). As artists began to familiarise themselves with the technology, an understanding of the technical properties of the electronic image grew. This permitted artists to question the flickering realism of the televisual image, which furthered their search for the truth behind how such an illusion was constructed (Elwes, 2005).

During the period between 1965 and 1975, there was an extraordinary amount of research done by artists to explore and understand the medium of video. Artists involved with video began to develop an affinity towards the 'electronic palette', influenced by the era of experimentation and modernist approaches (Sturken, 1996). Through these new approaches adopted, the role of the process was emphasised over the product – shifting their locus towards the structure and materiality of the medium (Sturken, 1996). However, artists working with video may not have had the ability to acquire the imaging tools they wanted or wished for, which drove them to design and bend equipment in a creative manner that was unique to them (Andrews, 2006).

The first generation of artists working with video began to modify and create imaging instruments and synthesisers to assist them in their creative expression of the medium. Artists wanted to build inexpensive and accessible image manipulation devices, which was the driving force in the alternative narrative of representation that was happening during this period (Furlong, 1983).

One of the first set of artists to do so were Ture Sjolander and Bror Wikström. The two Swedish artists constructed synthesizers to manipulate the image. They wished to transform video line-scan rasters with the help of waveform generators by applying electronic distortions (Andrews, 2006). One of the first instances of visual art that was created through manipulation of the electronic signal to be broadcasted was created by them in 1966 and can be found in their work titled *Time* (1966). Both Sjolander and Wikström had already exhausted the traditional modes of representation at the early stages of their careers which pushed them to experiment with the manipulation of the image, viewing it as an exploration of the language of communication. This was heavily influenced by the early works of Nam June Paik (Andrews, 2006).

Artists such as Nam June Paik and David Hall were among a few of the early video artists to move beyond the limitations and explore the technical possibilities of the medium, even during the times of radical socio-political and cultural change. Hall was one of the first artists from the UK to identify and incorporate a self-reflexive approach to his work. Hall enlightened the audiences in relation to his perspective in his essay titled 'Towards an Autonomous Practise' – stating that he was more concerned with works that foregrounded the video as the artwork (Hall, 1976). This is evident from the following quote from his article:

> "Video as art seeks to explore the perceptual thresholds, to expand and in part to decipher the conditioned expectations of those narrow conventions understood as television. In this context, it is pertinent to recognise certain fundamental properties and characteristics which constitute the form. Notably those peculiar to the functions('malfunctions') of the constituent hardware – camera, recorder, and monitor – and the artists' accountability of them (Hall, 1976)".

In the works of Hall specifically, it can be observed that he places a focus on exploring the relationship that exists between broadcast television and imaging technologies, to recognise and highlight the impact the development of technology has had on video art (Hall, 1989). Hall's exploration of this relationship can be seen in his work tilted *This Is a Television Receiver* (1976). In this work, the image is shown to gradually disintegrate which reveals the materiality of the TV (Figure 1).

Another influential example of a video image processing device was the Paik and Abe Synthesizer, which was created in 1969. Paik was inspired by how Sjolander and Wikström brought together image processing technologies in their early broadcast experiments, and so set out to build an image processing device purposefully for his experiments. The instrument that he built with the help of Abe had the capabilities to introduce colour to a monochrome image as well as the ability to distort the image (Devereaux, 2013). Its design was inspired by the audio synthesizer created by Robert Moog in the early 1960s, drawing on the same fundamentals and logic governing the electronic processes produced by both the audio and video signal. Later, both Abe and Paik began to build a video synthesizer called the Wobbulator which possessed the

ability to distort the image in a variety of different ways such as colour, contrast, and brightness (Devereaux, 2013). The Paik and Abe synthesizer highlighted the possibilities backing the instrument and this has been captured in the *Video Commune* (1970), which is a four-hour video broadcast exhibiting the functionality of the device (Hill, 2008).

Further building on the video synthesizer that Paik and Abe built in the late 1960s, Steve Rutt and Bill Etra were driven to develop the Wobbulator further. They wanted to create a synthesizer that would encompass all the capabilities of the Wobbulator in addition to the possibility of implementing zoom to its functionality. With the Wobbulator, Paik had the ability to move something to a variety of different locations across the raster, however, it could not stay in the position it had been moved to (Furlong, 1983). Through their various attempts, they were successful in creating the Scan Processor in 1973. The Scan Processor was essentially a video analogue computer, incorporating many analogue computer concepts such as addition and log functions to be able to produce processes such as oscillators and ramp generators (Collopy, 2014). This new analogue system had the capability to modulate the deflection signals of the CRT monitor display, affecting the time-based structure of the video by re-timing the electronic signal, with the signal processing then disrupting and displacing the television raster (Spielmann, 2004).

The Rutt-Etra Scan Processor is seen to be one of the most influential instruments in video image processing during the 1970s, with many artists such as Gary Hill, Steina and Woody Vasulka, and Nam June Paik utilising and implementing this tool in their workflow and their continued exploration of the medium. It made the instrument more readily available to the artists due to its affordability. What has been a defining moment in the history of video is the discovery that the instrument possessed the ability to transform the traditional video frame into an object, that exists within an undefined space and has the capability to be sculpted via the processing of the signal (Dunn, 1992).

Around the late 1960s, an American artist and engineer named Stephen Beck found himself developing methods of controlling light more precisely and in the pursuit of just that he built the 'Number Video 0 Synthesizer' (Beck, 2000). He later completed the Direct Video Synthesizer which enabled him to create video images without a camera. The Direct Video Synthesiser was viewed by him as an 'electronic sculpting device' as it was built specifically to control the form, motion, texture, and colour of an image

(Collopy, 2014). Beck's synthesisers were also one of the first instances behind the gradual digitisation of video synthesisers with his use of a particular digital logic chip. The incorporation of the digital logic chip was a defining characteristic of the Direct Video Synthesiser as it offered more control over the electronic beam (Collopy, 2014). In Beck's essay titled "Image Processing and Video Synthesis", he identifies four unique categories of electronic video instruments, namely (Beck, 1976):

1. Camera Image Processing
    - This category includes techniques such as Colorizers, Keyers, Quantizers.
2. Direct Video Synthesis
    - This process includes the creation of a complete TV signal is from electronic generators without the use of a recording device.
3. Scan Modulation/Rescan
    - Under Scan Modulation, the principle of a recording device observing and oscilloscope / television monitor which displays the image from another television source. The image then is manipulated via deflection modulation.
4. Non-VTR Recordable
    - Under this category includes video displays that do not produce a standard waveform and cannot be recorded by means of magnetic tape. The distortion of the image is primarily based on a magnetic distortion of the normal TV scan patterns.

Beck describes the various methods and techniques artists used at the time for the construction and exploration of the image while foregrounding the potential of video through the exploration of its inherent properties (Beck, 1976).

Overall, it can be seen that the artists working in the medium of video during this period wanted to explore, observe, and create different representational modes of the image in attempts to distance themselves from the direct representations of reality as the main method of communication. Some artists were doing so by exploring pre-existing devices that possessed the potential of electronic image processing that was specifically made for broadcasts, such as Sjolander and Cahen, while other artists like Paik and Beck were driven to construct their video processing instruments to suit their particular creative endeavours. The experiments carried out by this first generation of

video artists were crucial in the development of the medium, shifting the approach to video entirely while inspiring other artists to explore the electronic signal further through various image processing techniques and direct synthesis methods to uncover the hidden syntax behind the construction of the video image.

In relation to the term 'Image Processing', its true definition has been obscured throughout the early years of video. It was used as an umbrella term in commercial and video-art domains, possessing a wide array of varying meanings. Given the popular perception of image processing being linked to different stereotypes such as densely layered hallucinogenic imagery and geometric abstractions, its true meaning became diffused (Furlong, 1983). However, at its core, Image Processing describes any technical process that would alter the video image quite dramatically, through the use of the electronic signal and later being used to include any sophisticated graphics and effects created in the digital era.

In Lucinda Furlong's essay 'Tracking Video Art: "Image Processing" as a Genre' she identifies a connection between what was happening in the art world at the time, and the "modernist credo of exploring the basic properties of the medium" to Image Processing (Furlong, 1983). Artists working with video during this period of exploration started to treat the electronic signal as a plastic medium, or a medium that possessed its inherent properties that could be isolated. Furlong argued that this shift in perspective was crucial to the development of the image-processing aesthetic, further helping the medium to receive acceptance from traditional art institutions as a result of highlighting its formalist characteristics (Furlong, 1983). Artists such as Dan Sandin and Ralph Hocking wanted other artists to work with video at a fundamental level. They wanted artists to implement and explore the various parameters inherent to the electronic signal, such as, frequency, amplitude and phase which define the resultant image or sound (Furlong, 1983).

In Dan Sandin's heuristic approach to the electronic medium as explored in his work titled *How TV Works* (1976), he highlights the underlying mechanics behind the construction of the televisual image, in doing so foregrounding the major differences in the medium operating in comparison to film. Sandin distinguishes the temporal-spatial unity of an image as a "frame" and the information "encoded" within the electronic signal through the scanning lines that ultimately generates the video image,

characterising the transformation of the electronic signal into its transformation into the image form as “Imagery” (Spielmann, 2004).

A set of artists that have been influential in the critical and analytical mapping of this paper are Steina and Woody Vasulka. The Vasulkas are seen as one of the most prolific artists in image manipulation technologies in the United States, exploring and working with sound and video since the late 1960s (Andrews, 2006). Woody and Steina Vasulka first met in Prague when Woody was studying to be an engineer and a filmmaker, and Steina was studying the violin and music theory (Andrews, 2006). However, after marriage and after moving to the United States, Woody became fascinated with the transformative quality of the electronic image, and from then began to move away from film towards video (Sturken, 1996). The decision to work exclusively in the video was made in 1969, shortly after they integrated with the growing avant-garde and experimental video scene in New York. In 1971 the duo co-founded ‘The Kitchen’ as a means for working and collaborating with other artists and activists working in video, sound, and performance (Andrews, 2006).

Since their move to video, the Vasulkas have been focused on exploring the potential of video through their work. Their approach has been categorised as a didactic one that focuses on the materiality of the video image in pursuit of the development of an electronic vocabulary through a process of systematic deconstruction and reconstruction (Spielmann, 2004). In their early exploration of the electronic medium, they conceived video as the signal, describing it as an object of energy and time (Andrews, 2006). This perspective of video as a ‘pure’ signal enabled them to discover a connection between sound and image, and in the majority of their early works, this relationship can be seen to be explored (Andrews, 2006).

Throughout the 1970s, the Vasulkas collaborated with several electronic engineers and designers to create various machines to develop a medium-specific vocabulary, consisting of the ‘Field Flip-Flop Switcher’, the ‘Dual Colorizer’, the ‘Multikeyer’, the ‘Programmer’ and of course also using the Rutt/Etra Scan Processor (Andrews, 2006). The Rutt/Etra Scan Processor was one of the machines, in particular, that was highly influential in their early work. It allowed them to analyse the electronic signal. Comparing it then to Woody’s early work in video, it is evident that this new path fully augmented his understanding of the electronic image, fascinated by the energy, fluidity, and malleability of the frameless image (Gagnon, 1994). This shifted their recognition of

the electronic signal towards a time/energy object and its programmable structural elements – the waveform (Vasulka, 1975). This exploration of the waveform is visible in their work titled *Time/Energy Structure of the Electronic Image* (1974-75), produced exclusively with the Scan Processor (Figure 2). Woody's intention with this tape was to open up the dialogue around the potential of the waveform, in which light is the source of energy that is "sculpted" (Gagnon, 1994). He wanted to force the electronic medium into abstraction in an attempt to establish the foundations of a new visual syntax liberated from conventional lens-based representations.

The works of Woody and Steina Vasulka will be discussed in depth in the following chapter. A brief introduction to their work was given to establish an overview of their work and the impact it had on the development of the research question. The examination and exploration of their catalogue were crucial towards furthering my understanding of their contribution to the development of the new visual language for the medium of video. This study aims to enhance my understanding of the fundamental syntax backing the electronic medium and the creative strategies used by the Vasulkas and how their work influenced emerging electronic media.

Development & Research

The Materiality of the Electronic Image

After looking at the works of the artists who have produced experimental videos, it is now imperative to introduce some of the fundamental elements of video that may help one appreciate the experiments undertaken and the approaches adopted while working in video. The main reason for choosing to analyse the works of this group of experimental video artists, also known as the 'image technicians', is due to their focus on highlighting the inherent characteristics unique to video and its structure.

During early experiments in video, the works that artists produced were a direct reflection of their concern around the technical specificities of the medium and therefore, the majority of these experiments were self-reflexive, revealing the underlying organising principles of the image to establish the semiotics of the electronic medium. Such experimental practices enabled conventional conceptions of the medium to be constantly put into question and in doing so leading it to its inevitable expansion such as installations and sculptural works. The artists who have contributed greatly to

the development of the electronic vocabulary have been categorised as the image technicians as they have been focused on the aesthetics surrounding the technological capabilities of the medium, each artist fielding their unique approach towards this exploration and the development of the electronic vocabulary.

During this period of intense experimentation, artists were keen to distinguish the new medium of video from its predecessor, film. In their attempt to successfully separate the two mediums and their contrasting technologies, followed an exploration into the unique properties of the medium (Spielmann, 2004). The fixity, fluidity and transformative capabilities were tested upon and brought into question by artists. The electronic medium in comparison to the film revealed that the image could arise from a variety of places within the technical settings such as the camera, screen, or image processing devices (Spielmann, 2004).

In the following sections, three fundamental components concerning the materiality of video will be explored in depth. These three components have been specifically chosen, as they highlight key phases of development in the evolution of the medium in regard to its structure, temporal, and spatial capabilities. It will also offer insight into the works that influenced the creation of the final video studies.

1. Matrix

The Vasulka's series titled, *Six Programs for Television* (1978) is a phenomenological exercise on the construction of the electronic image and sound, demonstrating the transformative nature and flexible aspects of the medium. The audio-visual event is exhibited in the videotape installations titled *Matrix* (1970-1972). In *Matrix I* and *Matrix II*, which are both single-channel video installations, where sound is generated by the electronic image, while also the image is created by sound the Vasulkas demonstrate the deconstruction of image and sound in its most basic form, to investigate the nature of the electronic medium. The Vasulka's experiments of the *Matrix* are a cursive exhibition of the essential elements that are inherent to the electronic medium. This work, in particular, foregrounds the structural components of the electronic signal, revealing the flexibility and transformative qualities of video and its ability to engage with multiple aural and visual forms.

Matrix showcases how image and sound are structural expressions of video noise, which is a phenomenon inherent to the structure of a matrix. The term "noise",

borrowed from audio, can be understood as the raw matter of the electronic medium. However, in its most simplistic form, noise is a "random grouping of black and white pixels changing position every 25-30 times a second" (Spielmann, 2006). It is something that we do not acknowledge, a signal branded with a disorder, controlled by its laws (Gagnon, 1994).

This raw material is the electronic energy of the video signal from which any structure is fabricated from an unorganised and amorphous matrix (Gagnon, 1994). In both media and philosophical discourse, the matrix is recognised as a hidden structure that only becomes visible when the matrix is forced to retain its visual order, an order that is active yet concealed by the order forced upon it (Gagnon, 1994). This phenomenon is further explored in Steina and Woody's work. For example, in *No. 25*, this visual order is deconstructed and brought into focus. Again, similar to the experimentations carried out on video noise in *Matrix*, the phenomenon of noise is explored further. In doing so, the Vasulkas wished to heighten our awareness and understanding of the image and the language concealed in it, the unstructured energy that underpins the potential of all video (Spielmann, 2004). In *No. 25*, the recorded video is manipulated by voltage and frequency. Woody achieved this by processing random noise formed from the process of reversing a videotape into the scan processor (Spielmann, 2004).

Time/Energy Objects is another videotape by the Vasulkas which focuses on further experimentation of "noise objects" (Spielmann, 2004). In this work, waveforms are transformed through modulation. The noise that is concealed in nature by the image, is brought to the fore and is augmented extensively – creating many complex structures that are endlessly in motion. These objects of energy act as models of images, and like the other experiments carried out by the Vasulkas, it can be seen to uncover the identity of the matrix in electronic imagery, with a goal in mind to heighten our awareness of this unstructured form of energy (Spielmann, 2004).

The conception of this video signal as this time/energy object was shared amongst various experimental artists such as Stephen Beck and Nam June Paik, recognising and giving importance to the structural elements of video in their work. One work in particular which I believe is an excellent demonstration of these core concepts is in Stephen Beck's tape titled *Conception*(1972). The solid form of the human body begins to gradually diffuse into a video signal in flux. Beck has achieved this by controlling the

electronic beam, which in turn manipulates the raster lines to distort the image. The white noise that produces the static suggests the significance of content and purpose of function in how we perceive, engage, and understand the medium (Gagnon, 1994).

The final work that will be discussed in relation to the exploration of noise as a key structural element of the video is *Noisefields*(1974) by Steina and Woody. This work was chosen to be discussed last as it has been an imperative source of inspiration for my work titled "Embedded Energy". *Noisefields* is a valuable and prime instance of the Vasulka's work, that highlights their early formal and technical exploration of the medium. The work appears to be simplistic, but the imagery introduced refers to the detection and unveiling of the elementary information embedded within the electronic signal - noise (Spielmann, 2004). In this work, a circle is positioned in the centre of the frame as electronic snow or noise is keyed through the structure of the circle, while with the help of a video sequencer, it switches between two separate video signals (Figure 3). Finally, to add variation, a dual colouriser is used, processing the imagery to alter its colour and intensity. This piece by the Vasulkas is an ideal exhibition of the organising principles that are responsible for the construction of the video image, an audio-visual modulation of video noise (Spielmann, 2004).

2. Unbound Frame

Discs(1970) is another example of a videotape by the Vasulkas that highlights the flexibility and movement of the frame (Figure 4). This tape is an exploration of the horizontal drift phenomenon exploited through the use of time errors. By re-timing the motion of the reel set to the horizontal frequency and as a result, a time delay was produced which was derived from the re-entry of the signal into the raster system, filling the screen with abstract patterns that are constantly in motion (Spielmann, 2004). This horizontal stream is made to travel across an array of TV screens that have been stacked on top of each other, adding a vertical dimension to the horizontal expansion.

This work in particular was crucial in expanding on and defining the semiotics of the electronic signal for the Vasulkas. The key elements learnt from this experiment were in observing how the kinetics of the electronic signal functioned and how the directional movement of the signal is identical in both spatial and temporal dimensions (Spielmann, 2004).

The Vasulka's early investigations in the phenomenology of the medium can be viewed as an effort to decouple video from film as they analysed the various media codes presented in the moving image (Sturken, 1996). The examination of the frame has been a key principle in their work to distinguish film from video. In comparison to video, film is bound to the rigid structure of the frame, with the structure consisting of individual still frames projected at a speed of twenty-four frames per second. However, the electronic signal enabled this notion of the frame that has been established from film to be transgressed, and the "frame-unbound" video image to be recognised as an object that had the potential to be moulded through temporal and spatial manipulation (Bongiovanni, Duhard, & Fargier, 1984).

Another work that explores the temporal and spatial characteristics of the video image is in their videotape titled *Evolution*(1970). In this work, the technique known as "horizontal drift", coined by the Vasulkas, explores the development of the image between the various moving image technologies (Figure 5). Horizontal drift was a central visual motif to the work as the standard evolution chart of human development travels across the frame in a backwards motion (Sturken, 1996).

3. Time & Energy Objects

The final attribute of video that will be discussed when observing the specificity of the medium is that of its omnidirectional properties. The electronic "image" produced by video can be considered omnidirectional due to its simultaneity and density (Spielmann, 2004). Generally, media theories conclude that the primary characteristic of the electronic image is its ability to be presented immediately on the surface of the screen. However, it can be better understood as "image" without image, as there is not unifying material that constructs the "image" but is created through signals processing "noise" that has the potential to become something that corresponds to an image (Spielmann, 2004). The electronic image in this instance loses direction as a result of this omnidirectional space, where its angles and coordinates vary and exchanges the vertical and horizontal (Deleuze, 1985). The omnidirectionality and multi-dimensional nature of video allow the image to be expressed as an object. In the case of Steina and Woody Vasulka, they have radicalised this theoretical statement, transgressing the notion of the frame and towards an understanding of it possessing a sculptural dimension – Time/Energy object.

In works created by the Vasulkas such as *No.25, Time/Energy/Objects, The Matter, C-Trend* and *Explanation*, the sculptural capabilities of video are exhibited. In these experiments, the Rutt/Etra Scan Processor was instrumental in providing density to the electronic image, demonstrating the non-fixity of the medium through signal processing. In *No.25,* the Scan Processor manipulates the imagery embedded within the raster lines electromagnetically, enabling that information to be augmented into a 360-degree shape that appears as an abstract object (Figure 6) (Spielmann, 2004). Through modulation of frequency and voltage into numerous geometric forms, it showcases how elementary it is to manipulate the dimensions and direction of the electronic signal. *Time/Energy/Objects* also experiments with how these "energy objects", as Woody calls it, can be controlled. These "objects" can be seen to be bent, stretched, and compressed in all directions, recognising the frame as a spatial object. In *C-Trend*, Woody explores this tension between the unbound and bound frame in video, transforming the content recorded footage into an "object". This was one of the first instances where the content, regardless of it was generated from a waveform or a camera fed input, was manipulated to appear 3-D where the "Emphasis has shifted towards recognition of the time/energy/object and its programmable building element – the waveform." (Vasulka, 1975).

For Woody, the Scan Processor was seen as the initial step forward towards understanding the language hidden within the electronic signal. This instrument enabled Woody to dissect the essential components of the electronic image, departing from the two-dimensionality of video and the potential of its recognition as an "object". Woody's research into understanding the structure of the frame can be seen as foregrounding 3-D computer graphics which is interesting to note.

Methodology

In this section, the approaches towards the research thus conducted will be explored, while also detailing the processes behind the practical work carried out. The technical aspects of the project such as the tools that were utilised in the creation of the practical studies will be discussed, providing an overview into why those tools and techniques were specifically chosen, and the advantages and disadvantages gained from utilising a specific set of tools when compared to alternative approaches.

Research and Process

Throughout the development of the project, both the processes of research and practice have been closely linked and were highly dependent on one another. I started by researching and exploring the technical, cultural, and aesthetical context. This helped provide an insight into the main ideologies that were under question surrounding the materiality of the electronic signal and also helped me understand how the electronic vocabulary of video was gradually developed. Through the research of the works of various artists and research papers, I was able to analyse some of the approaches and philosophies propagated by the artists which proved to be a key inspiration for the creative practice. Although the research provided knowledge behind the functionality of the analogue tools used by artists at the time, experimenting with the tools individually yielded a deeper level of understanding of how these systems operate, both independently and collectively. The experimentation enabled me to materialise my own thoughts through the creative artefacts which significantly enriched the research.

After much consideration, I adopted practice-related research, wherein I attempted to understand the creative artefact itself which enabled me to give a form to the thought (Skains, 2018). Arguably, such a framework allows for knowledge to be naturally developed through observations arising from the creative practice in combination with exegesis formed through related materials (Skains, 2018).

The processes adopted by me for the exploration of the electronic signal have been inspired greatly by the methods incorporated by the Vasulkas in their experiments in the development of the electronic vocabulary. This particular method of experimentation that the Vasulkas adopted is based on the idea of exploring the construction principles of electronic image and therefore requiring a process of deconstruction (Spielmann, 2004). The Vasulka's works showcase a process that is dialectic, which may be defined as a process of deconstruction and construction that connects the aesthetics and technical attributes of the electronic medium. Such an approach, which is structural and naturally self-reflexive, assisted the Vasulkas in their understanding of the syntax of video (Spielmann, 2004). Ultimately, the work and research developed and explored through these video studies reflect the didactic approach of the Vasulkas surrounding the organising principles of the electronic image.

Technical Aspects

Instruments and techniques such as the Wobbulator, Direct Video Synthesiser, Rutt/Etra Scan Processor, Colourisers and Keyers were used to manipulate the electronic signal. However, after some research into the feasibility of acquiring or building such archaic analogue tools used by the artists of this era seemed unfeasible due to the discontinuation of such instruments.[3] In recent years, various companies, such as LZX Industries, have been created to make analogue video synthesisers more accessible for independent artists. Unfortunately, the interest in video synthesis and working with analogue video is still a niche practice, leading the price of units built by such companies and other independent engineers to be expensive. In addition, the size of the teams behind the creation of these products is small and therefore, the building process only begins once a product is purchased which leads to long wait times. For these reasons, the exploration of the electronic signal through analogue devices was not feasible, especially given the time constraints for the Dissertation.

The impracticality of using analogue tools made me research the digital tools and software available to facilitate the exploration of the electronic signal. While researching what could be achieved and offered from digital alternatives, I came across the *Vsynth* package in *Max/MSP/Jitter*. *Max/MSP/Jitter* is a powerful visual programming language created by the software company Cycling '74. The software is tailored towards the development of audio and visual media as it is capable of performing both audio synthesis and video processing. *Vsynth* is a set of modules built around *Gen*[4] that takes advantage of the efficiency offered by hardware-accelerated software to create a video processing environment that simulates the analogue processes inherent to video synthesis. After experimenting with the package, I felt that it was, both an accessible and well-designed software for video synthesis and image processing that offered fast real-time video production and infinite possibilities in comparison to similar software (such as *Cathodemer* and *LUMEN)*. The package includes a variety of modules that are commonly used in video synthesis and image processing, such as multiple waveform generators, oscillators, mixers, faders, keyers, colourisers

[3] Although, there is still a small subset of contemporary artists that practise video synthesis through analogue devices, most of these devices can be found in the Do-It-Yourself scene, where in one may manipulate the circuits of old video processors, imaging devices and synthesisers.

[4] Gen is an extension of the Max patching environment, that gives developers the ability to covert what is usually built visually into compiled code.

and displacement tools that simulate the capabilities provided by their physical counterparts. Lastly, all the work produced across the three studies was created in and only in *Vsynth*, as the aim was to keep it completely ad hoc without any post-processing effects applied from external software.

Although using digital software and its ability to virtually simulate instruments and processes used in video synthesis and image processing can be advantageous, however, it comes at a cost. It has been argued that working with digital tools that simulate the analogous elements is as good as not working directly with the electronic signal at all as it is not a true representation of the electronic medium, which may bring into question the credibility of the processes and techniques used to produce a project exploring the structure of the electronic image in such a manner. Curiously, throughout the history of synthesisers, analogous synthesisers have been used in conjunction with digital computers in the pursuit of full control over the instrument. For example, Becks' implementation of digital logic chips in his Direct Video Synthesizer, was used to control the activation of the electronic beam to manipulate the raster lines (Collopy, 2014). Digital computers have been a source of greater control when using analogue synthesisers. With artists such as, the Vasulkas and Nam June Paik, integrating the LSI-11 minicomputer into their analogue instruments to acquire more control over their image-processing equipment (Furlong, 1983). Even today, there are instances of instruments, such as Dan Sandin's Image Processor, that are integrated with digital systems that host Max and Jitter programs (Hoking, Hoking, & High, 2009). It is in fact the industrious and determined work of experimental artists exploring video through analogue technologies that have facilitated and influenced the new electronic medium of the digital.

However, in the context of this paper, the focus of the research is on the development of the electronic vocabulary inherent in video, with an aim to provide an understanding of the structure of that language. The use of digital software, that has accurately virtualised this language, is sufficient for the purpose of this project.

Study 1: Embedded Energy

The first video study explores the underlying language of the "matrix" and the phenomenon of noise that is ingrained within video. In doing so, creating a work that utilises video noise as a primary visual element. The goal behind creating this work was

to foreground the structure responsible for the construction of the image. As stated above, the work *Noisefields* created by the Vasulkas was a primary source of inspiration behind this particular study.

Initially, the video signal displayed is engulfed in a sea of black and white electronic snow which then begins to slowly diffuse, revealing the hidden structure of a circle. The structure then gradually returns to its initial form as the matrix of noise degrades, unveiling an order within the chaos as the cycle continues (Figure 7). Similar to the Vasulkas, this work aimed to highlight the process behind the structure of the electronic image. This process was also designed to showcase the source and power of the energy responsible for its creation.

However, several important differences separate this work from *Noisefields*. Instead of just presenting the structure behind the video signal, the process behind its construction is underlined and is an essential component of the work. Instead of simply keying the noise in and out of the circle and frame, the horizontal and vertical scan lines responsible for the formation of the video noise are deconstructed and reconstructed. To achieve this, two Waveform Generator modules were used to produce both vertical and horizontal noise at a high frequency. These two oscillators were then patched together through Phase Modulation to create the noise field that is seen at the beginning of the video. The frequency of both the Waveform Generators was then controlled by a Low-Frequency Oscillator which oscillated between a frequency range of 0–120Hz, which in turn transform the size of the matrix over time. The final output produced by the combination of these modules was then processed through a Shape Waveform Generator, manipulating the image of the circle through modulation of its frequency. Similar to *Noisefields,* modules such as colourisers and keyers were used to add variance to diversify the process.

In addition to the video signal, another crucial element that contributed to the form of the work was the conversion of that video signal into audio. This conversion of the electronic image into sound is one of the primary characteristics common across the video works of the Vasulkas. The transformative and flexible nature of the electronic signal offers further engagement with the inclusion of the aural form. This specific study focuses on the structure of the electronic image and hence introducing an aural dimension was vital, as it has been argued that image and sound are recognised together as structural expressions of video noise (Spielmann, 2004). After extensive

experimentation and fine-tuning of the parameters of the various modules mentioned above, the work was completed and given the name “Embedded Energy”.

Ideally, this work was made in hopes that it would be presented in a gallery setting, with the patch running continuously. However, due to the many constraints surrounding the presentation of our work as a result of the COVID-19 pandemic, an alternative approach needed to be considered and adopted. The decision was made to record a segment of the patch and create a video that was modelled directly from the format used by the Vasulkas in their videotapes. This format included a short title sequence detailing the name of the work and the name of the artist, followed then by the actual study.

Study 2: Electronic Phase

After exploring the form of the matrix and the phenomenon of video noise present in its structure, the next characteristic that was explored was understanding the kinetics of the electronic signal. The second video study was heavily inspired by the experimentation surrounding the technique of “horizontal drift” in *Evolution* and *Discs*. However, the aim of this study was to not only foreground the horizontal motion of the signal through the frame but also to investigate how light temporally, and spatially traverses across the screen. This is a key distinction between the objectives of the Vasulkas and this video study.

For this study, I first synthesised two rectangles to capture the movement of the signal in the vertical and horizontal axis that overlapped each other. This overlap along with a Blend Mode mixer, enabled the intersection of the vertical and horizontal lines to be isolated, thus creating a square. The lines were then temporally synchronised and set into a sinusoidal motion with the direction of each line following its initial orientation. This patch was designed specifically to mimic the diurnal motion of the Sun as it cycles across our sky, to both symbolise and showcase the kinetics of the electronic signal (Figure 8).

I then keyed a second video through the vertical and horizontal lines with areas of the video source being gradually revealed as the lines cycle through the frame. The footage used consists of time-lapses of two landscapes which complimented the symbolic movement of the horizontal and vertical lines, which were then processed through multiple Colouriser modules to add variation between cycles. In an attempt to

make each cycle unique, experimentation with a wide array of blend modes and video feedback was conducted and included as a part of the final work.

Lastly, to pay homage to one of Woody's works titled *The Commission*(1983), a video signal that consists solely of video noise was added to frame the primary video source (Figure 9). However, in the final iteration of the video study, the size of the noise that framed the image was reduced due to its contrasting visual appearance to that of the main content. The aural dimension of the visual image was retained in "Electronic Phase" for the same reasons as discussed in the previous study.

Study 3: Omnidirectional Objects

For the final study, I was interested in investigating and experimenting with the spatial dimension inherent in the electronic "image" produced by video. In contrast to the first two video studies that highlight a certain process, I decided to depict numerous examples of video's omnidirectionality through my final iteration. Woody's work titled *Art of Memory*(1987) was a major influence in the creation and direction adopted in this video study. *Art of Memory*, which is considered to be his most famous works, demonstrates the potential of the electronic signal in diverging from the two-dimensional notion of the video screen. Instead, through these visual "codes" a narrative is explored, a multi-faceted audio-visualisation of fragmented memory that recalls upon the catastrophic events that defined twentieth-century history (Conomos, 1987). Through this study, I to achieve an understanding of the processes behind the transformation of the image forms seen throughout the videotape, to create what appears to be three-dimensional objects that float across the screen (Figure 10).

The key tools used in this study includes two displacement modules from the *Vsynth* package. The first displacement module was designed to simulate the functionality of the Rutt/Etra Scan Processor, which enabled the spatial dimension of the video image to be accessed. Similar to the scan processor, the displacement module produced a flat skeletal plane that could be moved in the x, y, and z-axis, with the brighter sections of the "image" increasing in height. The second displacement tool was used to bend and stretch a two-dimensional video source, to mimic a layer of distortion that could be applied to an individual input. Multiple Waveforms could be synthesised and passed through this module which would then control the x, y and zoom modulation, resulting in the distortion of the video input. Through the combination of the two displacement tools, I was able to construct effects similar to the ones utilised in *Art of Memory* to

convey the omnidirectional properties of the electronic image. The transitions seen in the video were also created and implemented in Vsynth which were inspired by the transitions used in *Art of Memory*.

The video study itself comprises of multiple segments which take advantage of the displacement tools discussed above to transform pictorial space into an experience of space as time. The completed work consists of eight segments, most including a blend of flat two-dimensional imagery, inspired by the vast landscapes seen in *Art of Memory*, and three-dimensional "objects". The second and fifth segments are exceptions to this as they exclusively consist of objects. The reason behind this superimposition was to emphasise the expressive possibilities of the electronic signal and offer a shift in perspective of how we experience space. Figure 11 is a still from the final segment, selected to showcase this superimposition.

Finally, the video was named "Omnidirectional Objects" and a title screen was added to showcase the omnidirectionality inherent to the electronic "image". Dan Sandin's *How TV Works* was also sampled in this study as a source of visual material to be manipulated and distorted. The aural dimension in this video study was also retained for the same reasons discussed in the "Embedded Energy".

Conclusion

In conclusion, the pioneering work and research carried out by experimental video artists in the 1960s propelled video from a novel technology to a standalone medium, one that was filled with creative potential. This period was a time of immense experimentation in video, where artists began embracing more modernist methods that prioritised process over product, with their focus shifting to the material and the structures present within it. For the artists, this resulted in the pursuit of an understanding of the phenomenology of video. This period of experimentation was also fuelled by technological advancements with the individual artist having access to a range of commercial components, that were manipulated by artists and engineers to fabricate unique electronic instruments that assisted them in their creative endeavours.

However, it has been argued that Steina and Woody Vasulka played a central role in the history of video art. The Vasulka's contributions to the development of the electronic vocabulary and their tireless experimentation with various imaging tools

have awarded them both the title of an artist and an innovator. They have also contributed tremendously to the broadening of video's expressive limitations through systematically deconstructing and reconstructing it, to understand its function and application in the arts. Through this investigation of the medium's creative potential, the Vasulkas have defined a dialect of interlinked processes derived from the machine itself, sharing a creative process with the technology to decipher its code and identify its capabilities in hopes of controlling it.

A historical and cultural exploration of the works of Steina and Woody offers one an understanding of how they may have formulated creative strategies. The atmosphere and yearning for innovation in the 1960s seems to have played a crucial role in the development of their creative strategies. Video for the Vasulkas signified a system of languages that suggested a new set of codes, with their investigation of the medium's specificities being guided by the cultural theories of media theoretician Marshall McLuhan. The Vasulkas and McLuhan shared a common outlook of imaging technologies being an extension of the human nervous system. They also seemed to agree on the fact that knowledge is derived from a source that then expands exponentially. This understanding is visible in the discovery of something analogous to knowledge by the Vasulkas, to establish the medium of video as an instrument through which knowledge may be shared. It is also important to recognise this intersection of art and technology that occurred during the 1960s and how that may have moulded the vision of the Vasulkas in their exploration of the electronic image's hidden potential. The instability prevalent in the socio-political, and cultural landscape paired with finding a particular way to form this intersection, empowered the artists to question the existing social structures and to defy archaic artistic laws. Historically, video was a medium that was obstinate from art history and tradition, one that especially appealed to artists of the period. It was considered to be an undiscovered expanse that was electronically derived from pictorial space. This newfound perspective helped shape the Vasulka's vision for video as they began to question previously defined truths about language structure and the role of the machine.

Steina and Woody's shared affinity for the electronic signal enabled them to engage with the semiotics of the electronic signal to redefine the organising principles of video by addressing the underlying mechanisms surrounding its kinetics, structure and its metaphysical merging of time and energy (Sturken, 1996). This engagement is apparent

in works such as *Time/Energy Objects*(1975), where Woody experiments with varying visualisations of the electronic signal and with the multidimensional capabilities of the medium, thus creating the illusion of three-dimensional objects. The Vasulkas created a language that defined the capabilities of the medium during this era of emerging electronic communication technologies, imaging systems and cultural change. In doing so, creating visual works that explored the mechanisms responsible for the construction of the televisual image, to transform our preconceived notion of the "image" by unveiling the processes responsible for its creation. However, Woody seems to be especially interested in the construction of the electronic vocabulary which is apparent in his systematic approach towards the medium, architecting works that are reflexive in practice that strip the medium down by isolating its essential components (Spielmann, 2004). They understood video as a new mode of visualisation that was not limited to surface expressions (Spielmann, 2004).

The three video studies created by me express and capture the same sentiment as that of the Vasulka's in relation to the medium of video and the electronic signal, to answer my research question, that is, 'How the visual language of the electronic signal was developed?'. Through a dialogue with imaging tools, I wanted to try and understand the mechanisms responsible for the production of the "image". Each video study explores one particular fundamental component of the electronic image such as its structure, motion and omnidirectionality. Through experimentation with these mechanisms and the insights gained from dissecting the works of the Vasulkas, I was able to expand my understanding of the electronic language and how it functions as a creative tool. Even though these works are quite systematic in their approach to the foregrounding and dissecting of the underlying processes responsible for the construction of the "image", one ideology that stood out was the perspective of the electronic signal as an object of time and energy (Vasulka, 1975). This view of the electronic image as a time and energy object, which was explored extensively by the Vasulkas, is arguably more natural when compared to how digital technologies operate today and for this reason, a central theme stemming across my three works is observing the functionality behind the time and energy object in the production of an image, and how that language can translate to more natural systems of light and energy. This understanding was only formulated during the later stages of the study.

Through dialogue with machines, Steina and Woody Vasulkas produced works that contributed to a deep catalogue of rich resources that served both as a framework and locus of departure for those who came after, that had a major influence on upcoming electronic media. I would like to follow suit by exploring the connection between the two systems of light and energy in the future not only for the creation of creative artefacts but also to enhance the existing pool of knowledge.

Works Cited

Andrews, C. M. (2006). *A History Of Video Art: The Development of Form and Function.* New York: Berg.

Beck, S. (1976). Image Processing and Video Synthesis . In B. K. Ira Schnider, *Video Art: An Anthology* (p. 184). London and New York: Harcourt, Brace, Jovanovitch.

Beck, S. (2000). Beck Direct Video Synthesizer. *Lecture Berkeley Art Museum* .

Bongiovanni, P., Duhard, J. M., & Fargier, J.-P. (1984). *Hommage a Steina et Woody Vasulka.* Montbeliard, France: 244-55.

Boyle, D. (1992). From Portapak to camcorder: A brief history of guerrilla television. *Journal of Film and Video*, 67-79.

Collopy, P. S. (2014). Video Synthesizers: From Analog Computing to Digital Art. *IEEE Computer Society*.

Conomos, J. (1987). The Art of Memory. *Photofile*.

Deleuze, G. (1985). *Cinéma 2. l'Image–temps.* Paris: Paris: Editions de Minuit.

Devereaux, E. (2013). To Whom It May Concern: Nam June Paik's Wobbulator and Playful Identity. *Leonardo Electronic Almanac*, 19(5).

Dunn, D. (1992). *Eigenwelt der Apparatewelt : pioneers of electronic art.* Santa Fe, New Mexico: Ars Electronica.

Elwes, C. (2005). *Video Art: A Guided Tour.* London: I.B.Tauris & Co Ltd.

Federman, M. (2004). What is the Meaning of the Medium is the Message. *Preuzeto sa http://individual. utoronto. ca/markfederman/MeaningTheMediumistheMessage. pdf. Uticaj interneta na tradicionalne medije*. Retrieved from Preuzeto sa http://individual. utoronto. ca/markfederman/MeaningTheMediumistheMessage. pdf. Uticaj interneta na tradicionalne medije.

Furlong, L. (1983). Notes Towards a History of Image-Processed Video. *Afterimage 11.5*.

Furlong, L. (1983). Tracking Video Art: Image Processing as a Genre. *Art Journal*, 234.

Gagnon, J. (1994). Video / Sonority: Video Born of Noise. *National Gallery of Canada*.

Hall, D. (1976, May). British Video Art: Towards an Autonomous Practice. *Studio International*, pp. 248-252.

Hall, D. (1989). Video Art - the Significance of an Educational Environment. *Video Positive Catalogue*, p. 47.

Hill, C. (2008). *Rewind: A Guide to Surveying the First Decade: Video Art and Alternative Media in the U.S., 1968-1980.* Chicago: Video Data Bank.

Hoking, R., Hoking, S., & High, K. (2009). Radical Learning, Radical Perception: A History of the Experimental Television Center. *ETC: Experimental Television Center 1969-2009*, 25.

Ilfeld, E. J. (2010). Contemporary Art and Cybernetics: Waves of Cybernetic Discoursewithin Conceptual, Video and New Media Art. *Historical Perspective*

Lopate, P. (1974). Aesthetics of the Portapak. *Radical Software*, 18-21.

Marita Sturken. (1990). *Paradox in the Evolution of an Art Form: Great Expectations and the Making of a History.* New York, NY: Aperture in association with Bay Area Video Coalition.

Marshall, S. (1986). Video From Art to Independence. *Video by Artists 2*, p. 34.

McLuhan, M. (1964). *Understanding Media.* London: Routledge and Kegan Paul.

McLuhan, M. (2003). The medium and the message. *British Journal of Health Care Management* 324-325.

Skains, R. (2018). Creative Practise as Research: Discourse on Methodology. *Media Practise and Education*, 82-97.

Spielmann, Y. (2004). Video and Computer: The Aesthetics of Steina and Woody Vasulka . *Montreal: The Daniel Langlois Foundation, 5.*

Spielmann, Y. (2006). Video: From Technology to Medium. *Art Journal*.

Sturken, M. (1996). *Machine Media: Steina and Woody Vasulka .* San Francisco: San Francisco Museum Modern Art.

Sturken, M. (1996). *Steina and Woody Vasulka: Machine Media.* San Francisco: The San Francisco Museum of Modern Art.

Vasulka, W. (1975). Didactic Video: Organizational Models of the Electronic Image. *Afterimage, vol. 3, no. 4*, 9.

Videography

Vasulka, S. and Vasulka, W. (1970). *Evolution.* 16 min, B/W.

—. (1971). *Discs*. 6 min., B/W.

—. (1973). *Vocabulary*. 6 min., colour.

—. (1974). *Noisefields*. 13 min., colour.

—. (1971). *Elements*. 9 min., colour.

—. (1979). *Six Programs for Television: Matrix, Vocabulary, Transformations, Objects, Steina, Digital Images*. 29 min., colour.

—. (1972). *Distant Activities*. 6 min., colour.

—. (1970). *Decay #1*. 7 min., colour.

—. (1970). *Decay #2*. 7 min., colour.

Vasulka, S. (1978). *Violin Power*. 10 min., colour.

Vasulka, S. (1976). *Switch! Monitor! Drift!.* 50 min., B/W.

Vasulka, W. (1974). *Explanation*. 12 min., colour.

Vasulka, W. (1974). *C-Trend*. 10 min., colour.

Vasulka, W. (1974). *The Matter*. 4 min., colour.

Vasulka, W. (1980). *Artifacts*. 22 min., colour.

Vasulka, W. (1983). *The Commission*. 45 min., colour.

Vasulka, W. (1987). A*rt of Memory*. 37 min., colour.

Vasulka, W. (1974-1975). *Time/Energy Structure of the Electronic Image.*

Sjölander, T and Wikström, B. (1966). *Time*. 30 min., B/W.

Hall, D. (1976). *This is a Television Receiver*. 8 min., colour.

Paik, N, J. (1970). *The Commission*. 9 min., colour.

Sandin, D. (1974). *How TV Works*. 28 min., colour.

Vasulka, W. (1975). *Time/Energy Objects*. 45 min., colour.

Vasulka, W. (1976). *No. 25*. 6 min., B/W.

Beck, S. (1971-74). Synthesis: *Conception, Methods, Cycles*. 29 min., colour.

Appendix A: Screenshots

Figure 1: Still from “This is a Television Receiver”(1976) by David Hall.

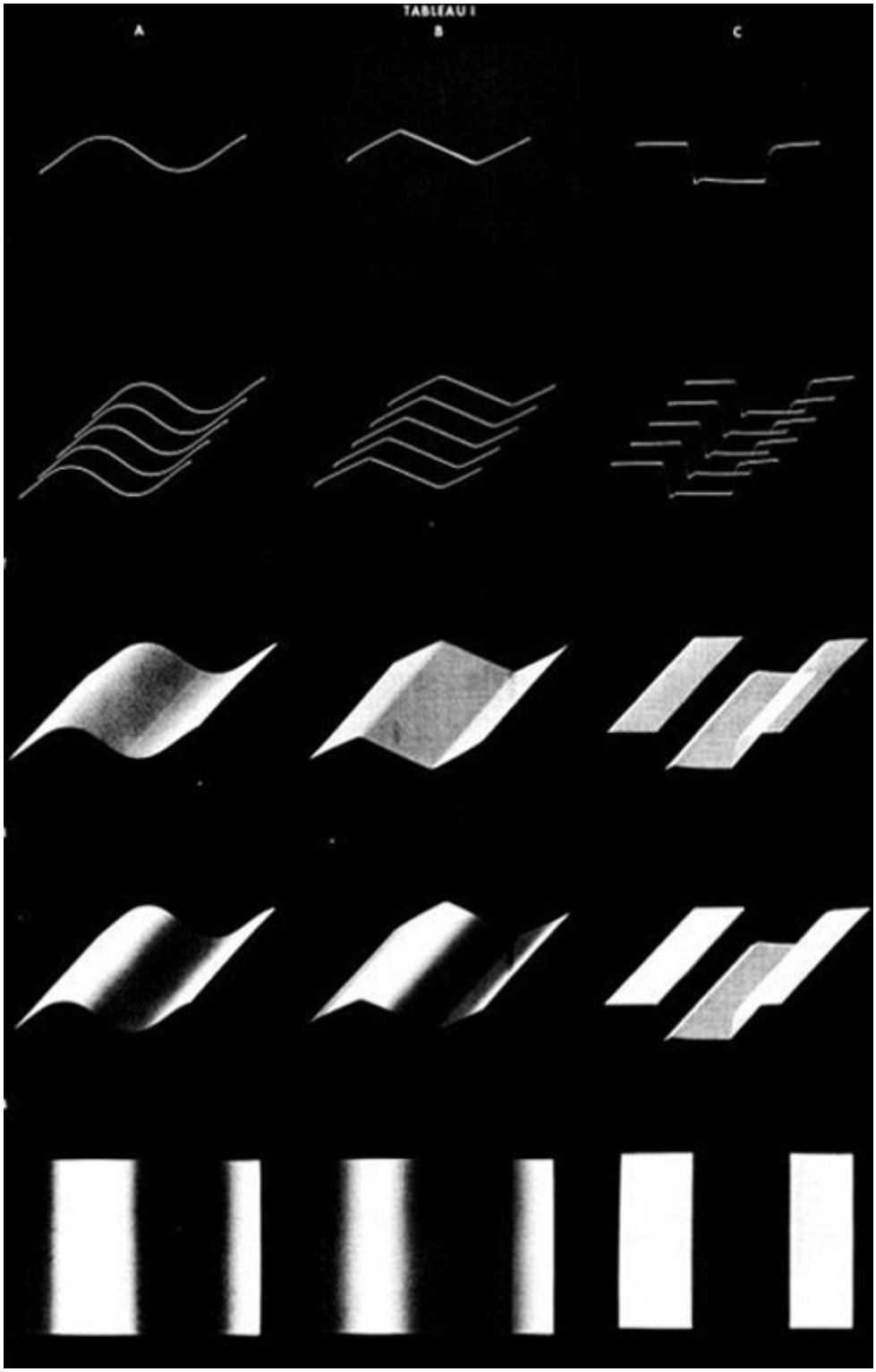

Figure 2: Tableaux of time segments belonging to “Time/Energy Structure of the Electronic Image”(1974-1975) by Woody Vasulka.

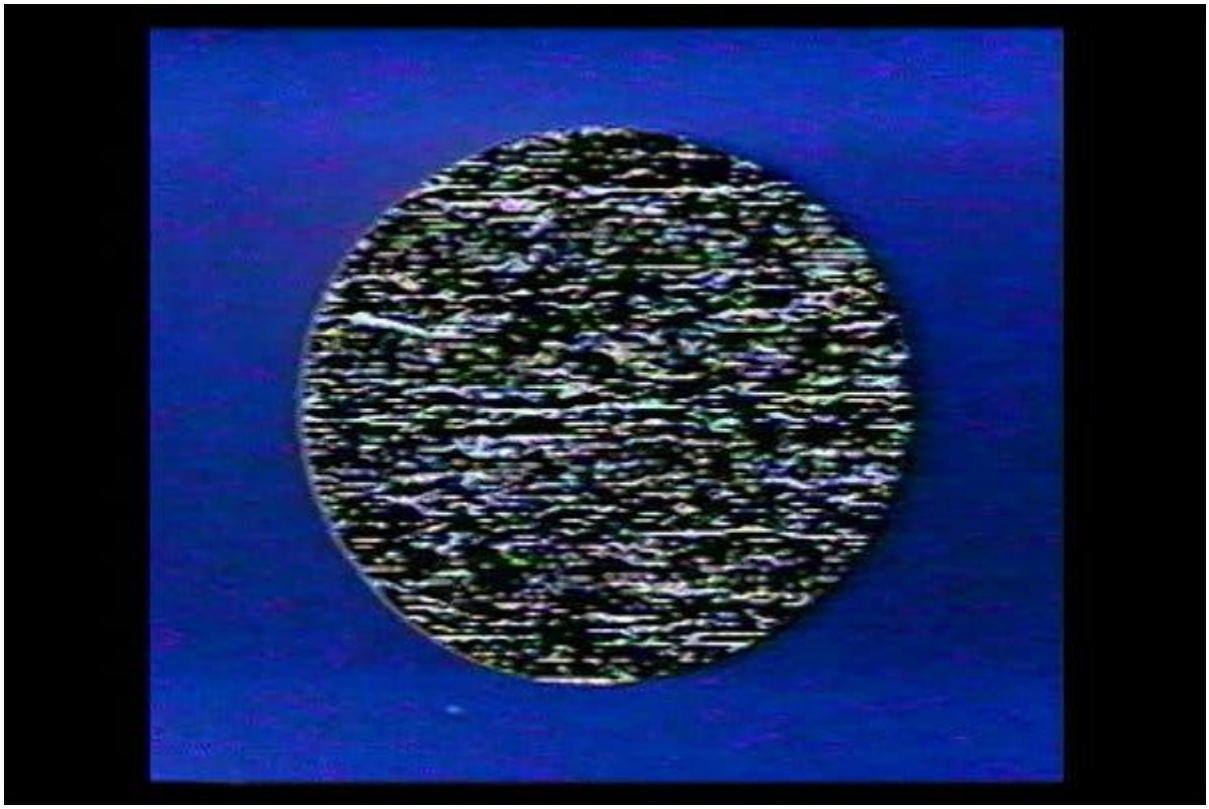

Figure 3: Still from “Noisefields”(1974) by Steina and Woody Vasulka.

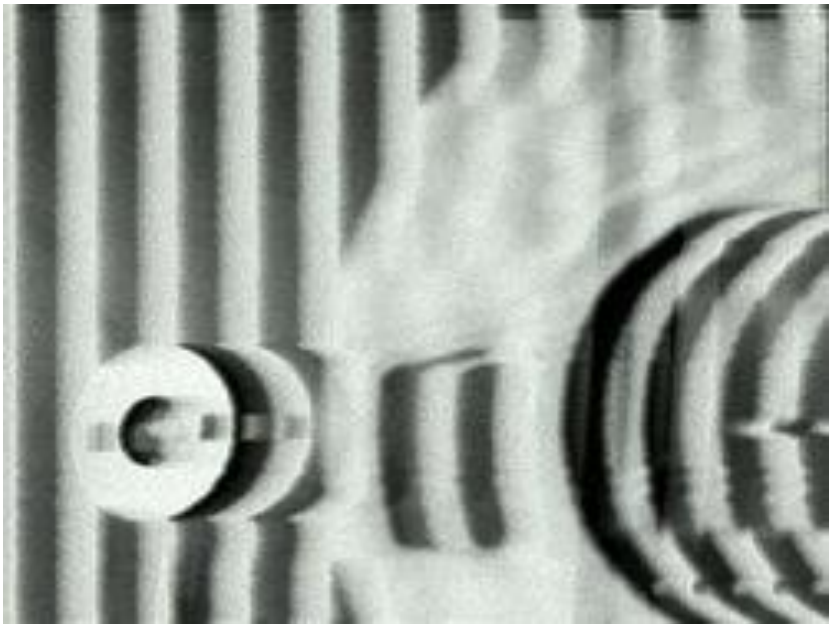

Figure 4: Still from “Discs”(1970) by Steina and Woody Vasulka.

Figure 5: Still from “Evolution”(1974) by Steina and Woody Vasulka, which showcases horizontal drift.

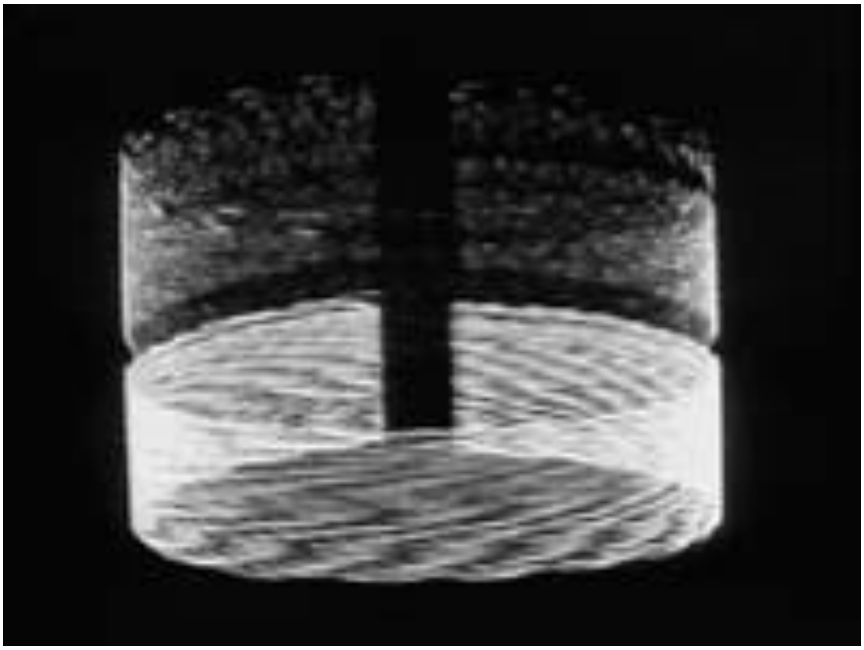

Figure 6: Still of the 360-degree shape created using the Scan Processor from “No.25”(1976) by Woody Vasulka.

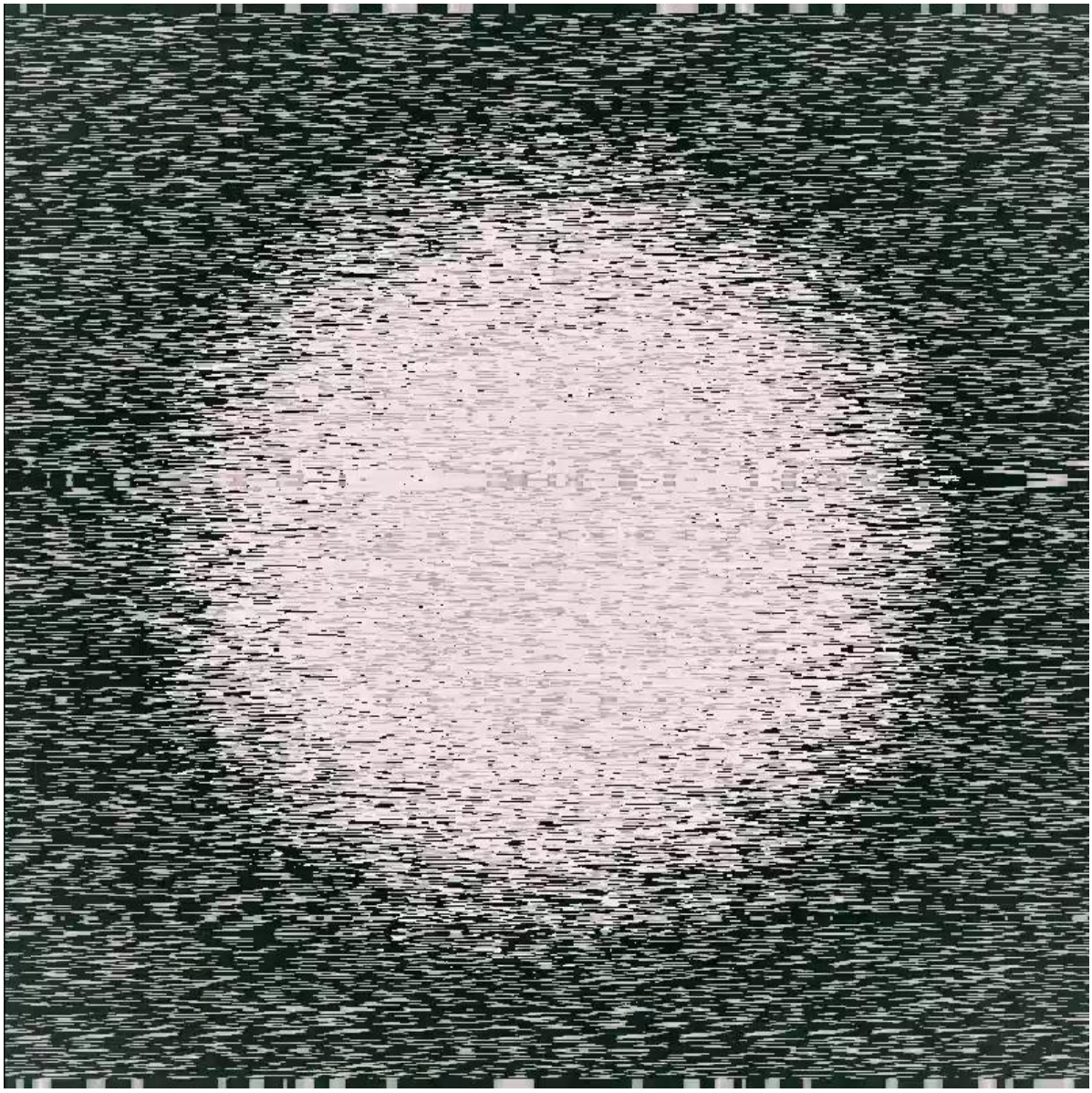

Figure 7: Still from “Embedded Energy”(2021) by Cailean Finn.

Figure 8: Still from “Electronic Phase”(2021) by Cailean Finn.

Figure 9: Still from “The Commission”(1983) by Woody Vasulka which displays the frame made of noise.

Figure 10: Still from “Art of Memory”(1987) by Woody Vasulka.

Figure 11: Still from “Omnidirectional Objects”(2021) by Cailean Finn showing the superimposition of the three-dimensional objects.