PART I

THE HISTORY OF LIVE VISUALS

Chapter 3 - Liquid Visuals: Late Modernism and Analogue Live Visuals (1950-1985)
Steve Gibson

Introduction

This chapter focuses on the period from the 1950s to the 1980s and provides an overview the dramatic expansion of audio-visual culture and Live Visuals practice during this timeframe. With the development of new tools, along with experimental ideas, the concept of the performed image became a reality. The year 1955 is also a particularly important date as it can be seen as the start of rock and roll music. It is also roughly the time in which electronic music expanded dramatically, both in modernist circles (Stockhausen, Cage, etc.) and in more popular forms (Louis and Bebe Barron's score for *Forbidden Planet* being a key exemplar).

Technologically, beginning with analogue tools such as film loops and overhead projection systems, and moving towards video in the 1970s and 80s, the moving image became a potent force for live performance, not only in so-called serious art culture, but also in popular culture. In addition, the concept of visual music as established by Fischinger and McLaren (as discussed in Chapter 2) continued to have wide impact, creating offshoots in the visual music films of John Whitney and Larry Cuba.

Simultaneous to the above developments, the expansion of electronic music in the 1950s brought new tools for performing and/or distributing sound by electronic means. Tape-based editing as employed by musique concrete composers Pierre Schaeffer and Pierre Henry, synthesized sounds by Karlheinz Stockhausen using newly developed studios in Cologne, pointed to a new form of music that had natural affinities with the visual music of Fischinger and McLaren. These were organically combined in a dramatic fashion by Edgard Varèse in his piece *Poème électronique*. This piece was composed for the Phillips pavilion in the Brussels Expo of 1958 and combined audio by Varèse and images from Le Corbusier. *Poème électronique* prefigured both the music video and the audio-visual installation as forms.

The 1960s saw a dramatic development of mixed media performance, engendered both by new technologies and by collaborations between popular and art culture. The Fluxus group of artists began exploring mixed-media in a performance context, often employing absurdist ideas arguably inherited from Dadaism and frequently built on ephemeral, conceptual strategies (as opposed to object-based and craft-oriented techniques). This in turn influenced the psychedelic movement, which exploded with liquid light show performances by The Joshua Light Show and Single Wing Turquoise Bird. Employing repurposed overhead projectors mixed with oils, and later adding film loops these groups created elaborate live visual performances

improvised to the music of Frank Zappa, the Grateful Dead and others.

Pop art live multimedia reached its apex in the 60s with Andy Warhol's collaboration with the Velvet Underground, *The Exploding, Plastic Inevitable*, now possibly the most well-known mixed-media event of the era, that combined lights, projections and live music. This performance set the stage for the development of multimedia performance using Live Visuals. Parallel to this, Expanded Cinema (as outlined by Gene Youngblood in his seminal text of 1970 and practiced by Guy Sherwin, Tony Hill, Jeffrey Shaw and others) began to conceive of film as a performed medium, with the filmmaker often interacting in some way with the film materials in a live context.

The chapter concludes with a look at the developments in the 1970s and 1980s that moved out of the analogue domain and into the digital. With the development of video editing devices and video synthesizers (both analogue and digital) and the rise of the personal computer, visual effects were easier to achieve in real-time and artists were able start working more precisely with visual material in a performance context. Looking at installations such as Myron Krueger's *Videoplace,* Stephen Jones' work with video synthesizers for experimental synth group Severed Heads, and large-scale multimedia performances such as Laurie Anderson's *United States Live,* as well as Merrill Aldighieri's live video mixes, this chapter argues that the hybrid form of contemporary Live Visuals was prefigured and borne out of these experiments.

The Technology of Live Audio-Visuals in Late Modernism

As illustrated in Chapter 2, the number of new technologies that were developed in the early part of the 20th Century was startling; however, it could be argued that many of these technologies became quickly obsolete, or at best led to the development of newer, better (and more enduring) versions of similar devices. It could equally be argued that the late modernist period (here roughly designated as 1955-1985) was an even more prolific era of innovation in audio-visual technology, and most importantly many of the technologies developed in this era (e.g. synthesizers, videotape recorders) had widespread use and a relatively long life-span.

As Léon McCarthy argues broadly in Chapter 8 "aesthetics are profoundly coupled to technological processes and inventions."[1] This is especially evident in a form such as Live Visuals, in which the technological means and processes are so intricately linked with the concerns and contents of the medium, and are simultaneously

subject to change at a rapid rate. Given this, it is no accident that the precipitous rise of various audio-visual technologies in the late modernist era was accompanying by an equally precipitous rise in the number of audio-visual forms, from electronic music to expanded cinema, music video and multimedia performance. Unquestionably these forms were ultimately enabled by technological advancements, so much so, that they would be impossible to have been established without their relevant technologies.

Key to the development of many of these new audio-visual forms were two key advances: the development of various electronic music devices, from simple oscillators and tone generators in the 1950s, to the synthesizers of the late 1960s and 1970s; and the advancement of film and video technology from simple 8 and 16 mm film, to 35 mm and 70 mm, to VHS and Beta videotape recorders in the 1970s and 80s, and finally to various devices for editing and/or manipulating visual material (i.e. videotape editors, video synthesizers).

The Technology of Electronic Music in Late Modernism

The early development of electronic music is well documented in various volumes including Paul Griffiths' *A Guide to Electronic Music,* among many others; however, for our purposes it is worth noting a few of the key developments that had a broad impact on audio-visual culture and are therefore relevant to the history of Live Visuals. The importance of musique concrète and the work of Pierre Schaeffer (1910-1995) and others at *Radio-difusion-Télévision Française* from 1948 onwards cannot be overstated. Utilising the new post-war recording tools, such a reel-to-reel tape deck, as well as simple editing by means of razor blades, Schaeffer pioneered a completely new way of creating sound through the collage of found and recorded sound. Using taped recordings of "railway trains or the piano… the recordings were transformed by his playing them at different speeds, forwards or in reverse, isolating fragments and superimposing one sound on the other."[2] The techniques used by musique concrète have rough parallels with visual music filmmakers such as McLaren and Lye, particularly in the use of a recorded medium for hand-crafted editing. It is also easy to trace the influence of musique concrète into such diverse musical forms as sample-based music (i.e. hip-hop), but also to visual forms such as experimental film and onwards to scratch video.

Similarly, the *Elektronische Musik* of Karlheinz Stockhausen (1928-2007) and others at *Cologne Nordwestdeutscher Rundfunk* from 1952 onwards had a profound influence on the development of electronic music and arguably all audio-visual culture of the next fifty years. Music "generated exclusively by electronic means"[3]

was the goal of Stockhausen and others in Cologne, and the impact of their early work with electronically generated sound had a profound impact on audio-visual culture of the late 20th and early 21st Centuries. Given the intimate connection between electronic music and contemporary Live Visuals, it is not an exaggeration to state that Live Visuals would not exist in their current form without the initial work by Stockhausen and others to produce work produced entirely electronically. In the 1950s any number of similar electronic music studios arose, and key composers of the era such as Cage, Varèse and Berio began to work with electronically generated sound, concrète tape-based music, or some combination of the two forms.

Figure 3.1 – A music studio at the College for Music (Musikhochschule) in Cologne, Germany, has two analogue synthesizers still in action: a Moog modular synthesizer from the late 1960s and, in the background, an ARP 2500 from 1970. Photo by Maximilian Schönherr. GNU Free Documentation License. Creative Commons Attribution-Share Alike.
https://commons.wikimedia.org/wiki/File:Moog_und_ARP_Synthesizer.jpg

A key follow-on development from *Elektronische Musik* that changed music production dramatically was the invention of the synthesizer in the late 1950s. The first commonly available device was the RCA Synthesizer, the Mark 2 of which gained some traction in the late 1950s and 1960s; however, it wasn't until Bob Moog (1934-2005) and Don Buchla (1937-2016) released more stable modular synthesizers in the early 1960s that the synthesizer really took off as a genuinely viable device for a broader group of musicians and composers.[4] Moog's original synthesizers were much easier to use than the RCA, as they were (relatively) easily tuned and included a keyboard. Through the invention and popularization of the synthesizer, electronic music was truly established as a separate form: over the next fifty years it continually expanded to become arguably the most dominant musical form of the 21st Century. Again, given the intricate connection between electronic music and Live Visuals the technology of the synthesizer is key to understanding the history of the performed image.

The Technology of Audio-Visuals and Visual Music in Late Modernism

In the 1940s and 50s there was an equal, if less publicly celebrated, explosion of visual technologies, that were often (though not always) used in tandem with the audio technologies mentioned above. Key to the development of new visual devices and strategies "were the brothers John Sr. (1917-1995) and James Whitney (1921-1982), who in different ways created works that left indelible marks on the history of visual music."[5] The brothers (alone or together) worked with many key technologies of the late modern era from analogue devices such as an optical printer in the 1940s to computers in the 1960s and beyond.

A good example of the brothers' early work can be seen in James Whitney's film *Yantra* (1950-58)[6] with an electronic score by Henk Badings (1907-1987). This work represents a logical continuation of the hand drawn visual music films of McLaren and Lye. Unlike McLaren's work though, the music is not drawn on the film strip, but is composed by electronic means. Also, unlike both McLaren and Lye, the combination of the audio and the visuals is not linked by precise correspondences between the mediums (though there are attempts at synchronization at key moments), but rather on the creation of particular synchronous moods. The piece represents both a precursor to the psychedelic visual era of the 1960s as well as a masterful summing up of the hand-drawn visual music film.

In succeeding years both brothers moved into increasingly computer-based audio-visual compositions, using repurposed technology such as WWII analogue computers:

> In Los Angeles in the late 1950s, John Whitney started purchasing junk: "mechanical junk excreted from army depots across the country…. Junk such as brand new thirty-thousand dollar antiaircraft specialized analog ballistic problem solver computers dating back to World War II."[7] He transformed this military-spec surplus into a machine for creating experimental animation - literally and metaphorically retooling a device that had itself served to remake human vision for modern war. A twin of this machine would enable John's brother James to create the 1966 film *Lapis*…[8]

Key to note here is that the brothers used repurposed technology to create this work. Repurposing of 'other-intended' technology as described above also resonates with the work of musique concrète composers described earlier, but also foreshadows the work of succeeding Live Visualists, from experiments with oils on overhead projectors in the 1960s, to the use of the film projector as a live performance device in expanded cinema, to the scratch video of the 1980s and 90s. Without a doubt, the history of audio-visuals and Live Visuals in the late modern period is one in which almost many if not most key advancements were made by repurposing existing technologies.

James Whitney's *Lapis* is described in particularly striking terms by Expanded Cinema pioneer Gene Youngblood (1942-2021) as "cybernetic cinema."[9] In general terms "cybernetics became part of the foundation for an emerging discourse of both human-machine interaction and computational representation. Youngblood's rhetoric situated the Whitneys' films not simply as works made with a computer but as works engaged with this larger field."[10] Key to this characterization is the notion of a larger body of technologically-created audio-visual art-production, in this case under the banner of cybernetics. While the visual field of *Lapis* superficially recalls the hand-drawn visual music of Lye and McLaren, its sensibility is much more in keeping with 1960s psychedelia and California-based cybernetic art. This is evident both in the choice of music (Ravi Shankar) and in the use of the analogue computer to generate complex mandalas.[11] Certainly watching *Lapis* in the present era one can see the visual composition as key to the development of a genuine style for audio-visual culture, and (acknowledged or unacknowledged) traces of the Whitneys' work can be felt in the work of club visualists as well more experimental live audio-visualists.

John Whitney had a long and varied career following this, and is now considered one of the pioneers of computer graphics audio-visuals:

> Whitney had an opportunity to work on the new high-powered digital computers between 1966 and 1969, when he was awarded a fellowship as artist-in-residence at IBM… John Whitney's computer films grew continually more intricate in their exploration of a genuine aesthetic goal: the establishment of a secure basis for harmonic events in audio-visual presentation. In the later 1980s, Whitney concentrated on developing a computerized instrument on which one could compose visual and musical output simultaneously in real time.[12]

Touching on so many aspects of audio-visual culture, the influence of the Whitneys on the work that followed in the succeeding decades was direct and profound.

Figure 3.2 - Le Courbusier and Edgar Varese, *Poème électronique*, Phillpis Pavilion, Brussels World's Fair, 1958. https://www.archdaily.com/157658/ad-classics-expo-58-philips-pavilion-le-corbusier-and-iannis-xenakis/expo-1958-paviljoen-van-philips-2?next_project=no © Wikimedia commons / wouter hagens.

Running roughly parallel to the Whitney's experiments of the 1950s was the work of architect Le Courbusier (1887-1965), his then student Iannis Xenakis (1922-2001), and composer Edgar Varèse (1883-1965), who collectively produced their installation *Poème électronique* for the Phillips pavilion in the Brussels Expo of 1958. Le Courbusier of course was extremely well-known as an architect at this point, and Varèse had already built a long career composing both acoustic and electronic music:

> … the two conceived a production that included architecture, light, music, space and color…. Varèse's music, made with electronic and concrete sounds, was not in strict relation with the images, indeed it had been conceived to provide a contrast with the images… At the same time, Varèse was able to explore the spatial effect of sound, since he worked with fourteen audio tracks piped through three hundred and fifty loudspeakers. From this point of view, one can claim that the work certainly contributed to the dialogue between music and the visual arts.[13]

Key to note in relation to *Poème électronique* is its conception as an installation, to be experienced in a public venue. While the audio and visual materials were fixed and played back on a projection and sound system, they were meant to be experienced in this particular venue, with a substantial number of speakers and in an imposing architectural space. While the work is obviously not 'live' per se, yet the experience of it required the live context in order for it to be fully appreciated. In addition, it is key to note the future relationship between Live Visuals and architecture, which is effectively pre-figured by the Phillips Pavilion. It can be seen as perhaps the defining starting point for considering then relationship between audio-visuals and architecture. See Chapter 14 *Architectural Projections* for a further discussion of this.

Fluxus, Happenings, Liquid Psychedelia in the 1960s

If the work in the 1950s described above paved the way for the visual to be moved into a live domain, then the 1960s can be described as the era in which visuals became genuinely live. This was not only due to a solidification of technological advances, such as those described above, but also to an increasing willingness to consider the visual as a performance medium in more direct terms. It is also at this point that the culture of late modernism collided with popular culture, and the results of this combination were felt on a number of fronts from popular music (e.g.

The Beatles, the Velvet Underground) to visual and performance art (Warhol, Nam June Paik).

Key to the development of a live visual performance approach in the 1960s was the Fluxus movement, and more specifically the 'happenings' that emerged from the movement. The first happening can be traced to Paris in 1958: *Theatre is in the Street* by Wolf Vostell (1932-1998), which was "the first artwork to incorporate a TV set."[14] The happening became a fixture of the New York-based Fluxus movement, spearheaded by Allan Kaprow (1927-2006) and others. Key to Fluxus-based happenings was a mixed-media approach to live performance that broke "down the barriers between artists and audiences, involving the public in the work itself."[15] In this way Fluxus happenings cannot only been viewed as nascent Live Visuals experiences, but also forerunners to interactive art. Happenings became a fixture in 1960s America and opened up late modernist art to ideas of improvised performance, visual spontaneity, and absurdity.

Figure 3.3 - Nam June Paik–Shuya Abe: *Video-Synthesizer*, 1969/92. Changing Channels, MUMOK, Vienna, 2010. Photo: Zs. Gyenes. Used by permission.

Possibly the most well-known of the Fluxus artists was Nam June Paik (1932-2006), who was educated as a composer and an early colleague of Stockhausen. He was one of the first artists to work explicitly and regularly with the television as both an exhibition and stage device. His work in the 1960s included *TV Cello,* a stack of TVs repurposed as a string instrument (see Léon McCarthy's further discussion of this in Chapter 8). Key to Paik's work was the use of visual devices in the performance context (though most Fluxus artists bristled at the term 'performance' at the time).[16]

Paik was also a keen inventor and his work with engineer Shuya Abe (1932-) resulted in the Paik-Abe Video Synthesizer (see Figure 3.3):

“From 1969 to 1971, together with television technician and specialist Shuya Abe, Paik constructed a video synthesizer that made it possible for him to edit seven different sources simultaneously - in real time. Seven cameras are calibrated to receive seven colors, each perceiving/photographing only a single color. The equipment is enhanced by a button for mixing, and a small clock that reverses the colors - from ultraviolet to infrared.”[17]

While the device itself remained a curiosity (though it was later used by one of Paik students Jim Wiseman),[18] both in its form and intent, the device is an obvious precursor to other video synthesizers such as the Fairlight Computer Video Instrument (released 1985). In addition, the ability of the Paik-Abe Video Synthesizer to mix up to seven-channels of video live was key to the conceptual idea of video mixing, which was later realized in the video mixers of the 1980s and 90s and the VJ software of the 21st Century. Paik did actually use the device, with the first ‘performance’ being a broadcast event at a Boston area television station:

> The Synthesizer debut[ed] in a four-hour broadcast television show called "Video Commune - The Beatles from Beginning to End" on WGBH, channel 44 on August 1, 1970. Paik took advantage of a licensing agreement that WGBH had which gave them rights to air all Beatles songs. So he created four hours of a wildly colorful broadcast performance to a soundtrack of Beatles music.[19]

If Fluxus represented an advancement in both the idea of the visual as a performance medium, and as a site for technological advances such as those made by Paik, Pop Art represented a consolidation of late modernism and popular culture as well as providing the one of the clearest examples of genuinely improvised Live Visuals. Arguably the key figures, particularly for a discussion of Live Visuals, were Andy Warhol (1928-1987) and The Velvet Underground. Warhol was obviously very well established in the New York art scene in the 1960s, and was a central figure (along with Robert Rauschenberg and others) in the Pop Art movement. The Velvet Underground were an interesting mix of popular musicians (e.g. Lou Reed) as well as figures associated with the New York avant-garde (e.g. John Cale, who played in minimalist composer La Monte Young’s ensemble).

Warhol’s collaboration with the Velvet Underground (and others) from 1966-67, named *Exploding Plastic Inevitable* consisted of “installations of monitors, film and slide projectors, lights and live music by Nico and the Velvet Underground, and other performances. These events certainly contributed to further the idea of

Figure 3.4 - Andy Warhol's multiple-screen projection environment - *The Exploding Plastic Inevitable*, with the music of the Velvet Underground and Nico. Photos © Ronald Nameth, 1966-2020, All Rights Reserved. Reprinted by Permission.

multimedia works that were not pre-established…"[20] The *Exploding Plastic Inevitable* is noteworthy due to its improvised, non-repeating, and 'not pre-established' form. The visuals were fluid, and changed as desired in response to the music, or the mood of the audience. While obviously the film footage used was pre-shot, it could be re-configured differently in each instance of the event. This mode of operation is key to Live Visuals and audio-visual performance as it is a preferred method of performance for many live visual artists (including VJs) as well as live audio-visual performers. Various video documents of the *Exploding Plastic Inevitable* demonstrate its obvious connection to these later forms in its use of multiscreen projections, complex lighting setups and a theatrical performance staging.[21]

Running roughly parallel to the happenings and Pop Art mixed media events in New York, were a series of psychedelic live audio-visual events in Los Angeles, San Francisco (and later elsewhere). These 'psychedelic light shows' echoed the general approach of the Fluxus group, while simultaneously they expanded on both the technology used and the audience reach:

> The psychedelic light show rejected the materialist art object in favour of the ephemeral Happening, the commercial gallery for the underground space… In these events, painting, film, color organs, and music came together… As early as 1952… Seymour Locks taught a course called "Light and Art" in which he demonstrated to his students the possibility of creating motion painting by swirling

> colored liquids in a dish and casting the "painting" on the wall by means of an overhead projector while a jazz group improvised a musical accompaniment.[22]

The psychedelic light-show was quickly adopted at various venues, particularly in San Francisco, and was often accompanied by the music of the electronic music composers associated with what later become the San Francisco Tape Music Center, including high profile figures such as Pauline Oliveros (1932-2016) and Morton Subotnik (1933-).[23] These shows eventually branched out to other locales and cities, including London and New York: "In London, artists such as Mark Boyle and Joan Hills, as well as Gustav Metzger, created light shows as art events and for rock concerts ranging from Soft Machine, Pink Floyd, and the Who."[24] In New York, a number of artist/techies, including Joshua White, William Schwarzbach, and Tom Shoesmith consolidated into the Joshua Light Show.[25]

Figure 3.5 - The Joshua Light Show with Frank Zappa and the Mothers of Invention, The Mineola Theater, Long Island, New York, 20 December 1967. Used by permission.

The Joshua Light Show was for many the public face of Live Visuals culture in the 1960s, appearing with popular musical figures as Jimi Hendrix, Frank Zappa and Janis Joplin. For their performances they used "liquid projection using colored oil and water on overhead projectors,"[26] clearly continuing the Whitney Brothers' (and others) proclivity for repurposing existing technology. These oils were mixed live

and projected large-scale, creating spectacular, non-repeatable visuals performances in sync with the psychedelic music of the era (see Figure 3.5). With these shows Live Visuals unquestionably entered the mainstream of popular culture.

Simultaneous to the Joshua Light Show's events in New York, Silver Wing Turquoise Bird in Los Angeles were performing alongside The Grateful Dead, Steve Miller Band and the Velvet Underground. Silver Wing were "a more film-based light-show group… composed of a number of filmmakers and artists directly aware of the work of Fischinger, the Whitneys and [Jordan] Belson."[27] Silver Wing applied a more cinematic approach to their live performances than the Joshua Light show and used "film, strobes, and a vast array of slides that could be animated over other images."[28] Their lionisation by Gene Youngblood as "a combination of Jackson Pollack, and *2001…"*[29] ties them more directly to Expanded Cinema, and indeed the fact that they also performed in galleries and museums as experimental performing artists in addition to the shows with popular music groups. In this respect Silver Wing connected Live Visuals to both art culture (and in particular to Expanded Cinema) as well as popular culture.

Expanded and Live Cinema

Gene Youngblood's exhaustive volume *Expanded Cinema,* published in 1970, traced various innovations in the conception of what could constitute cinema (beyond its limitations in pure drama), from synesthesia to cybernetics, through to TV and intermedia. Covering artists as diverse as Jordan Belson (1926-2011) and Stanley Kubrick (1928-1999), it proposed generally that cinema had become much than a simple playback medium, that in fact there were multivarious approaches to cinema, including through television, multi-projection environments and intermedia. While the complete history of Expanded Cinema outlined by Youngblood is beyond the scope of this book, some key concepts discussed by Youngblood are crucial to the understanding of later Live Visuals movements.

One of these is obviously Youngblood's prescient understanding of the profound implications of computer hardware and software for the future: "the digital computer opens vast new realms of possible aesthetic investigation."[30] This is obviously a given in contemporary practice, but in 1970 this would have been considered a somewhat radical idea, particularly as most computing power at the time was in the hands of the US military and specialist technology companies such as IBM. On the other hand, undoubtedly at this time there was a move to integrate the arts and computing in very specific ways, to humanize the power of the

computer, including at the Bell Labs programme “Experiments in Art and Technology” started by Billy Klüver (1927-2004). The work of the Bell Labs, was followed up by artist/programmers such as Myron Krueger (1942-), discussed below. Unquestionably the evolution of audio-visual culture more broadly over the following 50 years was deeply reliant on the aesthetic possibilities of computers that Youngblood so shrewdly foresaw. More specifically the contemporary forms of Live Visuals such as Vjing, Projection Mapping and Live Cinema would be demonstrably impossible without the computing advances that happened between 1970 and the present.

Equally important was Youngblood’s demonstration of all the ways in which cinema had or was transcending its limits as a dramatic medium as consumed in the film theatre. Covering an astonishing array of material from the art cinema of Stan Brakhage, Michael Snow and others (intended to be viewed in a gallery), to the installations and performances of Nam June Paik and Stan VanDerBeek (to be experienced in a live setting), and on to Holography, Youngblood charts the course of how cinema and the cinematic expanded into a non-dramatic, and eventually a live medium. Undoubtedly Youngblood’s idea influenced a generation of filmmakers, many of whom produced work in which the performance of the film was the work. Combined with influences from Fluxus, a new generation of artists began to think of film as a performance medium, often with the filmmaker as the key performer within the projected artwork.

While there were several filmmakers who took onboard and actively used the banner of Expanded and Live Cinema in the 1970s, key among them were British-born artists Guy Sherwin (1948-) and Tony Hill (1946-). These filmmakers transformed film into a live, performative medium, in which they or the audience interacted with the projected film, usually in a gallery or similar space. In this way the Live Cinema of the 1970s connected the art film culture of the 1950s and 60s (the Whitneys, Stan Brakhage) with the Fluxus, Pop Art and psychedelic light performances of the 1960s. A key early work of Live Cinema is Sherman’s *Man with a Mirror* from 1976:

> The performance involves Sherwin holding up a mirror which is painted white on the back, acting as a screen. The image is projected from a Super 8 projector onto the screen/mirror. The projected image, which shows Sherwin holding a similar mirror/screen in a park was shot in 1976. The intention was to perform the piece later in the year it was made. However as time has passed and Sherwin has been

asked to repeat the performance, it has taken on new meaning as the performer has aged and time has moved on.[31] (Note: BD films has made a performance of this work available on YouTube: https://www.youtube.com/watch?v=DX1-xuCNIe).

This Live Cinema performance is key to understanding the history and technology of early Live Cinema, as well as later developments connected to it, including the work of contemporary Live Cinema artists. In the performance Sherwin holds a mirror up to the projected image of himself, moving it around the room and changing its focus and angle. It becomes a sort of low-tech visual effects system for compositing an image on a figure, as well as a ghostly reflection on the nature of the changing self. In this manner, its 'lo-techness' is quite similar to the use of overhead projectors by the psychedelic light show artists of the previous ten years, and ties broadly into the repurposing common in much historical and contemporary Live Visuals production. Live Cinema is generally characterised not only by the liveness of the cinema experience, but also by the inclusion of re-purposed devices (some simple, some much more complex) often used to distort the film image in some way in relation to the performance itself.

Figure 3.6 – *Floor Film* by Tony Hill, 16mm film installation, 30 minutes, 1975. Images taken during a screening with a young audience on the screen watching the film. ©Tony Hill 2020. Used by permission.

Another Live Cinema artist known for repurposing devices and including both himself and the audience in the live experience is Tony Hill. His *Floor Film* from 1975 (see Figure 3.6) is similar in its 'liveness' to Sherwin's work as described above, but also includes audience as part of the live film experience:

> The 1975 original of this unique film was projected via a large, overhead mirror onto a screen which formed the floor of a small room. The audience watched the film either by standing on the screen or by viewing through the mirror. Seen through the mirror the audience members in the room become part of the film. Those standing on the screen experience situations such as walking on water, the screen catching fire and other unusual events.[32] (Note: a recent 2016 upgrade of this film installation can be view on Vimeo: https://vimeo.com/198752309).

In *Floor Film* audience members can superimpose themselves over a film projected onto the floor, often moving in front of or alongside figures and/or objects in the film scene. The audience therefore becomes a direct part of the performance event, in essence foreshadowing the role of audience later seen in interactive art of the 1990s and following. Hill is also well known for his technical rigs, which often involve repurposing or developing technologies for distinct filmic purposes. These rigs are often used to have an immersive experience of the film event.[33] For more information about Tony Hill's work please see Chapter 16, Interview 1 for a detailed interview with him.

The experience of Live Cinema continued from the mid 1970s to the present. Both Hill and Sherwin (as well as other Expanded Cinema artists such as Malcolm Le Grice) have created multiple works since these initial projects, often with updated technologies and techniques. In addition, many succeeding artists, from Laurie Anderson to the Light Surgeons, followed on from the approaches of these early works and incorporated film in a live and performative context, albeit in more multimedia contexts. In the early 21st Century Live Cinema is now a recognised, distinct form that overlaps audio-visual and live visual performance in some ways, but also retains unique features that can be tied back to these initial experiments. See Chapter 12 "VJing, Live Audio-Visuals and Live Cinema" for more on contemporary Live Cinema work.

Moving Towards the Digital I: Electronic Art and Interactive Installation

With the development of digital computers in the 1970s, visuals slowly became more digital, both in their production and dissemination. In addition, the development of various electronic music devices, including monophonic and polyphonic synthesizers, accelerated as the decade wore on, becoming somewhat ubiquitous in popular culture by the end of the decade. In this era, the idea of electronic art (later digital art and media art, all terms that were used interchangeably) was effectively born as a medium. Essentially created by artists with one foot in the technological world and the other in the art world, electronic art of 1970s became key to the development of audio-visual culture over the next 50 years.

Arguably the birthplace of electronic art was The Kitchen in New York, which has operated from 1971 to the present day as a place for artists to experiment with various forms of technology, and to present live electronic work. Among the founders of The Kitchen were Steina (1940-) and Woody Vasulka (1937-2019), whose piece *Violin Power* (1970-78) used the violin "as an instrument that controlled real-time processing of images during performances,"[34] effectively presaging later audio-visual work from Laurie Anderson (1947-) to alva noto: "The Vasulkas used audio synthesizers as a starting point: the core of their system was in particularly the idea of the oscillator, that is the wave generator that could be used for both audio and video. By regulating a synthesizer's control tension, they could in fact simultaneously modify the sound's pitch and the image's size."[35] This direct use of the synthesizer as a simultaneous control device for audio and visuals stands as a key development for VJ/DJ culture and present-day audio-visual performance, particularly as the keyboard synthesizer (along with the MIDI control surface) remains a key interface device for live audio-visual performance to the present day.

Another figure who was key to the development of electronic and interactive art in the 1970s was Myron Krueger (1942-):

> Myron Krueger was the first artist to focus on interactive computer art as a composable medium. In the process, he invented many of the basic concepts of virtual reality. He pioneered the development of unencumbered, full-body participation in computer-created telecommunication experiences and coined the term "Artificial Reality" in 1973 to describe the ultimate expression of this concept.[36]

Krueger had a distinct advantage over many other electronic and interactive artists, as he was trained as a computer scientist (he received his PhD in Computer Science from University of Wisconsin-Madison). He therefore had the technical background to develop his own computer systems. Beginning in 1969 (with Daniel Sandin and others) he "developed the audiovisual interactive environment *glowflow,"*[37] which allowed audience to interact with light and sound in real-time. His key project however was *Videoplace* (1974).[38]

Videoplace was a key piece of interactive art for Live Visuals as it used a camera-based system to 'transport' the outline of users' figures into a simple computer world, in which they could interact in real-time with visual figures:

> "Videoplace" takes up the closed-circuit video installation prefigured in 1969 in Nam June Paik´s "Participation TV II"[39] and modifies it: In Paik´s installation observers could use a control panel to manipulate video images recorded by video cameras and projected on monitors. Krueger replaces Paik´s interface (control panel and cameras) by a series of programmes transforming the recordings of a black/white-surveillance camera. The camera mounted underneath the projection surface records observers and their operations "against a brightly backlit sheet of translucent plastic." On a computer with parallel active "specialized processors" the software gathers the camera´s input as a "binary image" transforming the observers´ contours in a field with ones and zeros for recognised/non recognised observer operations. The software registers motions of heads, hands, fingers, legs and feet.[40] These data are used by programmes transforming and colouring the observers´ contours in different manners.[41]

Krueger laid the philosophical, technical and conceptual foundation for interactive art with *Videoplace.* Krueger importantly established that the quality of interaction could provide a means for discussing the aesthetics of the work, but he also illustrated how user input could be fed directly into a real-time visual world, allowing the audience to be directly part of a live visual environment. *Videoplace* became not only a touchstone for the idea and realisation of interactive art, it also established the groundwork for virtual and immersive environments more generally. A number of key artists - from Jeffrey Shaw (1944-) in the 1980s to Rafael Lozano-Hemmer (1967-) in the 1990s and 2000s - followed up on Krueger's ideas and strategies, creating ever more complex works in which the user interacted with graphics, video and eventually 3D worlds in real-time. For more information and a

direct discussion of the use of Live Visuals in Interactive and Immersive Environments see Chapter 13.

Moving Towards the Digital II: Video Synthesizers, Music Video

Parallel to the above developments a number of video synthesizer prototypes were developed in the late 1960s and 1970s. These were visibly inspired by the various music synthesizers (such as the Moog) that were developed in the years preceding this. Early video synthesizer devices included Myron Krueger collaborator Daniel Sandin's (1942-) *Image Processor* (1971-74) and Stephen Beck's (1950-) *Direct Video Synthesizer* (1971). Both devices were analogue, and were indebted the modular music synthesizers of the day, which used patch cables to connect sound modules together. "Daniel Sandin created the Image Processor… a modular and programmable analog computer for the treatment of video images that followed the Paik-Abe Video Synthesizer. When connected to a camera, the Image Processor could manipulate the video signal in various ways."[42] For an example of the layout of *Image Processor* see Figure 3.7. Various visual processors are connected by BNC cables, allowing the operator to alter the video signal projected on the attached TV. This modular approach clearly inspired future developers of Live Visuals devices and software, including most obviously Garagecube's Modul8 VJ software, which allows for the user to connect a number of image processing modules in software.

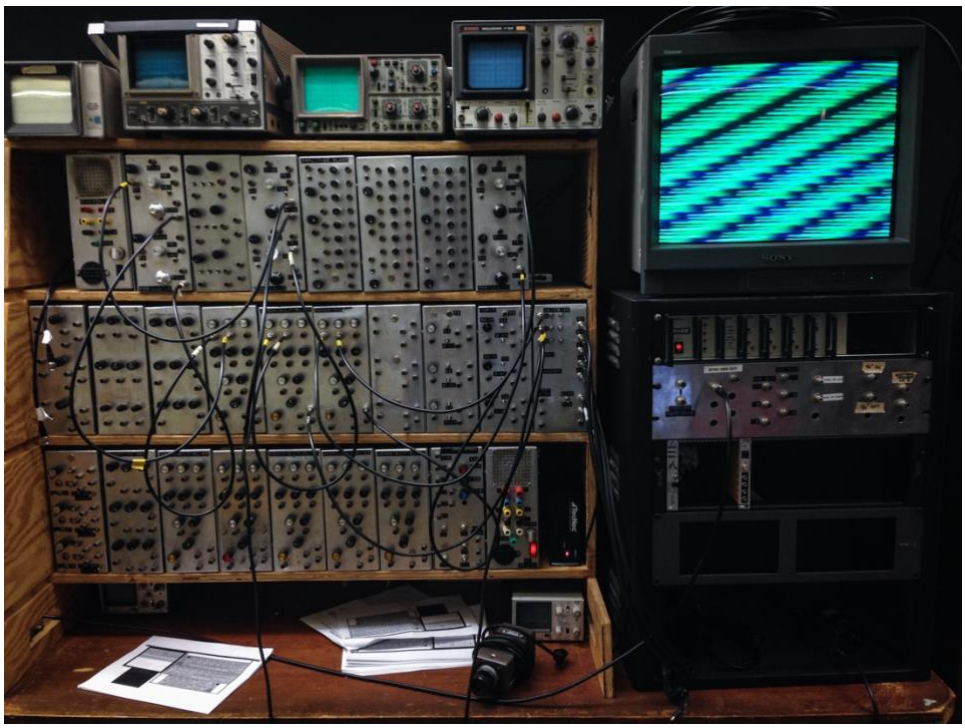

Figure 3.7 - *Sandin Image Processor*, exhibited at SAIC (School of the Art Institute of Chicago), with complex oscillators patch as written up by James H. Connolly. Photo by Rosa Menkman, 2015, https://www.flickr.com/photos/r00s/17016562038/. Creative Commons.

A number of audio-visual pieces were developed by both Sandin and Beck, including Sandin's *Spiral PTL* (1980), Beck's *Illuminated Music* (1972) with composer Warner Jepson, and *Union (1975)* "the latter dedicated to Jordan Belson, with whom Beck collaborated."[43] Similar to the early 20th Century, in which numerous variations of the Colour Organ appeared, in the 1970s a number of variations on the video synthesizer were developed. These included Bill Hearn's *VIDIUM* (1972), David Jones' *Jones Colorizer* (1974-75), and Laurie Spiegel's (1945-) video and sound computing system *VAMPIRE* (1974-76), developed with Ken Knowlton of Bell Labs:[44] "Spiegel could draw forms with a graphic tablet and simultaneously, through other devices, modify the image's parameters, such as size, color and texture, and then record them. The tools used for the audio, for instance filters, reverbs and so on, could also be used for images, and so Spiegel had her hands on a full-fledged audiovisual instrument."[45]

Figure 3.8 - Fairlight Computer Video Instrument, an early digital video synthesizer, Fairlight is now owned by BlackMagic. Used by permission.

Arguably the first (relatively) well-known commercial video synthesizer was the Fairlight CVI (Computer Video Instrument*),* "an early video synthesiser developed in Australia in the 1980's. It was intended to be a 'video version' of the iconic Fairlight CMI (Computer Music Instrument)."[46] The Fairlight CMI was developed in the late 1970s and became a fixture in popular music in the 1980s. It was the first commercial music device to allow both sampling and a primitive version of computer sequencing. It was used extensively by artists such as Peter Gabriel, Kate Bush, Jean-Michel Jarre and Art of Noise. The Fairlight CVI had a similar look to the CMI (See Figure 3.8) and allowed for the application of a number of video effects to source footage in real-time. It became a ubiquitous device for videos shows on MTV in the early days of the music video. According to http://fairlightcvi.com/ the following videos utilised the Fairlight CVI:

Crowded House – Now We're Getting Somewhere (1986)
A Flock of Seagulls – Who's That Girl? (1985)
Jean-Michel Jarre – Zoolookologie (1985)
Oscar (Sky Mitchel) Lariosa – I'm Just an Alien[47]

A cursory look at any of the above videos (available on YouTube) will reveal the quality of the processing capabilities of the CVI. It was capable of rudimentary composting, as well as a range of 8-bit effects, most of which are now quite dated looking. In the better examples above (e.g. Jean-Michel Jarre's *Zoolookologie*) the effects are relatively seamlessly used, and the compositing (while somewhat rudimentary) is achieved somewhat believably considering the era. It is clear though that there remained a lot of work to be done before digital video synthesis could be considered an aesthetically satisfying tool.

Undoubtedly the development of video as a format in the late 1970s and 1980s contributed greatly to the interplay between sound and image. The rise of the music video via MTV (and others) ushered in an era in which music was often discovered because of its visual representation. While early era MTV music videos are obviously not live in any sense, they plainly created a technical and conceptual language for the cross-pollination between sound, and image and undoubtedly influenced the next generation of scratch video artists and VJs. Videos such as David Bowie's *Ashes to Ashes* (1980) or Cabaret Voltaire's *Sensoria* (1984) reveal sensibilities that owed a considerable amount to earlier audio-visuals, montage and visual music, but also pointed to the future of Live Visuals in their use of extreme effects, fast cuts in sync with the music, and precise audio-visual timing.

The influence of MTV video, audio-visual culture and work with video synthesizers made its way into the live music domain as well. One of the more striking examples of this was in the work of Stephen Jones (1951-) for Australian electronic music group Severed Heads. Jones began working with video in the mid-1970s and "and acted as the technical attendant for the Nam June Paik & Charlotte Moorman exhibition at the Art Gallery of NSW (AGNSW) in April 1976."[48] In the late 1970s he worked extensively with video systems and live audio-visual productions for both art and popular figures. He developed his own video synthesizer in 1979 and in 1982 he joined Severed Heads as a full-time member of the band, arguably becoming the first resident VJ for a touring band: "Well-known as the video component of the important Australian electronic music group Severed Heads, Jones worked with them for ten years, producing and touring a large number of their videos. As a member of the band, he used his custom-built video synthesiser

as part of the live stage show."[49] Jones toured with the Severed Heads throughout the 1980s and produced Live Visuals that were genuinely performance visuals:

> Unlike most other bands who incorporate visuals into their show, Jones' contribution was very much a live performance. Rather than just projecting images with maybe some cross-fading and other simple manipulations, Jones with his videosynthesiser was able to do much more sophisticated image manipulation, such as changing key levels governing how images were overlaid and, perhaps more significantly, the videosynthesiser (as its name implies) generated moving patterns, often triggered by the audio. So no two performances would have the exact same visuals, even though they used the same base visual material.[50]

Having experienced one of their performances in 1986[51] I can confirm the uniqueness of this pairing: Jones was on stage with the band (Tom Ellard and Gary Bradbury were the musicians) and was unmistakeably on equal footing to the musicians (as opposed to the visual performers in the psychedelic light shows of the 60s, who were normally positioned off-stage). Jones was able to randomly select a large bank of found and abstract images, which he could access in real-time. These could also be composited and effected in real-time: in essence Jones used his videosynthesiser to perform the task that a VJ does in the present era.

A historical document of Jones demonstrating his videosynthesiser on Australia's ABC Television in 1986 is available at Tom Ellard's YouTube page - https://www.youtube.com/watch?v=MX0goKMpB4Y&feature=emb_logo. Tom Ellard has also made some of Jones' work with the videosynthesizer available on Vimeo including the video for the song *We Have Come to Bless this House* - https://vimeo.com/35074914 - and video of a live performance of *Petrol* from 1982 - https://vimeo.com/39454294.

As these examples demonstrate, Jones was a prototype for the Live Visuals performer in the 1980s, and he laid the groundwork for visuals performers for the next generation. While other bands began to work with stage visuals in the 1980s, most of these acts did not foreground the live visualist as an equal member on stage, and most other acts used various switching video devices to create live mixes on stage that were relatively pre-set for each performance (see Chapter 4 for a further discussion of this).

Moving Towards the Digital III: Multimedia

As technology advanced in the late 1970s and early 1980s, and audio and video devices became more affordable and therefore ubiquitous, live music performance became more 'multimedia.' The term has its original in the 1960s and 70s performance, but entered common usage in the 1970s and 1980s when artists such as Laurie Anderson began using multiple mediums consistently, and in a series of performances and projects. Prior to Anderson, a number of music artists, most notably those associated with Progressive Rock in the 1970s, began to incorporate film as well as theatrical elements in their performances. One key work in this regard was Genesis' live production of *The Lamb Lies Down on Broadway* (1974-75) in which lead singer Peter Gabriel took on the role of the lead character from the concept LP. The stage performance of this was extremely elaborate with extravagant lighting, baroque use of theatrical props and a complex multi-screen slide projection show by artist Jeffrey Shaw:

> The band Genesis commissioned *The Lamb Lies Down on Broadway* to provide a pictorial multimedia backdrop to their concert performance of the same name. Using three pairs of programmable synchronized Kodak Carousel slide projectors, more than two thousand slides were projected onto three screens installed over the full length of the stage behind the band… A custom-developed laser-wand enabled Peter Gabriel to point a dynamic cone of light into the audience. A number of inflatable event structures were also designed for this concert. Taken together, the slide projections, laser projections, inflatable costumes and kinetic stage lighting were a groundbreaking experiment in total theatre, merging live performance with multimodal staging that translated Peter Gabriel's sophisticated musical narrative into a visceral, memorable multimedia experience for the audience.[52]

The visual record of this event is somewhat limited (there are no official video or DVD releases of the original 1975 performances), but the pictorial evidence at Jeffrey Shaw's webpage[53] suggests a highly complex stage setup with multiple screens and complex lighting, that clearly has echoes in later Live Visuals performances, including those of Laurie Anderson (described below), scratch video performances (described in the next chapter) and live audio-visual performance in general from the 1990s onward. Other bands of the era also used increasingly complex stage setups, including Pink Floyd for their performances of *The Wall*

(1980-81) which used a very elaborate stage setup including an on-stage Wall. This was later was turned into a well-known film in 1982 by filmmaker Alan Parker.

With the advent of punk in the late 1970s, this level of theatricality was generally frowned upon, and most bands stripped down their stage setups. A few years later, in the early 1980s, with the rise of new wave and the integration of the 1970s avant-garde into popular culture, artists such as Laurie Anderson began to conceptualise complex stage shows as the de facto mode for live performance. Genesis and Pink Floyd's events were effectively one-offs for a single tour (though Pink Floyd resurrected *The Wall* after the fall of the Wall in Berlin in 1990). Anderson on the other hand made a career out of being primarily known as a multimedia performing artist: her work was best experienced in a live setting in which the viewer was immersed in a complex multimedia experience that included music performance, dance, spoken work, theatrical props and multi-screen projection.

Laurie Anderson was a classically trained violinist, who emerged from the New York Performance Art scene in the late 1970s. In 1982 she released *Big Science,* featuring the track *O Superman,* which surprisingly went to No. 2 on the British charts. Nonesuch Records has made the video for *O Superman* available at their YouTube page: https://www.youtube.com/watch?v=Vkfpi2H8tOE.[54] The video for this piece became an iconic representation of the avant-garde artist in the 1980s, but it also revealed a demonstrable pop sensibility, albeit one clearly in sync with the new wave rather than conventional rock or pop. The video was a representation of Laurie Anderson's multimedia renditions of the piece in performance. She plays keyboard and sings via a vocoder. The video uses simple lights and projections which Anderson interacts with, by means of her hands, and later in the video various other body parts. The effect is quite similar to the work of Live Cinema artists, as Anderson inserts herself within the projections in real-time. The video also evidences some rudimentary visual effects (compositing, multiple screens), particularly toward the end, but again represented within the context of Anderson performing live. In live performances of the piece, one of which I witnessed, she effectively recreated the video on stage, with all of the live video elements.

Prior to the success of *O Superman,* Anderson primarily played in small arts venues, but after it's surprise rise in the charts she moved to larger venues and ever more elaborate multimedia spectacles, such as her epic performance *United States Live* (released on 5 vinyl records in 1983 and four CDs later) or her video release of *Home of the Brave* from 1986 (available now on DVD). The latter featured not only a

group of highly skilled music performers (such as Adrian Below and David Van Tiegham), but it also had an incredibly elaborate (for the era) projection setup, with complex imagery accompanying each live performance, along with theatrical props, and very particular guest appearances, such as one from cut-up writer William S. Burroughs. Both *United States Live* and *Home of the Brave* set the stage for multimedia audio-visual performances of the succeeding two decades. Using a combination of analogue and digital projection systems, complex lighting, as well as live electronic music, the work of Laurie Anderson is the early 1980s was key to the development of the performed audio-visuals. Following on from her a generation of artists emulated the form (if not necessarily the look and sound) of Anderson's work, resulting in a generation of live video performances that dominated in the 1980s and 1990s.

Amongst a number of artists (Captain Beefheart, Frank Zappa, etc.) also associated with the American avant-garde in the 1970s (and 80s), well-known electronic avant-gardists The Residents used increasingly multimedia elements in their work in the early 1980s and beyond. For example, their performance of *The Mole Show* from 1983, included their trademark theatrical presentations (including an array of costumes) as well as multiscreen video, several dancers and a complex stage setup where the band played behind a burlap scrim.[55] These were followed by other more elaborate stage performances, as well as a series of specially produced CD-ROMs and DVDs in the 1990s. Other groups in Europe and the UK associated with either the avant-garde or the new wave, such as Cabaret Voltaire, Kraftwerk, and Gary Numan also used complex stage setups and projections in their works in the 1980s, and continued to do so in the coming decades. It was in this era that the idea of audio-visual multimedia performance was born and it finds echoes through to the present day where almost every major touring band has some sort of projection element.

The Rise of the VJ: Merrill Aldighieri

An unquestionably key development that occurred in the early 1980s was the establishing of the club-based Visual Jockey (VJ) as a clearly defined performer. The first artist to use the term VJ was Merrill Aldighieri (birthdate unknown-) in relation to her "pioneering work creating an improvised live video feed to interpret the DJ's music at the legendary club Hurrah"[56] in New York in 1980-81. While almost forgotten in the late 1980s and 90s, with the rise of Vjing in the 21st century her work has come to the forefront again. Over the course of two years at Hurrah she created live visual performances for an incredible number of punk, post-punk and new wave acts, which have been collected into a documentary called *V.J. Diaries*:

> Her historic filming of the live performances of punk, new wave, jazz and industrial music form a diary marking her time at this seminal club… More than 200 hours of live music performances were recorded by Aldighieri during a year at Hurrah (1980-1981). Excerpts from 30 different live shows include legendary bands like New Order, Mission of Burma, Magazine, Gang of Four, The Psychedelic Furs, A Certain Ratio, and Bush Tetras, as well as interviews with Cynthia Sley, Jim Fouratt, Anita Sarko, Dee Pop, Ron Jagger, Bill Laswell, Jim Jarmusch, Stephanie Kaye, Alan Vega, George Wrage and many more, blended with rare archival footage and visually daring animation inspired by her nightly VJ improvisations.

Aldighieri had been trained as a filmmaker and moved to New York in the 1970s, where she worked on The Muppets TV show. In 1980 she began to work at the HURRAH nightclub: "HURRAH was the first club to make a video installation as a focal point of the club environment, but until I came they were just turning it on occassionally [sic] to play films. I asked if I could experiment to create a real-time constant flow of visuals to work with the DJ's music so when my film played, the flow would not stop. When they offered me my first paycheck, the word VJ was born as we looked for how to note what I was doing."[57] Her approach was aided by an enormous bank of video clips she had at her disposal and were mixed in real-time to various DJs, as well as bands and performers. As such she became demonstrably the first club VJ, and while this may be apocryphal, it has been claimed that the "MTV founders came to this club [HURRAH] and Merrill introduced them to the term and the role of "VJ", inspiring them to have VJ hosts on their channel the following year."[58]

Regardless of the accuracy of the above claim, there is no doubt that the Aldighieri was the first to perform as a visualist in a club atmosphere, and therefore can reasonably be dubbed the godmother of Visual Jockeying. "Extracts from the LIVE AT HURRAH video archive made by Merrill Aldighieri that will serve as the basis for a series of documentaries on her pioneering experience in music-video in the early 80s" are available in a collection at 2 Live at HURRAH.[59] Certainly her influence lived on (either accidently or by design) in the scratch video of the succeeding years, and naturally in the club Vjing that came to the forefront in the 21st Century.

Conclusion

The period of 1955 to 1985 was undoubtedly a period of substantial change, both in the arts and sciences. In general, it was a period of considerable technological advancement, though these developments were achieved primarily through analogue means (with some obvious exceptions, as outlined above). Towards the middle of the 1980s, the digital became more prominent when the Musical Instrument Digital Interface (MIDI) specification was solidified in 1985. Combined with the broad dissemination of the personal computer in the late 1980s by Apple, IBM and Atari, this marked a significant shift from the previous primarily analogue work in which much live interaction was done by hand or with devices that were extremely large, often unreliable, and had no capacity to save configurations.

Clearly the work of artists as diverse as the Whitneys, Silver Wing Turquoise Bird, and Laurie Anderson fed into the next generation of live visual and live audio-visual performers, at least in terms of concept; however, as the 1980s moved on, analogue devices were slowly replaced by digital ones. The result was that a certain repeatability was achievable that was previously elusive. In addition, digital editing allowed for greater audio-visual precision, which was taken up by the next generation of live visualists, audio-visual artists and live cinema performers. This leads us to our next discussion on Scratch Video, Rave and Live Cinema.

Endnotes

[1] Léon McCarthy, "Live Visuals: Technology and Aesthetics**"** Chapter 8 in Steve Gibson, Stefan Arisona, Donna Leishman, and Atau Tanaka, *Live Visuals: History, Theory, Practice* (London: Routledge, 2022).
[2] Paul Griffiths, *A Guide to Electronic Music* (New York: Thames and Hudson, 1979), 12.
[3] Paul Griffiths, *A Guide to Electronic Music* (New York: Thames and Hudson, 1979), 13.
[4] Paul Griffiths, *A Guide to Electronic Music* (New York: Thames and Hudson, 1979), 18-19.
[5] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 55.
[6] James Whitney, *Yantra***,** 1957, Chapadão do Formoso YouTube page, https://www.youtube.com/watch?v=nvWwlZSXaR0
[7] John Whitney, Digital Harmony: On the Complementarity of Music and Visual Art (Kingsport, TN: Kingsport Press, 1980), 184.
[8] Zabet Patterson, "From the Gun Controller to the Mandala: The Cybernetic Cinema of John and James Whitney" Grey Room 36, Summer 2009, pp. 36–57 (Grey Room, Inc. and Massachusetts Institute of Technology, 2009), 37.
[9] Gene Youngblood, *Expanded Cinema* (New York: E.P. Dutton & Co., 1970), 194.
[10] Zabet Patterson, "From the Gun Controller to the Mandala: The Cybernetic Cinema of John and James Whitney" Grey Room 36, Summer 2009, pp. 36–57 (Grey Room, Inc. and Massachusetts Institute of Technology, 2009), 38.
[11] James Whitney, *Lapis, 1966,* Chapadão do Formoso YouTube page, https://www.youtube.com/watch?v=kzniaKxMr2g

[12] William Moritz, "Digital Harmony: The Life of John Whitney, Computer Animation Pioneer," *Animation World Magazine*, Issue 2.5, August 1997, https://www.awn.com/mag/issue2.5/2.5pages/2.5moritzwhitney.html
[13] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 74.
[14] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 76.
[15] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 76.
[16] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 77.
[17] Nam June Paik, "Videa 'n Videology 1959–1973," Emerson Museum of Art, Syracuse, New York, 1974 p.55.
[18] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 82.
[19] George Fifield, "The Paik/Abe Synthesizer," The *Early Video Project* website, 2000, http://davidsonsfiles.org/PaikAbeSythesizer.html
[20] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 78.
[21] A documentation of *Exploding Plastic Inevitable* can be seen on tomorrowpictures.tv, http://tomorrowpictures.tv/radio-tv-film/VNE4lSYAACcNQSvL/exploding-plastic-inevitable
[22] Kerry Brougher, "Visual Music Culture," in in Kerry Brougher, Jeremy Strick, Ari Wiseman and Judith Zilczer, *Visual Music: Synesthesia in Art and Music Since 1900,* organized by Kerry Brougher, (London: Thames and Hudson, 2005), 159.
[23] Kerry Brougher, "Visual Music Culture," in in Kerry Brougher, Jeremy Strick, Ari Wiseman and Judith Zilczer, *Visual Music: Synesthesia in Art and Music Since 1900,* organized by Kerry Brougher, (London: Thames and Hudson, 2005), 159-60.
[24] Kerry Brougher, "Visual Music Culture," in in Kerry Brougher, Jeremy Strick, Ari Wiseman and Judith Zilczer, *Visual Music: Synesthesia in Art and Music Since 1900,* organized by Kerry Brougher, (London: Thames and Hudson, 2005), 161.
[25] Kerry Brougher, "Visual Music Culture," in in Kerry Brougher, Jeremy Strick, Ari Wiseman and Judith Zilczer, *Visual Music: Synesthesia in Art and Music Since 1900,* organized by Kerry Brougher, (London: Thames and Hudson, 2005), 161.
[26] Kerry Brougher, "Visual Music Culture," in in Kerry Brougher, Jeremy Strick, Ari Wiseman and Judith Zilczer, *Visual Music: Synesthesia in Art and Music Since 1900,* organized by Kerry Brougher, (London: Thames and Hudson, 2005), 162.
[27] Kerry Brougher, "Visual Music Culture," in in Kerry Brougher, Jeremy Strick, Ari Wiseman and Judith Zilczer, *Visual Music: Synesthesia in Art and Music Since 1900,* organized by Kerry Brougher, (London: Thames and Hudson, 2005), 166.
[28] Kerry Brougher, "Visual Music Culture," in in Kerry Brougher, Jeremy Strick, Ari Wiseman and Judith Zilczer, *Visual Music: Synesthesia in Art and Music Since 1900,* organized by Kerry Brougher, (London: Thames and Hudson, 2005), 166.
[29] Gene Youngblood, *Expanded Cinema,* Introduction by R. Buckminster Fuller (New York, P. Dutton & Co., Inc., 1970), 394.
[30] Gene Youngblood, *Expanded Cinema,* Introduction by R. Buckminster Fuller (New York, P. Dutton & Co., Inc., 1970), 183 and ff.
[31] Guy Sherwin, *Man With Mirror*, 1976, BD Films YouTube page, https://www.youtube.com/watch?v=DX1-xuCNIeg.
[32] Tony Hill Films Official website, "Installations," http://www.tonyhillfilms.com/installations
[33] Tony Hill Films Official website, "Rigs," http://www.tonyhillfilms.com/rigs
[34] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 79.
[35] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 78.
[36] "Small Planet Myron Krueger," *The Interaction '97: Towards the Expansion of Media Art* conference website, https://www.iamas.ac.jp/interaction/i97/artist_Krueger.html
[37] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 80
[38] See Myron Krueger, *Videoplace 1975* for several videos documenting the project https://aboutmyronkrueger.weebly.com/videoplace.html

[39] Nam June Paik, *Participation TV II*, video-closed-circuit, three cameras combined with a Paik/Abe synthesizer and four monitors, Galleria Bonino, New York 1971: Davis: Experiment 1975, p.189; Decker: Paik 1988, p.65s.,151; Kacunko: Circuit 2004, p.187s

[40] Myron Krueger, *[Artificial] Reality*, (Boston, Addison-Wesley, 1991) p.105ss.

[41] Thomas Dreher, *History of Computer Art*, IASLonline Lessons/Lektionen in NetArt, http://iasl.uni-muenchen.de/links/GCA_Indexe.html, 2013-14.

[42] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 80.

[43] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 82.

[44] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 82-83.

[45] Adrano Abbado, *Visual Music Masters* (Milan: Skira Editore, 2017), 83-84.

[46] VJzoo, Fairlight Computer Video Instrument "About" page, http://fairlightcvi.com/wordpress/?page_id=2

[47] VJzoo, Fairlight Computer Video Instrument "Home" page, http://fairlightcvi.com/wordpress/

[48] Steven Jones, *Scanlines: Media Art in Australia Since the 1960s* webpage, http://scanlines.net/node/1704

[49] Steven Jones, *Scanlines: Media Art in Australia Since the 1960s* webpage, http://scanlines.net/node/1704

[50] Severed Heads Biography, *LTM Recordings* official web page, https://www.ltmrecordings.com/severed_heads.html

[51] See http://sevcom.nilamox.com/photo/1986%20The%20World/tour/index.html for images from the 1986 Severed Heads tour.

[52] Jeffrey Shaw, *The Lamb Lies Down on Broadway, Jeffrey Shaw Compendium* website, 1975, https://www.jeffreyshawcompendium.com/portfolio/the-lamb-lies-down-on-broadway/

[53] Jeffrey Shaw, *The Lamb Lies Down on Broadway, Jeffrey Shaw Compendium* website, 1975, https://www.jeffreyshawcompendium.com/portfolio/the-lamb-lies-down-on-broadway/

[54] Laurie Anderson, *O Superman (Official Video)* Nonesuch Records YouTube page, 1982 (remastered 2007), https://www.youtube.com/watch?v=Vkfpi2H8tOE

[55] The Residents, *Mole Show (1983), The Residents Official Site,* https://www.residents.com/historical/?page=moleshow

[56] *Merrill Aldighieri V.J. Diaries*, *Howl Arts* website, 2017, https://www.howlarts.org/event/merrill-aldighieri-v-j-diaries/

[57] Merrill Aldighieri, *Merrill Aldighieri Resume, ARTCLIPS -the multi-media dream palace of Merrill Aldighieri,* http://artclips.free.fr/cv_eng_merrill.htm

[58] *Vjing, HisoUR* website, https://www.hisour.com/vjing-2984/

[59] See *LIVE AT HURRAH*, video archive made by Merrill Aldighieri, https://www.youtube.com/playlist?list=PLF17B5AD4D07B27C2. Also see https://www.howlarts.org/event/merrill-aldighieri-v-j-diaries/ for a trailer of her documentary *V.J. Diaries.*