Chapter 32

Hardware Hacking, Software Modding, and File Manipulation: Process Cinema in the Digital Age

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Traditionally, *process cinema* is a methodology that involves improvisation, experimentation, and direct physical interaction with the filmic apparatus. In contemporary moving-image practices, the filmic apparatus has been digitized and, as such, a new form of process cinema has emerged. In other words, process cinema methodologies are still being employed by moving-image artists who work in the realm of digital video and game art. Despite the lack of an explicit physical basis, I propose that the materiality of digital video is the file, and artists use algorithms and software to manipulate that file. Furthermore, there are still some unconventional processes that allow the contemporary digital video artist to physically interact with and manipulate the digital apparatus. In recent years, software as a ubiquitous, inherently political interface has been a topic of academic discourse. However, the challenges moving-image artists present through unconventional uses of software and hardware hacking have not been sufficiently theorized. In this essay, I will examine some of the theoretical and artistic developments concerning digital approaches to process cinema. In particular, I intend to provide a brief survey of some of the techniques and theory surrounding hardware hacking, software modding, and direct file manipulation.

The Paradigm Shift: The File as a Material

Film theorist David N. Rodowick suggests that "we need to go beyond a formal definition and try to understand how a medium is not simply a passive material or substance; it is equally form, concept, or idea. Or, more provocatively, a medium is a terrain where works of art establish their modes of existence, and pose questions of existence to us" (Rodowick 2007, 42). Expanding on this further, Rodowick has suggested that "a medium should not be considered as a 'material' in any literal or simple sense" (33), despite the fact that many artists still view it as a material and choose to work in a specific medium due to its properties, limitations,

and errors. That is, many digital video artists have been viewing the file as a material while many scholars seem reluctant to.

In *The Language of New Media*, new media theorist Lev Manovich has referred to his method as "digital materialism" (Manovich 2001, 10) without explicitly claiming that the file is the new material used by artists working in digital video. As observed by Malcolm Le Grice, "digital and electronic media seem to defy finding a physical basis for the aesthetic unless this is added through the output technology" (Le Grice 2001, 311). Despite this lack of a physical basis, I propose that the material of digital video is the file.

Digital video's status as file is commonly misapprehended. For instance, traditional video editing software systems are often heavily based in a film-editing paradigm. As observed by software engineer Shigeki Amitani and multidisciplinary artist Ernest Edmonds, most "editing software has been developed as a metaphor of the traditional editing tools such as films and VCRs. This means that video editing software does not provide suitable interactive representations for artists" (2008, 171). Digital videos are files, meaning that they have more of an ontological basis in computer science than in traditional filmmaking. Rather than use the available editing software, many digital video artists have been developing their own algorithms or modifying existing ones in order to manipulate video files. In doing so, I argue they are working more directly on the material of the medium.

In a 2010 paper titled "On Glitching," theorist and artist Evan Meaney explicitly asks if it is possible for artists to make "hand-processed videos" that "might incorporate the narrative of the medium into the discourse of the piece as a functioning whole" (46). That is, Meaney is implicitly asking what I consider to be one of most salient questions about digital video: *What concepts can artists exploring digital video borrow from those who produce hand-made films?*

In order to begin to answer this question, let us ask a more specific question: is there an analogous concept for scratching on film in the realm of digital video? One response might involve asking another question: what exactly is scratching on film and how does the artist do it? In order to scratch on film, the artist must have a tool, namely, a sharp instrument that is used to remove the emulsion. By removing emulsion, the filmmaker is in essence removing information. Thus, one possible analogous concept of scratching on film for digital video might be to use algorithms to remove data from the digital file, an approach that many glitch artists have experimented with. Of course, not all traditional experimental film techniques have analogous digital processes in this way, and digital video opens up a new set of techniques, many of which have yet to be discovered.

Hacking the Home Entertainment System: Video Games as Art

Game art, as defined by art historian and game theorist John Sharp, is artwork produced by "artists using the technologies, formal considerations and content of video games to artistic ends" (2012, 26). One of the major developments in the history of game art occurred when game data were made available by game programmers. As observed by curators Shiralee Saul and Helen Stuckey:

> Aware that players had tried to produce customized levels for their previous game release, *Wolfenstein 3D*, ID Software's lead programmer, John Carmack, designed *Doom* (1993) so that game data (such as levels, graphics, sound effects and music) was stored separately from the game engine in WAD files. Just over a month after the shareware release of *Doom*, users uploaded the first version of the *Doom Editing Utility*.
>
> …
>
> More than this, *Doom* put the tools to create three-dimensional space – virtual worlds – into the hands of everyone. (2007, 2)

This philosophy of designing games with accessible game data continued to ID Software's next release, *Quake* (1996), which spawned many other games like *HalfLife* (1998) and *Counterstrike* (2000) and also allowed for artists to experiment with game mechanics.

JODI's *Untitled Game* (1996–2001) series,[1] which consists of twelve modifications of the video game *Quake*, is one of the earliest and most innovative examples of game art that explores the underlying mechanics of the game. Some of the modifications allowed for navigation of the game space while others simply exploited the game engine as an effect-generating tool. In a review of the work, critic and curator Anne-Marie Schleiner observed: "One aesthetic manoeuvre repeated in the *Untitled Game* collection, reminiscent of JODI's net art, is to strip the environment of 'realistic' graphics, to reduce anti-aliased pixels and colour palettes to primary minimalist colours and shapes. Stripped of all pretense of photorealism, game play is reduced to algorithms normally cloaked as 'representational' actions … And these bare algorithms can be quite stunning" (Schleiner 2002, para. 6).

In other words, the works reveal the underlying algorithmic structure of the game. However, more importantly, they allow the player to experience this structure and explore it. Being able to explore and navigate these digital spaces allows us to experience the aesthetic nature of the algorithm. JODI explicitly made the underlying algorithms of *Wolfenstein 3D* (1992) playable in their work *SOD* (1999), a piece in which all of the representational elements from the game have

been removed, creating an abstract black and white maze. By removing the semantic cues, the game becomes unplayable. However, the game's representational system is revealed and new insight is gained. Sharp observes:

> Works like *SOD* attempt to push the accordances of game technologies against themselves, and in the process subvert the formal characteristics of video games. In doing so, they make it difficult or even impossible to interact with the game in order to pursue the game's goals and use the player actions in the sense originally intended. In much of their work, JODI endeavours to make everyone – gamers, art viewers, IT professionals – as disoriented and uncomfortable as possible. This is another trajectory of Game Art – the critique of the game industry, gamers and game culture. (2012, 27)

Another major development in the history of game art occurred once video game emulators and ROMs became available: "One of the most widespread forms of piracy is video game software extracted from Read-only Memory (ROM) chips and freely distributed across the Internet. A staple among classic gaming enthusiasts is the use of unauthorized video game emulators to play these copied or downloaded games on systems other than those for which they were designed, most often modern personal computers" (Jordan 2007, 708). Once the video game was liberated from the video game cartridges, it became possible for the artist to ROM-hack since the artist had direct access to the underlying code and could play with it using a hex editor.[2] Of course, ROM-hacking is often illegal since the code in the ROM usually contains copyrighted intellectual property. In the digital age, the commodification of information no longer appears in a specific material form. Rather, it appears as "a protected algorithm embodied in computer code" (709). Artists are thus able to ROM-hack only by blatantly ignoring copyright laws, which signifies both an outdated profit structure pertaining to intellectual copyright and to outdated laws pertaining to the artistic "re-licensing" of proprietary code and technology.

One of the earliest artistic uses of ROM-hacking was by artists Paul B. Davis and Cory Arcangel in their work *Fat Bits* (2001). In this three-channel work, images of a hockey fight were generated on reprogrammed 8-bit Nintendo cartridges. The following is a description of the work by Davis:

> Bereft of a veneer, interaction with such complicated machinery requires a significant amount of technological knowledge and awareness. In this spirit, *Fat Bits* represents a step towards what Cory and I describe as "Post-Data." We create computer art which is aesthetically aware of both its own identity and the underlying process which supports it – that is to say it recognizes the fundamental prototype of the "computer," and not the

> "software," as the tool and medium … The use of the Nintendo Entertainment System is itself important because it, firstly, signifies an artistic "re-licensing" of proprietary corporate technology and, secondly, refutes Nintendo's forced obsolescence profit structure which defines it as "outdated" (the Nintendo Entertainment System was introduced to the US home video game market in 1986). Our primary foundation of Post Data is then this: the conscious corruption of data, the releasing of bits from their imprisonment within the restrictive, limiting boundaries of corporate software applications, and the exploitation of the extreme complexity of computer systems paired with the extreme intentionality of artist(s) who seek to engage the computing process at a fundamental level. (Davis 2001, sec. 2)

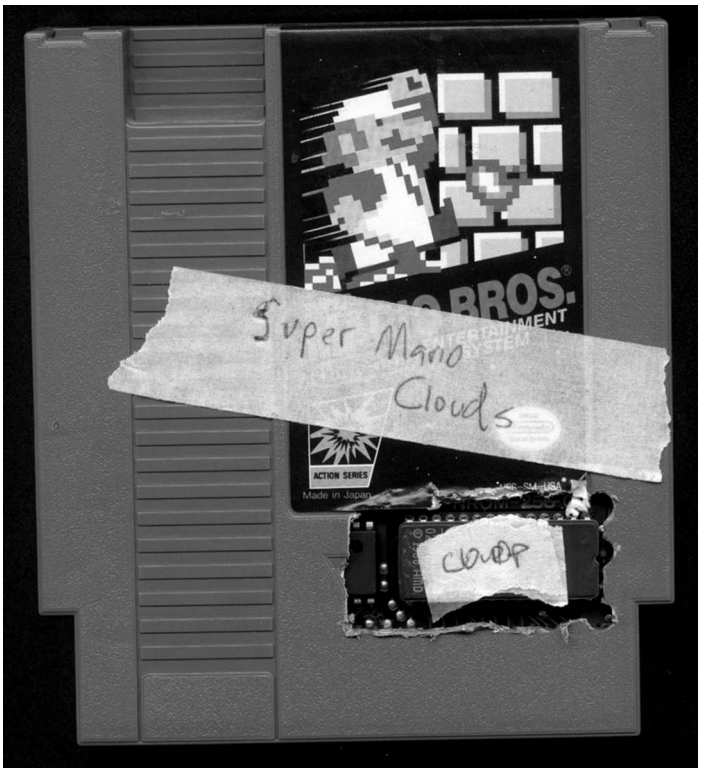
In this description, Davis reveals artistic, political, and cultural motivations for the work. More recently, Brooklyn-based artist and VJ NO CARRIER[3] released *NESFlix* (2011),[4] a movie player for the Nintendo (or a Nintendo emulator) that allows everyone access to the techniques Arcangel and Davis used to create *Fat Bits* by removing technical barriers.

After *Fat Bits,* Arcangel went on to create many other ROM-hacks, including *Super Mario Clouds* (2002) and *Super Mario Movie* (2005, in collaboration with Paper Rad).[5] Saul and Stuckey describe *Super Mario Clouds* as follows:

> Seemingly far removed from the conceptual challenges offered by these works, the delightful *Super Mario Clouds* (2002) is pure simplicity and beauty. The work of hacker artist Cory Arcangel, it was made by re-wiring the software code of game classic *Super Mario* [*Super Mario Bros.*] (1985) for the Nintendo NES. Arcangel removed all game elements except the fluffy white clouds that endlessly scroll on a brilliant 8bit-blue background. The result is joyously simple – a hidden pleasure released from the demand of game play to become like Warhol's *Clouds* (1966) of the sixties. (2007, 5)

This description ties Arcangel's *Super Mario Clouds* to the work of Warhol. However, it is worth pointing out a similar connection to the structural/materialist tradition through the anti-illusion work *Clouds* (1969) by British filmmaker and theorist Peter Gidal, and to the structural tradition through the durational work *Ten Skies* (2004) by American filmmaker James Benning.

In Arcangel's *Super Mario Movie,* the game character Luigi exists in a world where the underlying rules of the game are slowly undermined. In essence, the universe is slowly being corrupted through ROM-hacking. The movie is generated in real time on a hacked NES cartridge while played on a Nintendo. In the movie, the world collapses around Luigi until he finally loses the language to express the existential crisis he is experiencing and is absorbed into the decaying digital



32.1
Cartridge for *Super Mario Clouds* (2002).

landscape. In a sense, *Super Mario Movie* could be interpreted as Jean-Paul Sartre's *Nausea* (1938) amended for a generation raised on video games.

Breaking the Toy: Circuit Bending and Hardware Hacks

In a section of *The Imaginary Signifier*, titled "'Theorise', he says … (Provisional Conclusion)," Christian Metz makes the following argument:

> To study cinema: what an odd formula! How can it be done without "breaking" its beneficial image, all that idealism about film as an "art" full and simple, the seventh of the name? By breaking the toy one loses it, and that is the position of the semiotic discourse; it feeds on this loss, it puts in its place the hoped for advance of knowledge: it is an inconsolable discourse that consoles itself, that it takes itself by the hand and goes to work. Lost objects are the only ones one is afraid to lose, and the semiologist is he who rediscovers them *from the other side*: *"Il n'y a de cause que de ce qui cloche"* – "there is a cause only in something that doesn't work." (Metz 1982, 80)

The act of "breaking the toy" has always been an intrinsic part of process cinema. For instance, in "Words per Page," Sharits suggests that the "so-called 'defectives parts,' which in 'cinema' are regarded as 'mistakes' are probably the most adequate parts to deal with in 'cinematics' approach; obviously, flaws reveal the fabric and 'cinematics' the art of the cinema's fabric" (1978, 33). By "breaking the toy," the artist is able to experiment with the medium, make use of it in unconventional ways, and demystify its inner workings. Although the toy in the "breaking the toy" argument is intended to be allegorical/metaphorical in nature, the act of circuit bending – the creative short-circuiting of low-voltage electronics to produce aesthetic glitches – is often the literal act of breaking the toy since the most commonly bent objects are battery-operated toys. Of course, toys are not the only objects that artists bend – they also bend VHS machines, old video mixers, digital cameras, and any other electronic devices that artists are "not afraid to lose." Circuit bending breaks and distorts the "beneficial" image in fairly unpredictable ways. However, with some experimentation and patience, it is possible to develop some control over the bends and to predict the effect the bend will create. One of the main benefits of breaking the toy is the awareness that it is possible to break the image. Yet there is a fear in breaking the image, one that is possible to overcome. Breaking the image can be read as an attempt to take back the medium.

It is worth observing that many medium-specific properties reveal themselves through errors. For instance, it becomes excruciatingly obvious what medium you are viewing a "film" on when a DVD skips, the internet lags, or a film print burns. In fact, many artists use a specific medium because the medium's errors and limitations create a specific effect and affect. In addition, artists will often experiment with the limitations of a medium by using the medium in ways for which it was not intended. For example, Dutch circuit hacker Gijs Gieskes creates new electronic devices by making sophisticated modifications to old electronic devices through circuit bending. Glitch artist and theorist Rosa Menkman explains Gieskes's work:

> Gieskes takes machines apart and changes their circuitry. Through circuit bending, he redefines the technology and its contents, penetrating and exploring the machine from the inside. First, he dismantles the system and then he deconstructs and re-appropriates it. One of his circuit bent machines, the *circuitbend sega megadrive2.2* (2007), consists of a Sega console with a modified circuit, actively transforming the video game console into an autonomous video synthesising machine. Gieskes did not add any code to the chips or the video game; he only changed the circuitry of the console. This means that the glitches that appear on the television screen were already part of the video game's software (the ROM);

the generated visuals are readymade, manipulated appropriations of mass-produced objects. (Menkman 2011, 37–8)

This act of creative rewiring releases images that the viewer is normally unaware of while they play the device. Through this process, Gieskes often reveals the underlying protocol used by the machine – for instance, its tiling and layering protocol.

In 2009, NO CARRIER released *glitchNES*,[6] an emulator that generates graphics similar to those obtained through circuit bending an NES, a process physically explored by New York–based artist Jeff Donaldson.[7] In essence, NO CARRIER is simulating the glitches obtained through actual bending. *GlitchNES* is open-source and modifiable by anyone, which provides the possibility of new aesthetic explorations to anyone who is interested. Making software that duplicates or replicates experimental techniques is becoming a common practice – a democratizing process that allows everyone to experiment with them, not simply those who identify as experimental film and video artists.

Avant-Garde as Software: Algorithmizing the Avant-Garde

Another contemporary approach to working with digital video is to transform experimental techniques into readily available, easy-to-use, open-source software. The following section might be seen as an extension of some of the ideas in Lev Manovich's paper "Avant-Garde as Software" (2002). Manovich's main conclusion is: "On one hand, software codifies and naturalizes the techniques of the old avant-garde. On the other hand, software's new techniques of working with media represent the new avant-garde of the meta-media society" (11). While I agree with the main sentiment of Manovich's conclusion, it is also worth observing that he neglects to mention any artist-made software or the works of artists attempting to codify the avant-garde. For instance, consider the two previously mentioned ROMs by NO CARRIER (*GlitchNES* and *NESFlix*) and the work of Barbara Lattanzi, a new-media artist who has developed her own original, open-source software to algorithmically edit films. Lattanzi uses software consisting of "simple, dynamically-modifiable algorithms" to encode and emulate editing techniques of seminal avant-garde films (Lattanzi 2006, 1). Her software, *AMG Strain* (2002), *HF Critical Mass* (2002) and *EG Serene* (2002), emulates the editing schema of Anne McGuire's *Strain Andromeda The* (1992), Hollis Frampton's *Critical Mass* (1971), and Ernie Gehr's *Serene Velocity* (1970), respectively.

By referencing other work, Lattanzi observes that "the simulation of film structure in a software algorithm – where the software becomes *referential* to a specific

film experience – *paradoxically registers a narrative in the algorithm*, a narrative with concrete reference within an abstraction" (Lattanzi 2004, 1; emphasis in original). However, I would argue that while reference to another film's structure is not enough to produce narrative, it is enough to enter into a cultural dialogue with the original artists. On the other hand, the clips the software is applied to become extremely important and play a key role in contributing to the narrative or content of the film. In other words, as observed by Lattanzi, the "software is not narrativising in itself." She continues, "Software is not about something. Software *performs* something" (5; emphasis in original). In the case of Lattanzi's software, it performs an algorithm on a specific video clip – and the choice of the clip is significant. For instance, *Critical Mass*, *Serene Velocity*, and *Strain Andromeda The* are considered works of cultural significance precisely because the artists took careful consideration in the content to which they applied their editing schema. The editing schema in and of itself was not enough.

Recently, Nick Briz paid homage to Martin Arnold by creating the *Martin Arnolizer* (2011), an algorithm that allows the user to duplicate the technique used in Arnold's *Pièce touchée* (1989), *Passage à l'acte* (1993), and *Alone. Life Wastes Andy Hardy* (1998).[8] Briz explains:

> The *Martin Arnolizer* is an application I made on MAX/MSP which lets you recreate your favourite Martin Arnold films/effects/experiences in realtime. All you have to do is drag and drop a video clip into the Martin Arnolizer and use your arrow keys to repeat frames, skip/stutter through the clip, and flip the image vertically and/or horizontally, it's so easy! Some may be unfamiliar with Martin Arnold's process. He would work on his films intensely for months – *Piéce Touchée*, which is only 16 minitues [*sic*] long, took him a year and a half to make! He would write scores (as long as 200 pages), similar to music compositions, and work from that on a delicate optical printer he made himself. (Briz 2011)

This would seem to devalue Arnold's techniques. However, without Arnold's work, we might not be thinking about this particular process. In addition, much has been written about the work beyond its technique, demonstrating that although the technique has been made easily reproducible, Arnold's work remains securely canonized. Finally, Briz's technique is open-source, which offers new realms of possibility to anyone who is innovative enough to expand on Arnold's technique.

There are many consequences of algorithmizing the avant-garde. Creating an algorithm that performs a specific technique allows others to explore the aesthetics of the original work. This means that the same techniques are available to everyone to experiment with, and the techniques in and of themselves become mere tools for making other artworks. In other words, the value in the artwork is not

based upon the techniques used since they are potentially ubiquitous. Rather, the value of the artwork is dependent on how the algorithms are put to use. Without artist innovation, simply employing these algorithms has the potential to reduce the techniques to kitsch or novelty. That is, they become the equivalent of an Instagram filter. Moreover, the algorithm has the potential to mystify the original technique. For instance, software that emulates the aesthetics of hand-processed film does not show a person how to actually hand-process film. Finally, by referencing the work in which the technique was originally used, the creator of the algorithm is paying homage to the original artist. In fact, this may even reinvigorate interest in the original work by potentially introducing the work to an entirely new audience.

Welcome to Heartbreak: Compression Explorations

Another form of software manipulation is codec hacking, or the manipulation of the algorithms used to compress digital videos. One of the first major innovations was a process now referred to as datamoshing, the process of manipulating and inducing artifacts inherent to video compression. Examples include Takeshi Murata's *Monster Movie* (2005) and Paul B. Davis's *Compression Studies 1–4* (2007, *Compression #1* made in collaboration with Jacob Ciocci). When Davis released *Compression Studies 1–4*, he provided a lo-fi explanation of how to create the techniques using an open-source video editing software called Virtual Dub.[9] He documented this process in an article titled "STRUCTURES FOUND – STRUCTURES LOST," which was released alongside the videos. This type of dialogue and knowledge sharing is not uncommon within the community. To this effect, Menkman released "A Vernacular of File Formats" in which she categorized and explained how to exploit various image compression errors. As well, director Ray Tintori[10] released a comprehensive, three-part YouTube tutorial titled "HOW TO DATAMOSH,"[11] and Tom Butterworth has written software[12] for Quartz Composer that allows you to datamosh and play with compression artifacts in real time. Releasing software and sharing techniques both democratizes them and opens up the creative process as one potential experience for the audience.

In *The Glitch Codec Tutorial* (2010), Briz attempts to provide more than just a detailed guide on how to create your own glitch codec. He explains: "This tutorial, however, is more than just a 'how to' – it is a full disclosure of my personal process. This means that I share not only my tools, techniques, and tricks but my feelings, philosophy, and ethic as well. Issues ranging from the open-source and copyleft movements to the phenomenological impact of codecs on our moving image culture are addressed while accessibly guiding participants through the

32.2
Still from *How to Datamosh* (2009).

hacking/data-bending process" (2). This demonstrates Briz's belief that creating codecs is about more than simply the technology involved. He argues that the unexpected interruption caused by the glitch makes the viewer "aware of the medium, its structure, and its politics" (4). In order to follow Briz's tutorial, the user must temporarily switch their computer to an Ubuntu OS, a user-friendly, open-source GNU/Linux operating system, which encourages users to permanently switch from a proprietary operating system to an open-source one by providing hands-on experience to the participant.

Briz has exploited the codecs of various online upload-video hosting sites to create *Black Compressed* (2009). He describes the process of creating this work as follows: "Beginning with four minutes and thirty-three seconds of solid black video I proceeded to compress the video various times. The last stage of compression is that of the various video hosting sites where I posted the same exact video" (Briz 2009). The effect of Briz's process is the creation of six separate and unique-looking videos. Although the piece is explicitly referencing John Cage's seminal *4′33″* from 1952, it can also be seen as an extension of Nam June Paik's *Zen for Film* (1962), a piece which consists of transparent leader that accumulates scratches and dust each time it is passed through the projector.

In both *Zen for Film* and *Black Compressed*, the material and the medium dictate the structure of the work. Briz observes that "a glitch is this (unexpected) moment in a system that catches us off-guard & when it does that, it (more often

than not) reveals aspects of that system which might otherwise go unnoticed (while the system attempts to remain 'invisible')" (2015, 9). This observation can be seen as both literal and metaphorical. For instance, the various underlying algorithms used on streaming video sites affect the content we receive, implying that there are once again financial, commercial, and procedural concerns involved. Moreover, most of the content we watch is filtered through a commercial codec. As Briz observes in *The Glitch Codec Turorial*:

> The role codecs play in our ways of seeing the world is more pervasive than one would imagine. Nearly every bit of media content we encounter (television, DVDs, CDs at a store, mp3s on our Ipods, videos on the internet, etc) have been compressed with codecs. Its importance is made clear from an economic standpoint. [Adrian] Mackenzie points out that MPEG-2, a widely used codec (commercially and otherwise), "is a mosaic of intellectual property claims, 640 patents held by entertainment, telecommunications, government, academic, and military owners according to Wikipedia. The large patent pool attests to the economic significance of MPEG-2 codecs. (2010, 12)

In the case of streaming video sites, this is mainly an aesthetic concern. However, there are many sites that use algorithms to control our access to information (e.g., Google) and even our potential love interests (e.g., OkCupid). This demonstrates that these algorithms influence the content and information we receive, implying that this is more than simply an aesthetic concern.

Finally, only five of six *Black Compressed* videos currently remain. The sixth video was hosted on Myspace and has since been removed by the site. Briz explains: "[The Myspace video] originally had one of the most drastic compression bugs (changed the color pretty insanely) and then shortly after I uploaded it … they removed it … so I uploaded it again … and again it got taken down."[13] This raises a serious concern about the ephemerality of internet-based digital works, especially those that exist on third-party websites, since the work is not in the hands of the artist – whether the work remains is at the site's discretion, which is primarily financially motivated.

Transmedium Transcoding: Hybrid Forms

One extreme example of attempting to preserve digital work is *VinylVideo*™ made by Gebhard Sengmüller, in collaboration with Martin Diamant, Günter Erhart, and Best Before. *VinylVideo*™ is a device that converts a regular turntable into one that plays custom-made vinyl video records. *VinylVideo*™ attempts to

32.3
VinylVideo™ on display at DEAF Festival Rotterdam, 1998.

offer one solution to digital archivability since "*VinylVideo*™ Picture Disks have a virtually unlimited life if they are properly stored (at room temperature)" (Sengmüller 1998b). Although *VinylVideo*™ Picture Disks lack the fidelity required to archive work, storing work on vinyl reveals, at the very least, one possible conceptual solution regarding archiving in the digital age.

In addition to the archiving potential of transcoding work, many artists transfer their work to other mediums in order to obtain and exploit the errors specific to that medium. As observed by Sengmüller, once the video is transferred onto vinyl, the *VinylVideo*™ has "unmistakably distinctive visual effects" (1998a). Although it is possible to emulate some errors, it is common for artists to migrate their work between mediums in order to utilize medium-specific effects. For instance, many artists transfer their digital footage onto film in order to abstract and transform their images through manipulating film emulsion. Other artists transfer to VHS in order to transform the video using analog video synthesizers. At this point in time, it is possible to cheaply, and fairly seamlessly, transfer between mediums. This allows the artist to work in the medium of their choice while still maintaining the conveniences associated with digital video.

In Defence of a New Imperfect Cinema: Process Cinema in the Digital Age

Recently, in "Aesthetics of the Error: Media Art, the Machine, the Unforeseen, and the Errant," theorist Tim Barker observes that "the error has become an aesthetic tool that is exploited in the art making process. This is an art of the found object; an art practice in which the artist gives new meaning to an object, in this case, the error" (2011, 55). It is worth asserting that this practice is not new, and embracing error is an intrinsic part of process cinema. By embracing errors, artists are provided with a freedom not allowed by more commercial ventures. In filmmaker and critic Hito Steyerl's article "In Defense of the Poor Image," she remarks: "The imperfect cinema is one that strives to overcome the divisions of labor within class society. It merges art with life and science, blurring the distinction between consumer and producer, audience and author. It insists upon its own imperfection, is popular but not consumerist, committed without becoming bureaucratic" (2009). Embracing lo-fi images allows everyone the opportunity to create. Of course, this idea is not new, as observed by Steyerl, and a previous iteration of this approach can be found in the 1960 political manifesto of Juan García Espinosa, titled "*For an Imperfect Cinema*." At this point, almost everyone has access to the equipment and techniques to experiment with moving images – all that is required is the desire.

Notes

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1 JODI (or jodi.org) is the moniker used by internet artists Joan Heemskerk and Dirk Paesmans.

2 A hex editor is a computer program that allows users to manipulate the data that make up computer files.

3 NO CARRIER is the alias of artist Don Miller.

4 Available at http://no-carrier.com/index.php?/nesflix/.
5 Paper Rad is an art collective whose members included Jacob Ciocci, Jessica Ciocci, and Ben Jones.
6 Available at http://no-carrier.com/index.php?/glitchnes/.
7 Until recently Jeff Donaldon often used the moniker NoteNdo.
8 A demo of the software is available at https://www.youtube.com/watch?v=Lok9wK8LeTs.
9 Virtual Dub is a free, open-source video processing utility for avi/mpeg-1 created by Avery Lee.
10 Under the screen name datamosher.
11 Available at http://www.youtube.com/watch?v=tYytVzbPky8.
12 Available at http://kriss.cx/tom/datamosh/.
13 Briz, Facebook conversation with author, 24 October 2012. Used with permission.

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