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UNIVERSITY OF CALIFORNIA,
IRVINE

Saving Cinema: Circulation and Preservation in the Age of Computational Film

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Visual Studies

by

Eric Hahn

Dissertation Committee:
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2022

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ABSTRACT OF THE DISSERTATION

Saving Cinema: Circulation and Preservation in the Age of Computational Film

by

Eric Hahn

Doctor of Philosophy in Visual Studies

University of California, Irvine, 2022

Professor Peter Krapp, Irvine, Chair

Defining what makes cinema a unique artistic medium has been a central theoretical tendency dating back to its earliest years. Already an unsettled question throughout film's century-plus existence as an analog format, the introduction of digital carriers has only complicated the debate. Cinema—a medium so connected to its traditional physical carrier that it is often referred to as "film"—exemplifies the difficulties of essentializing any medium in the age of digital convergence.

Refusing to accept that all digital media are homogeneous or that cinema is "dead," I approach the question of medium specificity by tracing an ecology of cinema. One that considers cinema's joint cultural *and* technical constitution. From preservation to protocols, marketing to moire, fears of cinema's death to hopes for greater immediacy through raw data, cinema, as I argue, can only be defined through its larger shifting web of relations. As such, I examine the current state of computational film broadly, paying equal attention to marketing tactics, technological shifts, legal battles, distribution strategies, and preservation best practices alike.

Central to this ecological understanding is the reality that changes in one node of this meshwork resonate through each other often with dramatic results. While working towards unveiling a broader picture of cinema in its current state, each chapter of this dissertation also meditates on conflicting determinations of quality at varying nodes in this ecology and examines how such determinations come to influence film's circulation and preservation. Quality, in relation to cinema, functions simultaneously as (among other things) a marketing tool, a means of controlling access, a production goal, a fuzzy technological standard, and a staple of archival practice. Quality is a term deployed in wholly different ways to drastically different ends, each influencing the overall "essence" of cinema and each carrying its own increasingly concerning ramifications for the future of the seventh art.

INTRODUCTION

In 1895, Auguste and Louis Lumiére captured one of the most well-known moving images in the history of cinema, a steam locomotive pulling into G*are de La Ciotat* on their newly created cinematographe. The lightweight cinematographe was able to document, in approximately 800 frames of film at roughly 16 frames per second, a train approaching a platform, stopping, and passengers disembarking. This early film, *L'arrivee d'un train en gare de La Ciotat*, has become firmly embedded in popular memory as the film that frightened cinema-going audiences throughout France, an audience who failed to understand the artificiality of the cinematographic image.[1] While debates about the veracity of this claim are well-known, its place in popular culture situates it within contemporary fears/feats of technological amazement.[2] In 2020, some 125 years later, digital news curation service *Digg* ran a story with the headline "Someone Used Neural Networks to Upscale An 1895 Film to 4K 60FPS, and the Result is Really Quite Astounding."[3] YouTuber Denis Shiryaev used "several neural networks" to upscale the original Lumiere footage to 4k while also increasing the frame rate to 60fps, giving the clip an uncanny hyperreal aesthetic.

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[1] *Arrival of a Train at La Ciotat* (Auguste and Louis Lumière, 1895).

[2] See Marita Sturken, Douglas Thomas, and Sandra J. Ball-Rokeach, eds., *Technological Visions: The Hopes and Fears That Shape New Technologies* (Philadelphia: Temple University Press, 2004);
Tom Gunning, "Old and New: The General Line from Amazement to Habit," *Rethinking Media Change: The Aesthetics of Transition*, ed. Henry Jenkins and David Thorburn (Cambridge: The MIT Press, 2004);
Jeffrey Sconce, "On the Origins of the Origins of the Influencing Machine," *Media Archaeology: Approaches, Applications and Implications*, ed. Erkki Huhtamo and Jussi Parikka (Berkeley: University of California Press, 2011).

[3] "Someone Used Neural Networks to Upscale an 1895 Film to 4K 60 Fps, and the Result Is Really Quite Astounding," Digg, February 4, 2020,
https://digg.com/2020/arrival-train-la-ciotat-upscaled.

What is most striking about Shiryaev's version of the film is less the finished product than the weight of the language used to announce it. "Neural networks," "4K," "60FPS," all carry a technocultural cachet which overshadows the media artifact itself. In a play on the myth of the film's original 1895 screening, the first comment on Reddit following the release of the video states, "I jumped when the train almost came at me through the screen."[4] This pithy comment invokes both the film's history and the relative immediacy of Shiryaev's version, and yet also succinctly deflates the hype around the video itself. Like the imagined 19th century audience jumping from the oncoming train, this iteration does not truly promise a new degree of immediacy causing the viewer to confuse the captured image with reality but rather presents us with an aesthetic shift, a shift that nonetheless circulates culturally as signifying a radical break.

New cultural interpretations of technological and aesthetic shifts, in this case of the perceptual quality seemingly offered by high frame rates and increased resolution owing to the manipulability of digital media, inspire both hopes and fears about the future of the cinematic medium. By now we are all too familiar with the cries that "cinema is dead" we hear echoed by directors, cinephilic purists, film theorists, and cultural critics alike often stemming from these technocultural shifts. In 2014, Tarantino famously declared, "As far as I'm concerned, digital projection and DCPs is the death of cinema as I know it…. The fact that most films now are not presented in 35mm means that the war is lost. Digital projections, that's just television in public. And apparently the whole world is OK with television in public, but what I knew as cinema is

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[4] Shir_man, "R/Videos - [OC] I Have Made 60 FPS 4K Version of 1896 Movie 'Arrival of a Train at La Ciotat' with Several Neural Networks," reddit, February 4, 2020, https://www.reddit.com/r/videos/comments/eyoxfb/oc_i_have_made_60_fps_4k_version_of_1896_movie/.

dead."[5] Similar positions have been publicly taken up by Martin Scorsese, Christopher Nolan, Ridley Scott and a slew of other high profile cultural icons.[6]

Reflecting on these shifts in the technological and cultural construction and understanding of cinema is central to this project which operates around three correlated spheres: The circulation of cinema, the "quality" of cinema, and the preservation of cinema. Throughout this dissertation, I examine how the technologies of computational cinema—that is, cinema reliant on algorithms and shifting pixel values rather than chemical reactions registered on analog filmstock—shape and are shaped by shifting definitions of quality and how these impact circulation and resonate within the tragically undervalued practice of film preservation. At its core, the stakes of this project are tied to the increasing difficulty of preserving computational film, particularly at a moment when quality and access as marketing tools are fundamentally linked with new technology. I argue that preservation as a practice and cinema archiving as an important component of the film industry more broadly are negatively affected by the increase of (often misleading) marketing promising improvements in quality and seamless access.

Particular technological assemblages in conjunction with mutable conceptions of quality as a technical and aesthetic category serve as the foundation for new cultural and industrial conceptions of cinema. The promise of new technologies—whether those be new camera

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[5] Quentin Tarantino quoted in Aly Weisman, "Quentin Tarantino Declares 'Cinema is Dead' After Filmmakers Go Digital," *Insider*, May 27, 2014.
https://www.businessinsider.com/quentin-tarantino-declares-cinema-dead-2014-5
[6] See Martin Scorsese, "Il Maestro: Federico Fellini and the Lost Magic of Cinema," *Harper's Magazine,* March 2021;
Morgan Jeffery, "Ridley Scott's turned down 'several' superhero films and thinks 'cinema mainly is pretty bad," *Digital Spy,* Dec. 31, 2016;
Cory Stillman, "The Future of Cinema is in Danger (& Christopher Nolan is Not the Villain)," *ScreenRant*, December 9, 2020.

sensors, new carriers, or more efficient compression algorithms—shape and are in turn

developed with an eye toward what are considered improvements in quality but all too often

reflect an obsession with objective (and marketable) metrics over any perceptual benefits.

"Quality" is a signifying term whose meaning often says more about the speaker than the object

being described. Whether we're using the term in reference to a fairly abstract concept like

"quality TV" or commenting on the higher sonic quality of a 180 gram vinyl pressing in

comparison to a heavily compressed MP3, any and all determinations of quality are ultimately

understood as being shaped by the cultural, economic, and political positionality of the subject

making the determination.[7]

While the discourse around taste cultures, spurned-on by Bourdieu's *Distinction: A Social

Critique of the Judgment of Taste*, continues to color most debates about "quality" in the media

sphere, this focus on taste cultures needs to be expanded to encompass computational media and

their marketing. For Bourdieu, taste cultures are largely determined socioeconomically, as

aspects of social training through education and experience tie in with cultural capital leading to

a hierarchy of artistic value (e.g., quality). Taste, in other words, becomes a "marker of 'class.'"[8]

For computational film, quality can never be a singular state but is always already a network of

shifting iterations defined infrastructurally, industrially, and technologically just as much as

culturally. Although there is often an implicit tendency in academic and popular culture of

equating verisimilitude and signal definition—in the case of the moving image this has been

defined as resolution—this correlation is less a result of traditional "taste cultures" and more so

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[7] For more on "quality TV" see Michael Z. Newman and Elana Levine, *Legitimating Television: Media Convergence and Cultural Status* (Oxfordshire: Routledge, 2012).
[8] Pierre Bourdieu, *Distinction: A Social Critique of the Judgment of Taste* (Cambridge: Harvard University Press, 1984), 2.

an imposition of the growing marketability of "objective" quality metrics.[9] Regardless of increasing socioeconomic stratification, "objective" quality through technology is central to its marketability broadly by spurning any explicit linkages to cultural status. "Perceptual quality," unlike the hierarchies of artistic value, is sold as measurable in data points and no longer bound to cultural capital and human subjectivity. This correlation of course covers over the essential transmutability of digital video specifically and misunderstands perceptual quality as materially objective rather than culturally and industrially determined regardless of data points. Perceptual quality, despite growing appeals to objectivity, is still a mutable phenomenon.

This relationship between technology and quality has always been key to the production, marketing, and circulation of cinema but this has intensified with the introduction of digital content. As quality is increasingly linked to new changes in compression algorithms, physical carriers, and capture technology, archives already struggling with the transition to preserving digital media must constantly adjust and update best practices to accommodate these upstream changes. Furthermore, quality is often defined in wholly different ways and to different ends within a given field of the film industry. What might be most valued in terms of "quality" in the area of film production (raw image capture for example) is relatively useless in the areas of exhibition and distribution but such determinations still shape expectations and marketing tactics broadly. Regardless of overlap in defining quality throughout the industry, I argue that each and every new and modified definition of cinematic quality reverberates throughout, affecting preservation practice in particularly troublesome ways.

Despite these downstream effects on film preservation, saving cinematic artifacts is often

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[9] Jonathan Sterne, *MP3: The Meaning of a Format* (Durham: Duke University Press, 2012), 4.

ignored in the hype devoted to "saving" one fixed technocultural configuration of cinema. I include preservation as a key throughline in this project precisely due to its lack of inclusion in both popular and academic discussions of cinema as a unique artistic medium. While the death of cinema is a trope that seems to recur with every new technological shift, the actual death of cinematic artifacts languishing in underfunded archives, on hard drives, and in collector's basements is rarely, if ever, mentioned in popular (and even most academic) discussions. In other words, as cinema "dies" again (and again and again) with new technology and new notions of quality, the larger shifting discursive formation that is cinema never seems to include preservation as a core element of cinema itself—a depressingly ironic truth when we consider that preservation is what stands between cinematic artifacts and their actual physical demise.

With that in mind, we turn to a question that no doubt surfaced in that very first screening of *L'arrivee d'un train en gare de La Ciotat* in a Paris cafe in December of 1895 and which recurs as contemporary audiences watch a digitized and upscaled iteration of the same film on YouTube over 120 years later: what is cinema? Decrying cinema's death necessitates accepting a fixed technocultural construction of cinema *as* cinema and it behooves us as academics to investigate precisely *what* cinema looks like in our current moment to respond to this perceived crisis. Attempting to define cinema academically is more than just a futile theoretical exercise. Firstly, we must remember that cinema is continuously being defined and reinvented culturally and industrially whether academics take up the challenge directly or not. More importantly, preserving cinematic artifacts necessitates defining the medium in order to secure its artifacts for future generations. While myriad archives must grapple with this question as a means of establishing best practices, as I will illustrate, this process is often an imperfect one and prone to

shortcomings for reasons related to the very same technological and cultural shifts motivating the cries of film's demise. Meditating on the question "what is cinema" at this particular juncture is fundamental to understanding how it can survive beyond its many pop cultural deaths and remain a viable and accessible object of academic study decades from now.

Finding Cinema in Digital Times

While returning to such a question after more than a century of its being debated might at first seem like an act of futility, the need to define cinema is perhaps most urgent precisely due to the shortcomings of contemporary academic discussions of the topic as the medium itself fully embraces its virtual life, as Rodowick has put it.[10] Theoretical debates about medium specificity have functioned to different ends historically and I argue that a return to the question of medium specificity is particularly necessary at our current moment. Beyond panics about the death of cinema as a popular cultural pastime, the need to define cinema is important as a means of ensuring its perpetuation through preservation. Archival practice (formal and informal) is largely absent from discussions about medium specificity and yet preserving a cinematic artifact necessitates defining exactly what the artifact is in order to establish best practices.

At its core, medium specificity is a theoretical position superficially forwarding the notion that "each art form has its own domain of expression and exploration" often owing to the specifics of the "physical structure of the medium."[11] I am saying "superficially" here because each claim of medium-specificity historically, seems less about truly identifying the essence of a particular medium and more so a kind of playing politics. In the case of film, we can look back

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[10] David Norman Rodowick, *The Virtual Life of Film* (Cambridge: Harvard University Press, 2007).
[11] Noël Carroll, "The Specificity of Media in the Arts," *Journal of Aesthetic Education* 19, no. 4 (1985): 6.

to Rudolf Arnheim's 1933 book *Film as Art* which represents perhaps the first full-throated defense of the burgeoning medium of cinema as an "art form" in its own right. Arnheim notes that critics of early cinema suggest that the medium is nothing more than a mechanical reproduction of reality as opposed to an artistic medium like painting. Giving voice to the critique, Arnheim states, "In painting, the way from reality to the picture lies via the artist's eye and nervous system, his hand and, finally, the brush that puts strokes on canvas."[12] In an approach contradictory to more recent accounts of cinema as a means of accurately representing "reality," Arnheim defends cinema as a unique artistic medium by pointing out its limitations as a tool for objective mechanical representation. Early film's absence of color, two dimensionality, and lack of coherent space-time continuum forced artists/filmmakers into a position of careful selection, curation, and creativity not so unlike a painter sitting at a canvas. Rather than attempting to cleanly differentiate cinema from traditional arts, Arnheim sought to find difference through similarity. While the process and technology of filmmaking was altogether different, it still involved the direct guidance of an artist's careful hand to craft images.

Arnheim's investment in seeing cinema accepted as an artistic medium in its own right was driven no doubt by his own background in gestalt psychology, a position which grounds perception in the concept of irreducibility. Like a film, consisting of individual frames, the experience of watching a film is in no way reducible to an analysis of one frame alone. In embracing film as a unique artform, Arnheim was, directly or indirectly, seeking to support gestalt psychology as a mode of psychological study and recognized film as a valuable tool in such a process. Arnheim's embrace of cinema as a means of expressing "mental processes"

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[12] Rudolf Arnheim, *Film as Art* (Berkeley: University of California Press, 1957), 8.

alludes to this motivation.[13]

Like Arnheim, Eisenstein, Pudovkin, and Alexadrov had their own motivation for defending cinema as an artform that should largely refrain from being overly invested in "representing" reality. Their "Statement on Sound" rejected the incorporation of recorded spoken dialogue suggesting that such an incorporation would detract from the power of editing (montage), a practice and focus which the three filmmaker/scholars had become heavily invested in.[14] Furthermore, spoken dialogue would delimit the potential of cinema to be a universal visual language (a goal not so disconnected from the Soviet filmmakers' political inclinations toward an international movement of the proletariat). Thirty years later, Bazin argued that cinema was a unique artistic medium precisely because of its ability to capture reality. A position equally bound to justifying his own cinephilia and love of analysis devoted to films often ignored in high cultural circles.[15]

All that is to say, arguments tending toward the medium specificity debate are often not purely motivated by understanding cinema as an artform for its own sake. Rather than calling for a new understanding of medium specificity to justify an academic department or push for cinema's acceptance into high cultural discourse, reinvestigating medium specificity is particularly important now precisely because of how quickly the debate has been dismissed with the arrival of digital technology and how important understanding cinema remains for preservation work. While it is easy to lose "cinema" as a unique medium amidst the hype of

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[13] Arnheim, 134.
[14] Sergei Eisenstein, Vsevolod Pudovkin & Grigori Alexandrov, "Statement on Sound," in *Film Theory and Criticism 7th Edition,* eds. Leo Braudy & Marshall Cohen (Oxford: Oxford University Press, 2009), 315-317
[15] André Bazin, *What Is Cinema?: Vol. 1.* (Berkeley: University of California Press, 1967).

quality and authenticity, neural nets and 4K, virtuality and immateriality, there remains a web of relations which serves as the fundamental basis of computational cinema: a technical and messy network of mathematics, transistor states, fiber optic cables, patents, "pirates," and questionable afterlives among other things. This network is not the soil which gives birth to cinema, nor is it simply the environment in which computational cinema exists, instead it *is* the ontological default of contemporary cinema and, despite its complexity, it is ripe for academic study.

Contrary to Rodowick's argument, "Because the digital arts are without substance and therefore not easily identified as objects, no medium-specific ontology can fix them in place," digital media are, in fact, defined by these entanglements and unique networks, and cinema is no exception.[16] I argue that to define a medium we must recognize its connections particularly as digital media increasingly congeal into seemingly homogeneous objects. This call to take up the mantle on cinematic medium specificity is also intended as a provocation and corrective to current trends in cinema studies that seem all-too-eager to throw in the towel on understanding cinema as a unique medium. As Benson-Allott states, "While some consumers and producers still consider television and film separate genres, there is no rationale for studying their current material cultures separately.... I argue that film has lost its medium specificity, meaning that the genre and its original technology are no longer co-constitutive."[17]

Benson-Allott's comment mirrors many other positions within the growing subfield of post-cinema. While recognizing that "filmmaking has been transformed over the past two decades, from an analog process to a heavily digital one" and "these changes have been massive

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[16] D.N. Rodowick, *The Virtual Life of Film*, 10.

[17] Caetlin Benson-Allott, *The Stuff of Spectatorship: Material Cultures of Film and Television* (Berkeley: University of California Press, 2021).

enough, and have gone on long enough, that we are now witnessing the emergence of a different media regime, and indeed of a different mode of production, than those which dominated the twentieth century," post-cinema retreats to a strictly aesthetic and experiential/phenomenological accounting of the current state of cinema as a medium even as it seeks to claim that traditional understandings of the medium are no longer relevant.[18] Holding onto an image of cinema as either too complex to map or too caught up in media convergence to be a unique medium, post-cinema hints at technological configurations only to bury them beneath aesthetics and spectatorship studies.

In a refusal to recognize the stakes beyond academic positioning, post-cinema theorists see digital media technology as creating a "new" cinema yet one not worth defining. Similar to pop-cultural claims that cinema is dead, post-cinema does not sufficiently define what we are "post" beyond pointing to simplistic analog/digital divides and cinema's (debatably) waning popularity. Claiming a shift in the medium without seeking to fully define it is inadequate in our current moment. Furthermore, it disregards the need for a more materially grounded definition of cinema for preserving moving image artifacts. This short-sightedness is most apparent when we consider that the 990 page tome *Post-Cinema: Theorizing 21st Century Film* mentions "preservation" a total of three times and every reference to the "archive" refers to a more theoretical, Foucauldian concept of *the archive* as the extent of the possible within a given episteme.[19]

This is of course not to say that every analysis of cinematic objects needs to meditate on

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[18] Steven Shaviro, *Post-Cinematic Affect* (Winchester: Zero Books, 2010), 14.
[19] Shane Denson and Julia Leyda, eds., *Post-Cinema: Theorizing 21st-Century Film* (Falmer: Reframe Books, 2016);
Michel Foucault, *The Archaeology of Knowledge* (London: Routledge Classics, 2002), 145.

preservation and archival practice in relation to cinema. But, for a subfield as diverse as post-cinema, and one so invested in what amounts to passively defining cinema by refusing to define it in our current "digital" moment, the absence of preservation is telling. Looking at some of the most influential recent works under the loose banner of post-cinema helps illustrate the extent of the problem. Shaviro's "post-continuity," Casetti's "relocation of cinema," Hansen's "post-perceptual image," Benson-Allott's "stuff of spectatorship," and Denson's "discorrelated images," (to name a few) all exemplify the ways in which post-cinema as a broad methodology superficially engages with the material specificity of cinema yet largely retreats to high-theory, aesthetics, reception, and phenomenology rather than grappling with the complex web of cultural *and* technical relations that make cinema unique.[20]

The theories of discorrelated images and the post-perceptual image specifically each use the shift to digital technology within cinema to support a claim about new aesthetic trends but problematically use the computational foundation of digital technology as a means of explaining these aesthetics rather than locating the shifting aesthetics coherently as emergent from digital cinema. In other words, computational cinema serves as an easy explanation for aesthetic changes but the technology itself is often insufficiently explored as truly connected to such changes. For example, Denson's notion of discorrelated images refers to the "new configurations and perimeters of perception and agency" which place spectators "in an unprecedented relation

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[20] Francesco Casetti, *The Lumiere Galaxy: 7 Keywords for the Cinema to Come* (New York: Columbia University Press, 2015), 19;
Shaviro, *Post-Cinematic Affect*, 209;
Mark B.N. Hansen, "Algorithmic Sensibility: Reflections on the Post-Perceptual Image," *Post-Cinema: Theorizing 21st Century Film*, ed. Shane Denson & Julia Leyda (Falmer: Reframe Books, 2016), 786;
Benson-Allott, *The Stuff of Spectatorship*;
Shane Denson, *Discorrelated Images* (Durham: Duke University press, 2020).

to images and the infrastructure of their mediation" created by the introduction of computational imagery.[21] What Denson means specifically, is that the nature of digital images (more accurately computational images) are essentially computed/generated in real-time through algorithmic processes that are pre-perceptual in nature. Operating at temporal registers far faster than human perception can detect, computational imagery, according to Denson, doesn't represent a new neutral intermediary, but rather represents "computational agencies…not only active in real-time generation of images but also in the production of an irreducible relation between these new images and the novel sensory ratios or faculties that distinguish the viewing subjects to whom they are addressed."[22]

More simply, digital mediation, particularly when considering exhibition media, often means "unique" playback based on micro-temporal/algorithmic reinterpretations (decoding) of mediated content in accordance with things like network bandwidth or real-time determinations of pixel values. Hansen describes this process by arguing, "In digital compression[...]we can no longer speak of a relationship between images but rather of an ongoing modulation of the image itself that is effectuated by contaminating the image with instructions for its own continuous self-modification, and crucially, that operates through continuous transformation at the level of the pixel." For all its theoretical complexity, an example of Denson's discorrelated images and Hansen's post-perceptual images might be more easily understood in the changing bitrate (lower perceptual quality) a film might undergo during streaming playback.

Of course, there is far more to this process than simply one algorithm changing a modulating image in realtime. The process is both more and less complex than Denson and

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[21] Denson, *Discorrelated Images*, 21.
[22] Denson, *Discorrelated Images*, 22.

Hansen acknowledge and relies on a large infrastructure of servers hosting multiple copies of the same film in varying resolutions, formats, and bitrates. Changing perceptual quality in this scenario means swapping out one encoded file for another (much like changing from a Blu-ray copy to a DVD). Rather than visualize playback of a single digital file as a perpetually mutable scenario, this particular approach to streaming is much more impressive due to the underlying protocols that can register bandwidth limitations and attempt to play the proper file in response, a process that (despite Netflix's greatest hopes) is imperfect at best.[23] Alexander reminds us that these impressive technologies often lead to frustrated spectators waiting impatiently as their streaming content buffers.[24]

Digital imagery is not magical, it is constructed and reliant on a web of underlying analyzable technologies. Even as computational images are at their core built upon a set of instructions (algorithms) for determining pixel values, Denson and Hansen seem to flatten streaming playback with access more generally and, furthermore, misunderstand the micro-temporal processes of transcoding. Transcoding, where shifting inter and intraframe pixel valuations occur, is the process of creating a new iteration of a media artifact based on a different set of instructions. For example, a film exported in the ProRes 4444 format would result in a large file owing to its high bitrate (the amount of data written per second of footage) and the ways in which it evaluates and assigns pixel color and brightness (chroma subsampling). Because of its file size and the amount of data that would need to be transferred each second, a ProRes 4444 file would not be easily streamed due to internet bandwidth constraints. To remedy

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[23] "Per-Title Encode Optimization," Netflix Technology Blog (Netflix, December 14, 2014), https://netflixtechblog.com/per-title-encode-optimization-7e99442b62a2.

[24] Neta Alexander, "Rage against the Machine: Buffering, Noise, and Perpetual Anxiety in the Age of Connected Viewing," *Cinema Journal* 56, no. 2 (2017): pp. 1-24.

this, that content might be *transcoded* using an alternative compression algorithm (e.g., H.264) which would result in a computational process in which pixel values are determined based on repetitions in information between one frame and the next and information (data) deemed redundant is removed. If an image consisted mostly of pure white, the file size would end up quite a bit smaller owing to the fact that there was little need to compute changes in pixel value from one frame to the next. This process, however, is largely determined at the stage of *encoding* during the export and/or transcoding process (i.e., the process of "writing" a file to a digital storage medium using a particular compression algorithm) and is not nearly as variable during playback (decoding) as Denson and Hansen would have it. Furthermore, if we follow Denson and Hansen's logic, analog film is equally bound up in these micro-temporal processes as the technology of playback itself always fundamentally changes the experience based on material damage done (however minor) to the analog medium carrying the cinematic content.

For Denson, these micro-temporal characteristics of computational film result in an entirely new aesthetic: specifically the discorrelation of camera perspective from spectatorial perspective. Referred to as the "crazy camera," Denson sees shifting objective/subjective perspectives (e.g., a wide shot not connected to a character's point-of-view moving to become a characters' point-of-view), sometimes within a single shot, as indicative of a wholly new mode of affective embodiment.[25] Tying this still fairly uncommon aesthetic choice to a shift in the material base of cinema is convenient but does little to rule out other possible influences. For example, one might just as easily look to classical literary works reliant on free indirect discourse as fundamentally playing with the same subjective-objective perspectival shifts. Was

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[25] Denson, *Discorrelated Images*, 23.

Flaubert—the author of *Madame Bovary*, a novel famous for its use of free indirect discourse and written well before computational media—a time traveler influenced by digital technology?

Post-cinema then represents not so much a break in understanding cinema but rather an acquiescence to the overly broad myth of digital convergence. Seeing the loss of indexicality, dating back to cinema's first embrace of digital technology, as a core component of film circulation, exhibition, and production, post-cinema is a continuation of an academic and pop-cultural way of thinking about digital cinema as a radical break in cinema history. As a corrective to this limited approach, I move away from the strictly theoretical and work to define digital cinema by analyzing the networks that serve as the skeleton of the medium. I approach digital cinema in this dissertation holistically, taking into account technology, industry, law, infrastructure (both macro and micro) and culture as a means of reevaluating cinema as a medium. Cinema is nothing more or less than its larger ecology and defining it is best achieved by examining the network in all its facets rather than restricting analysis to the purely phenomenological and vice versa. It should be noted then that the network that is digital cinema is an expansive one that cannot be wholly untangled in a short dissertation. I will, however, begin to trace some of its contours particularly by looking at its emergence, some aspects of its circulation and creation, and, in each chapter, meditating on its future oftentimes by means of interrogating the affordances and challenges associated with its preservation.

Some of the work needed to begin to outline digital cinema is to avoid the all-too-common tendency to look for the "essence" of cinema through a nostalgic flattening of analog carriers often pivoting on the fulcrum of indexicality, a trend we see carried through into post-cinematic scholarship but with much deeper roots. Like photography, Kracauer, Bazin,

Rosen, Rodowick, and others stress the way in which analog cinema serves as an imprint of a particular time and space with light causing silver-halide crystals to react in a direct physical process—a process at odds with digital cinema's computational mediation.[26] Comparing the constructedness of painting to the indexicality of photography, Rodowick asserts that painting functions "in the modality of presence."[27] For Rodowick, a painting always speaks from a position of the present, confronting a spectator with "little or no historical evidence" quite contrary to a photograph which freezes a moment in time, written by light on silver-halide crystals:

> That a painting is *totally there* means that it functions aesthetically in the modality of presence, of being completely present in space and in time and self-disclosing to sight, even if we ourselves fail to see. Its only causal relation to a past state of affairs relates to the layering of paint on canvas by the artist's hand. Although these layerings are records of past actions, to ordinary perception they give few indications of the when of their appearances, nor do they necessarily encourage us to attribute causality to them. In other words, to the untrained eye they present little or no historical evidence.[28]

What this analysis fundamentally misrepresents is the operative discursive layer that conceals the present pastness represented in both painting and photography. While it's true that a photograph is understood first and foremost as an indexical trace of the past, what is ignored is the very material base of silver-halide, gelatin, cellulose, developing agents, etc. that truly serve as an object of presentness. Similarly, while a painting may confront us with its presentness, it is a

[26] Bazin, *What is Cinema Vol. 1*;
Rodowick, *The Virtual Life of Film*, 106;
Philip Rosen, *Change Mummified: Cinema, Historicity, Theory* (Minneapolis: University of Minnesota Press, 2001);
Siegfried Kracauer, *Theory of Film: The Redemption of Physical Reality* (Princeton: Princeton University Press, 1997).
[27] Rodowick, *The Virtual Life of Film*, 55.
[28] Rodowick, *The Virtual Life of Film*, 56.

discursive rather than material issue that we cannot recognize the past trace reified in the present work, a truth that Rodowick mentions in passing but refuses to interrogate.

Materially speaking, the difference between painting and photography is overblown just as the analog and digital technologies also share more in common than many contemporary film scholars are willing to admit. The index captured in the photograph is no different than the index of the brushstrokes, or the manufactured canvas, but one favors a very straightforward ocularcentrism and one requires a degree of knowing which, ultimately, comes down to how we discuss and come to understand the object itself. While *The Birth of Venus* [fig. 1] might not serve as an indexical visual trace of a moment in time, its linen canvas pulled tight over a wooden stretcher is an index of labor and a dendroclimatological trace, its degrading paint itself an index of years of exposure to light, in that regard, it is more similar to a photograph than one might expect, albeit for less immediately observable reasons. Similarly, when we discuss digital cinema, the superficial lack of a direct index to a specific moment (i.e., a physical link between light and an irreversible chemical change registering that light) does not delimit the materiality/reality of the trace. Instead, it simply forces a change in how we come to detect that trace, that footprint of time.
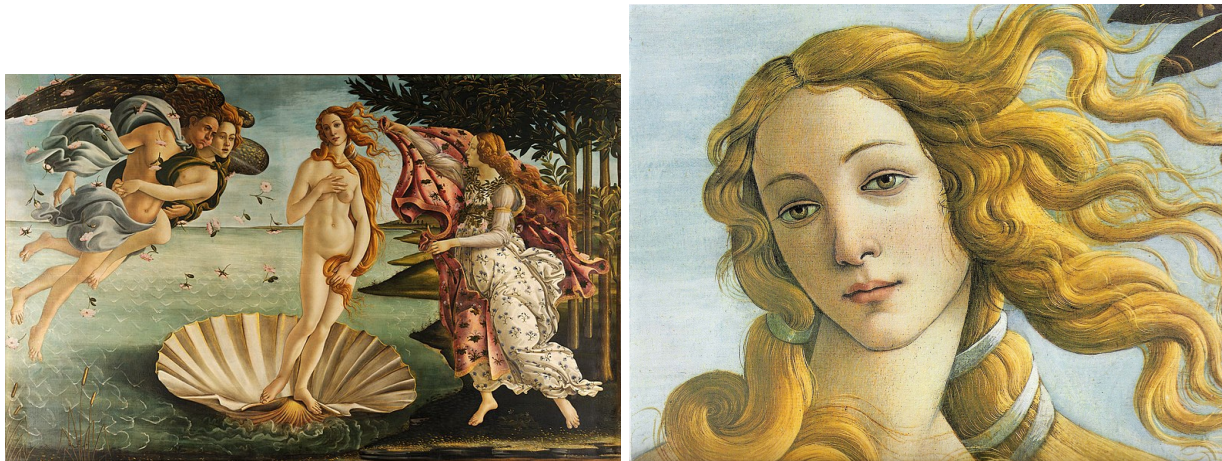
Figure 1: Sandro Boticelli, *The Birth of Venus* (c.1484) and close up.[29]

For Rodowick, it is that very temporal element which separates "digital capture" from "analogue transcription," a trend we see mirrored in the more recent works of Shaviro, Hansen, and Denson among others. According to Rodowick, digital capture breaks any spatio-temporal causality and continuity as a non-quantifiable image (the subject) must be converted into an "abstract symbolic structure independent of and discontinuous with physical space and time."[30] Rodowick continues, "In the process, light does not become temporalized space; it becomes abstract symbolization[…].[31] Once space becomes information, it wants not to be preserved in an analogous record of duration, but to be transformed, manipulated, and exchanged. It cedes itself to other powers and new ontologies."[32] Of course, what's fundamentally lost here is the fact that analog transcription itself already shifts the subject into an altogether new ontology. Rodowick, as well as many others looking for a critical distinction between film and digital capture, fail to appreciate the ontology of the analog film strip itself as well as the processes involved in

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[29] Sandro Botticelli (Florence, Italy).
[30] Rodowick, *The Virtual Life of Film*, 117.
[31] Rodowick, *The Virtual Life of Film*, 118.
[32] Rodowick, *The Virtual Life of Film*, 118.

producing and developing analog film. With all the stress placed on indexicality, analog purists begin and end their analysis of film-based cinema and photography at the point of capture. It is as if filmstock grows naturally and is harvested by the reel. What is lost is the complexity of manufacture, capture, and processing. A complex ecology in its own right, severely understudied and largely overshadowed by the computational processes more immediately (in)visible with digital capture.

In an attempt to grapple with the "black box" of digital imagery in which an input leads to an output but the processes that the input undergoes are obscured, theorists and the average digital user alike nostalgically project backwards on analog media a kind of immediacy that only superficially existed. The problem with this mode of thinking is not that cinema has failed to undergo degrees of change particularly in light of a move toward the digital, it certainly has as I address throughout this dissertation, but rather that in grappling with such change there is a tendency among scholars to inadvertently buy in to the marketing hype of the digital which is all too often reduced to either a form of "screen essentialism" that sees only the *content* and its reception rather than the larger *context* of a digital artifact's existence, or reduces that context to only one small facet of a larger ecology (i.e., digital artifacts are *only* fleeting transistor states and shifting pixels).

In an early attempt at redirecting scholarly engagement with digital artifacts/spaces away from the immaterial to the larger ecologies that foster their existence, Markley argues, "The imaginary realm of cyberspace[...]is a fantasy based on the denial of ecology and labor, a dream that is also an apology for the socioeconomic power to bring together sophisticated

technologies."[33] Even with a move towards more materialist accounts of media, there has been a relative lack of film studies discourse which grapples equally with the technical specificity of analog and digital photography/cinematography when discussing the shift toward digital content. Materiality is increasingly becoming a focus for investigations of media assemblages more broadly.[34] However, examining film through its larger ecologies has tended to result in studies that pick and choose a limited set of material connections as a means of analyzing the purely perceptual (e.g., aesthetics, phenomenology, spectatorship, etc.) or the purely environmental (e.g., climate change, mining operation, etc.). In *Ecologies of the Moving Image: Cinema, Affect, Nature* for example, Ivakhiv frames his discussion of cinema within three ecologies defined by Guattari: the material, the social, and the perceptual. While acknowledging the entangled connections of each of these, he, like many others focusing on cinema's materiality, chooses to focus on the "perceptual dimension of cinema, because that is where the essential work of cinema takes place."[35] This approach is shared by numerous scholars who "embrace" materiality only to retreat into reception and phenomenology.[36]

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[33] Robert Markley, *Virtual Realities and Their Discontents* (Baltimore: Johns Hopkins University Press, 1995), 77.

[34] For more discussions of media materiality and ecology see Rahul Mukherjee *Radiant Infrastructures: Media, Environment, and Cultures of Uncertainty* (Durham: Duke University Press, 2020); Sy Taffel, *Digital Media Ecologies: Entanglements of Content, Code, and Hardware* (New York: Bloomsbury Academic, 2019); Mathew Fuller, *Media Ecologies: Materialist Energies in Art and Technoculture* (Cambridge: The MIT Press, 2005).

[35] Adrian J. Ivakhiv, *Ecologies of the Moving Image: Cinema, Affect, Nature* (Ontario: Wilfrid Laurier University Press, 2013), 32.

[36] See Thomas J. Connelly, *Capturing Digital Media: Perfection and Imperfection in Contemporary Film and Television* (New York: Bloomsbury Academic, 2019); Caetlin Benson-Allott, *Killer Tapes and Shattered Screens: Video Spectatorship From VHS to File Sharing* (Berkeley: University of California Press, 2013); Shaviro, *Post-Cinematic Affect*; Patricia Pisters, *The Neuro-Image: A Deleuzian Film-Philosophy of Digital Screen Culture* (Stanford: Stanford University Press, 2012).

Argued as a distinction between analogical transcription and digital conversion, Rodowick lays the groundwork for this approach by pointing to a continuity between subject and image—analog capture—as opposed to conversion from subject, to quantization, to output with regards to digital.[37] A difference in kind that becomes the impetus for imagining a slew of phenomenological implications for spectators of computational cinema. But I argue that the imagined continuity between input and output in the analog realm ignores the complexities of the process itself. No "black box" effect exists for analog photography because we *know* the process, light causes the silver-halide crystals to react and voila, the image! Of course what this marks is an epistemological issue rather than an ontological one and speaks more to oversimplifications solidified at the discursive level than to actual imaging processing. The reality is far more complex and necessitates a larger scope of analysis for a clear distinction about how this process actually occurs.

Specifically, most contemporary analog photography and cinematography relies on the chromogenic process which itself is incredibly complicated and is built upon an immensely complex infrastructure. Rather than simplifying the process to silver-halide + light = image as is so often the case in many introductory works on film history, the process begins and ends with careful chemical formulations and manipulation of both material substances and the captured image itself. Without digressing into a longer history of analog photography, it is enough to briefly walk through the processes involved in capturing a single analog image using the chromogenic process.

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[37] Rodowick, *The Virtual Life of Film*, 116.

To begin with, photochemical detectors, like silver-halide, are themselves not altogether different from their photoelectric counterparts in that both processes involve a transfer of electrical charge between atoms and molecules as a photon is absorbed. But even this creation of silver-halide necessitates the mixing of soluble compounds silver nitrate (AgNO3) with a soluble halide salt like sodium chloride (KCl) resulting in a double replacement reaction in which the silver disassociates from the nitrate, the halogen (in this case chlorine) disassociates from the sodium, and the silver and chlorine bond creating an insoluble, light sensitive, compound.[38] Of course already at this stage a decision must be made regarding which halogen molecule is best suited for a particular form of exposure. In theory, any halogen could effectively be used for photographic paper, and often a combination of three are used (chlorine, bromine, and iodine) but each variety of halogen itself affects the capture and exposure of the image differently. So, before the presence of human intervention by way of shot selection, lens choice, etc., there's already a fundamental decision to be made at the level of chemical compounds which, like the index of time registered in the fading paint of *The Birth of Venus*, disappear as the "image" captured/painted is embraced as the index/object.

In working through what makes computational cinema unique, we need to recognize that the specificity of analog cinema has itself been under-theorized and subject to a kind of flattening and has always been in need of a larger ecological positioning. Examining analog and digital cinema as shifting ecologies allows us to better find the new links and alterations in their respective networks in turn allowing for a more materially grounded analysis of what

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[38] Known as the emulsification equation, we can illustrate this process by way of the following: AgNO3 + KCl = KNO3 (salt) + AgCl (silver halide).

differentiates analog cinema from digital cinema and why this matters beyond overblown indexicality panics.

The Ecologies of Cinema

The difficulty in embracing media ecology as a means of defining a specific medium rests in these very entanglements themselves. The permeable bounds of digital media serve as the focus of endless scholarly works which overlay the interlaced tentacles of "the network society" onto any and all media that undulate to the surface of its meshwork.[39] Just as this project requires expanding how we come to understand cinema based on a larger set of entanglements, so too does it necessitate avoiding the opposite tendency embraced by many digital media scholars to dissolve all media into a homogeneous and formless sludge of new media as a broad signifier. While Kittler's suggestion that the "final act of writing in history" may have been the drafting of the hardware architecture of the first integrated microprocessor, remains a profound and perhaps technically accurate one, there has been perhaps a premature embrace of "convergence" and media flattening that one might deem suspect for its lack of critical focus on the real complexity of the undergirding technology.[40]

Manovich's axiom of the digital laid out in *The Language of New Media* in many ways has set the stage for this future-looking flattening. For Manovich, new media can be differentiated from "old media" precisely in their programmability. Manovich explains, "Comparing new media to print, photography, or television will never tell us the whole story. For

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[39] I am attributing this term to Manuel Castells's *The Rise of the Network Society* (New York: Wiley Blackwell, 2009) but it is apt in describing myriad works dealing with the implications of digital media.

[40] Friedrich A. Kittler, *The Truth of the Technological World: Essays on the Genealogy of Presence* (Stanford: Stanford University Press, 2013), 220.

while from one point of view new media is indeed another media, from another it is simply a particular type of computer data, something which is stored in files and databases, retrieved and sorted, run through algorithms and written to the output device."[41] This tendency to think all digital media as "a particular type of computer data" is not inaccurate in the sense that indeed, all digital content is reducible, on one level, to binary, yet it takes one condition of being as *the* condition of being and it ignores the uniqueness of the larger networks of media that, when analyzed, make visible the contours that continue to allow for differentiations between media. Manovich is guilty of the same level of idealization and flattening that Rodowick is charged with. Picking and choosing elements from a larger eco-ontology as the distinguishing elements of a medium. For Rodowick, this meant a nostalgic flattening predicated on dwelling in the past, for Manovich, a futuristic flattening meant to end history in exchange for the permanent insipidness of the singularity.

Manovich's claim might better be described as convergence in a more traditional Latin sense as moving toward union and uniformity, whereas Jenkins famously offers up yet another take on the term which has also contributed to an embrace of this notion of flattening. Rather than at the level of carrier, Jenkins looks to the level of content. For Jenkins, convergence refers to "the flow of content across multiple media platforms, the cooperation between multiple media industries, and the migratory behavior of media audiences who will go almost anywhere in the search of the kinds of entertainment and experiences they want."[42] Rather than simply dwelling on the fact that digital moving images and e-books, for example, are both essentially the same at

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[41] Lev Manovich, *The Language of New Media* (Cambridge: The MIT Press, 2002), 65.
[42] Henry Jenkins, *Convergence Culture: Where Old and New Media Collide* (New York: NYU Press, 2008), 2.

the binary level (itself a drastic oversimplification), Jenkins considers how the conditions of digitality have given rise to a more fluid, networked media landscape. While the technology undergirding this shift is essential, Jenkins is less concerned about what the technology itself has changed and more about what the users of this technology have changed.

Jenkins's approach to agency here falls in line with Marvin's in that both understand media as first and foremost, built on technologies that don't shape, but rather lead to, "new kinds of encounters."[43] In a definition that might be said to encapsulate Jenkins's own position, Marvin defines media not as fixed, natural objects but "constructed complexes of habits, beliefs, and procedures embedded in elaborate cultural codes of communication."[44] The problem with this definition of course is precisely the way in which technology is superficially subjugated to societal will which overlooks the fundamental ways in which the affordances of new technology already circumscribe and drastically influence the ways in which that technology itself will be utilized and theorized. Without embracing a full technodetermistic mindset, it is important to flag that the technological base of a given medium certainly shapes how we think of that medium and ourselves. New media technologies "signal new subjectivities."[45] However, it is equally significant to avoid the temptation to flatten/equate a medium with the technological substrate which serves as one component of that medium's larger ecology.

It is important to note that a media ecological approach itself is of course representative of the ways in which the technological substrate of media no doubt shapes the kinds of questions

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[43] Carolyn Marvin, *When Old Technologies Were New: Thinking About Electric Communication in the Late Nineteenth Century* (Oxford: Oxford University Press, 1990), 5.
[44] Marvin, *When Old Technologies Were New*, 7.
[45] Lisa Gitelman, *Scripts, Grooves, and Writing Machines: Representing Technology in the Edison Era* (Stanford: Stanford University Press, 2000), 11.

asked and the modes of interrogating this specific question of medium specificity. Postman

notes, "Whatever the original and limited context of its use may have been, a medium has the

power to fly far beyond that context into new and unexpected ones. Because of the way it directs

us to organize our minds and integrate our experience of the world, it imposes itself on our

consciousness and social institutions in myriad forms."[46] Kittler offers us an example noting that

as the printed book became more ubiquitous as, essentially, a storage device (unlike the more

ephemeral and rarefied parchment codices preceding it), scholarly traditions shifted from a focus

on rhetorical mnemonics and "literalness of quotes" towards "an interpretive approach which

reduced the quantity of printed data to its essence" or what Kittler refers to as a "hermeneutic

silhouette of the totality of books."[47] Books as storage media ushered in a shift away from rote

memorization as a scholarly virtue and opened the gates toward an increasing value being placed

on the direct interrogation and broad distillation of the content itself. A discerning critic might

note that a turn toward mapping networks of media systems might also represent an embrace of

the logic of digital networks. Theoretical trends like new materialism, deep mediatization,

actor-network theory, critical infrastructure studies, object oriented ontology, and media ecology

all stress, to different degrees, the importance of recognizing the complex assemblages that shape

our current moment. While these approaches all differ markedly, the embrace of a kind of

networked thinking undergirds each to varying degrees and points back to the ways in which

technology continues to shape and circumscribe the ways in which it is theorized and the kinds

of questions we can ask about that technology and society writ large.

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[46] Neil Postman, *Amusing Ourselves to Death: Public Discourse in the Age of Show Business* (New York: Penguin Books, 2006), 18.
[47] Friedrich Kittler, "The History of Communications Media," *CTheory*, July 30, 1996, n.p.

There is nothing inherently wrong with this embrace of "network thinking" as I hope to make clear in this project. That "media metaphors…enforce their special definitions of reality" doesn't preclude them from being valuable ways of interrogating the world.[48] The problem occurs when these metaphors become the only means of interrogation. McLuhan warned against such tendencies when considering the ways in which print media came to structure our thinking, and our thinking about thinking. McLuhan argues, "we have confused reason with literacy, and rationalism with a single technology [the book]. Thus in the electric age man seems to the conventional West to become irrational."[49] With that in mind, the media ecological approach embraced by this project seeks to recognize the reality of these entanglements without falling into what can be described as the twin tendencies of flattening present in a majority of contemporary content focused on "digital cinema." One side is a forward looking approach that flattens all media into the same technological base of 0's and 1's. We see this tendency in the aforementioned works of Manovich and Jenkins, the "deep mediatization" of Hepp, the media archaeology of Ernst, and in the "rogue archives" of De Kosnik.[50] For this approach, a focus on the general affordances of digital media overtake the particular. While it is true that digital media is all reducible to binary, it ignores the specificity of unique media which reveal themselves through their larger ecologies. The other alternative, yet similarly minded approach, is the nostalgic flattening of the pre-digital. Rodowick's stress on the indexicality of analog

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[48] Postman, *Amusing Ourselves to Death*, 10.

[49] Marshall McLuhan, *Understanding Media: The Extensions of Man* (Cambridge: The MIT Press, 1994), 15.

[50] Andreas Hepp, *Deep Mediatization* (London: Routledge, 2020); Wolfgang Ernst, *Digital Memory and the Archive* (Minneapolis: Minnesota University Press, 2012); Abigail De Kosnik, *Rogue Archives: Digital Cultural Memory and Media Fandom* (Cambridge: The MIT Press, 2017).

photography, Casetti's focus on the "essence" of a cinema now without a clear material base, Denson's "discorrelated images," Shaviro's "post-cinema," Hansen's "post-perceptual images," and the endless theorizations and public debates about the loss of "materiality" as we have moved from analog to digital cinema all reflect an embrace of a similar kind of network thinking in that returning to the "simplicity" and "materiality" of analog belies a fear/acceptance of the assumed "complexity" and "immateriality" of the digital.[51] If the forward looking flattening too easily embraces a networked logic of convergence (in both Manovich and Jenkins's sense of the word), this backwards looking nostalgia assumes a consistency of the pre-digital that ignores the larger ecologies that shaped and are shaping analog media. In regards to film scholarship, these are two sides of the same coin as both approaches equate the medium with one component of its larger networked substrate.

The latter tendency of nostalgic flatting is embodied in Rodowick's lament that seems to be a refrain heard frequently in the film industry and some scholarly circles, "As film disappears into the electronic and virtual realm of numerical manipulation we are suddenly aware that something was cinema. The history of film theory has produced more than ninety years of debate on the question 'What is cinema?' Yet suddenly we feel compelled to ask the question again, but in the past tense."[52] A misguided linkage of "cinema" with "film" (the material carrier) historically has led to a crisis when it comes to addressing medium specificity and cinema at a moment when what was once seemingly specific to cinema has given way to what appears (and

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[51] Francesco Casetti, *The Lumiere Galaxy: Seven Keywords for the Cinema to Come* (New York: Columbia University Press, 2015);
Quentin Tarantino qtd. in Aly Weisman, "Quentin Tarantino Declares 'Cinema is Dead' After Filmmakers Go Digital," *Insider*, May 27, 2014.
[52] Rodowick, *The Virtual Life of Film*, 31.

this is not unique to cinema) as now a mediumless medium. This has of course led to both

intense mourning and, at times, praise.

The effects of a move toward digital aren't simply limited to nostalgic film theorists and

purists' attempts to elevate a specific experience of cinema as *cinema*, but materialize in the

nostalgia heavy content of 21st century cinema itself. For Sperb, this embrace of nostalgia

functions as a balm for the uncertainty of entering into new modes of production, distribution,

and exhibition but, most importantly it helps cover over the accompanying shocks that come

with the razing of an older industry model in a system hyper focused on efficiency and cost

saving techniques which often come to negatively impact a majority of industry players

themselves. Sperb notes, "Recent cinematic self-theorizing of nostalgia, especially film's

nostalgia for itself, must be considered, at least in part, as an attempt (conscious or otherwise) to

hide those destructive capitalistic tendencies underlining the digital transition within reassuring

narratives of individual perseverance, industry tradition, and technological inevitability."[53] We

might note that this nostalgic self-theorizing which covers over material shifts in industrial

practice—while clearly present at the 84th Academy Awards with films like *The Artist*

(Hazanavicius, 2011) and *Hugo* (Scorsese, 2011), both films dealing with cinema's own past as

noted by Sperb—most strikingly surfaces when looking at the following year's Best

Picture/Editor winner *Argo* (Affleck, 2012) and Best Visual Effects/Director/Cinematography

winner *Life of Pi* (Lee, 2012).[54]

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[53] Jason Sperb, *Flickers of Film: Nostalgia in the Time of Digital Cinema* (New Brunswick: Rutgers University Press, 2015), 54.
[54] *The Artist*, directed by Michel Hazavanicius (2011);
Hugo, directed by Martin Scorsese (2011);
Life of Pi, directed by Ang Lee (2012);
Argo, directed by Ben Affleck (2012).

If, according to Sperb, *Hugo* and *The Artist* flaunt digital technology to bring to life tales of cinematic history thus embodying and soothing fears of industrial change by crafting a kind of seamless teleology of film technology, *Argo* and *Life of Pi* together illustrate the limits of this mode of nostalgic thinking. While *Argo* highlighted its embrace of myriad analog formats from 8mm to 35mm and pushed the visibility of analog film grain even as some scenes were shot digitally, *Life of Pi* embraced the visual power of digital technology to create impossibly lush and surreal landscapes with no allusions to an analog past. Both films can be read as rather self-reflexive yet point back not to cinema as an abstract medium but to the specificities inherent in analog and digital cinema respectively. Significantly, the real long tale of *Life of Pi* comes less from its cinematic achievements but rather in the well publicized story of its primary visual effects team Rhythm & Hues filing for bankruptcy prior to the Oscar win for best visual effects rendering one aspect of digital cinema's "medium specificity" apparent from an industrial perspective. If digital cinema essentialists are to be believed, *Life of Pi* is a clear representation of the essential qualities of digital cinema because of its ability to incorporate wholly imagined scenarios and characters by way of computational manipulation (Manovich's numerical representation at work). However, defining and understanding digital cinema by way of its larger ecology finds just as much, if not more significance in the conditions that led to Rhythm & Hues filing for bankruptcy, the subsequent protests by precarious VFX laborers, and even the handling of the awards ceremony itself.

What I am proposing then is not a turn away from attempts to define cinema but rather to resist the urge to move away from more materialist accountings of the medium simply because

film-as-carrier has given way to transistor states. In many ways, I am simply heeding Elsaesser's

call to embrace digital cinema not as a massive rupture but rather as a sort of reset in how we

practice film history and theory. In "Early Film History and Multi-Media: An Archeology of

Possible Futures," Elsaesser suggests that rather than use digital cinema as a means of spawning

endless debates about what distinguishes film qua film from digital cinema, instead we should

think of this move toward the digital as a zero-degree allowing us to explore cinema in new

ways.[55] With that in mind, the need for embracing an ecological accounting of cinema as a

medium is key at this juncture not purely as a theoretical exercise to better understand what

makes cinema a unique medium but more importantly to ground the medium within a larger

network of change of which cinema is both shaped in and shaped by.

The (After)Life of Digital Cinema

A significant component of change in regards to current cinematic trends, relates to how

cinematic artifacts both emerge, circulate, and pass away. Movie audiences have greater and

greater access to larger and larger libraries of content through myriad streaming services and yet,

the long-term survivability of cinematic artifacts has never been more hotly debated or

precarious since cinema preservation became an important element of the larger ecology of the

medium. In *The Death of Cinema: History, Cultural Memory, and the Digital Dark Age,* Usai

comes to define cinema first and foremost as the "art of destroying moving images."[56] As an

archivist/theorist, Usai's proclamation could not be more astute. With celluloid film, every

screening essentially places that particular material object, the reel(s) of film, one step closer to

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[55] Thomas Elsaesser, "Early Film History and Multi-Media: An Archaeology of Possible Futures?" *New Media, Old Media: A History and Theory Reader* (New York: Routledge, 2006).
[56] Paolo Cherchi Usai, *The Death of Cinema: History, Cultural Memory, and the Digital Dark Age* (London: British Film Institute, 2001), 7.

death. Every time a reel of film passes through a projector it inevitably results in varying degrees of degradation, contradictorily, as Usai notes, cinema can only ever exist on a film-based carrier as a suicidal art form.

Cinema is unique precisely because it offers us the illusion of motion and yet this illusion is only possible through its own destruction. Film-based cinema is specific in that it is the only medium which exists to erase itself. A shift toward a media ecologically oriented understanding of cinema as a unique medium retains this definition but expands its scope. Cinema, in its current state, does not merely work to destroy itself at the level of single prints but rather exists in an increasingly precarious state due to the difficulties in preserving what is largely understood as a fleeting mode of technology both in terms of fleeting transistor states but also regarding the ever-increasing speed of technological obsolescence.[57]

While cinema and death have been linked quite often in the history of film, Usai's definition differs significantly from Laura Mulvey's "death 24x per second" or Bazin's (and later, Rosen's) notion of photography and cinema as essentially the mummification of change, in that we shift from the content toward the medium and the mechanisms of its existence: film stock and projector.[58] For Mulvey and Bazin, cinema and the photograph represent indexical traces of a past removed from space and time, essentially an imprint of a dead moment, given life through the cinematic apparatus. Usai, however, stresses that it is not a matter of indexicality here but

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[57] This of course leaves out digital cinema's role in larger ecological change from an environmental standpoint particularly as streaming services funnel increasing amounts of carbon into the atmosphere owing to the energy demands of its underlying infrastructure.
[58] Laura Mulvey, *Death 24x a Second: Stillness and the Moving Image* (Chicago: University of Chicago Press, 2006);
Bazin, *What is Cinema Vol. 1*, 9;
Rosen, *Change Mummified: Cinema, Historicity, Theory.*

rather material decay that is significant. The question then, is how much this materialist

definition of cinema relies on the existence of filmstock? Can we distill an ontology of cinema

that finds its ground in the material reality in which it exists even in light of its move toward the

superficial immateriality of the digital? For Kirschenbaum, the largely accepted assumption of

"convergence" and digital flattening ignores the specificities of digital media:

> All media are bound to the materialities of their particular forms, materialities that
> materialize in the shape of intellectual property, incompatible standards[…],
> obsolescence, IPOs, sell-outs, buy-outs, and so on. Nonproprietary data standards reflect
> one brand of materiality, that of corporate influence, but all media remain part of a social,
> political, and economic landscape whose shifting contours resist any attempts at erosion
> through the mere rhetorical invocation of homogeneous ones and zeroes.[59]

That there is a kind of medium specificity only decipherable through the accounting of these

larger assemblages is key for understanding media in the 21st century, cinema included, and a

key structuring throughline shaping this dissertation. The contours of that ecology are varied, its

nodes endless, but preservation and longevity of the medium are key to better understanding

digital cinema in its current form and, as such, find their way into each chapter of this

dissertation. If digital technology killed cinema, yet analog cinema can be defined by its own

predisposition toward death, then attending to the forces that keep cinema limping into the future

is one important way of understanding the medium. Archives, archivists, libraries, collectors, and

sharers, both professional and amateur, have always been (and remain) significant nodes in the

larger ecology of cinema and ignoring the all too often undervalued (and sometimes outlawed)

services these actors offer would paint an incomplete picture of cinema.

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[59] Matthew G. Kirschenbaum, *Mechanisms: New Media and the Forensic Imagination*
(Cambridge: The MIT Press, 2008), 106.

Methodology

As the state of cinema shifts and its borders become more and more porous owing to the

affordances of digital technologies, it becomes increasingly difficult to adhere to a singular

methodological approach as a means of defining it. Embracing media ecology as a broad

framework allows the necessary latitude to explore the multifaceted nature of the medium while

also highlighting how these various facets intersect and affect each other. There have been

myriad flavors of media ecology as a framework of study over the years—even if not explicitly

named as such—with early adherents like Innis, Postman, and McLuhan famously embracing a

kind of "media environment" approach focused primarily on a cultural media ecology cut off

from larger material implications.[60] More recently, media ecology has taken on a more direct

relationship with the broader environmental impacts of media in the work of Cubitt, Gabrys,

Parikka, Bozak, and others.[61] My approach to media ecology recognizes that, more than

anything, ecologies are complex and ever-changing and no matter how thoroughly one attempts

to explore a complex ecology, it is impossible to fully map and understand such complex

systems. Taffel nicely outlines the scale of ecologies in *Digital Media Ecologies: Entanglements*

of Content, Code, and Hardware:

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[60] Harold Innis, *Empire and Communication* (Toronto: Dundurn Press, 2007);
McLuhan, *Understanding Media*;
Postman, *Amusing Ourselves to Death.*
[61] Sean Cubitt, *Finite Media: Environmental Implications of Digital Technology* (Durham: Duke University Press, 2016);
Jennifer Gabrys, *Digital Rubbish: A Natural History of Electronics* (Ann Arbor: University of Michigan Press, 2011);
Jussi Parikka, *The Anthrobscene* (Minneapolis: University of Minnesota Press, 2015);
Nadia Bozak, *The Cinematic Footprint: Lights, Camera, Natural Resources* (New Brunswick: Rutgers University Press, 2012).

> Unlike biology – the study of life – ecology comprises the study of patterns of entanglement, connectivity, interaction and symbiosis between agents ranging in scale from individuals to ecosystems, exploring how different parts of the global household relate to one another. Whereas the term 'environment' evokes something outside of human systems, a 'natural' exterior, ecology makes no such distinction between the human and nonhuman, living and nonliving elements of ecosystems. Ecology, therefore, becomes a productive way of eliding the assumed oppositions between socially constructed human culture and the nonhuman domains of nature and technology.[62]

Taffel's broad definition lays out the boundaries and general inclinations of this dissertation but given such a large potential object of study, I rely on various other approaches to better delineate what nodes of this larger ecology I interrogate throughout. Accepting that this dissertation cannot map an entire ecology of digital cinema—I would be suspicious of any book-length project that promised to achieve that feat—I focus my attention on specific facets of computational cinema to begin highlighting the contours of the medium as it currently stands. Some of these foci are of strategic necessity and some are arbitrarily based on my own interests. The point being, mapping the ecology of digital cinema is both deeply structural and deeply personal.

I embrace the material specificity of digital media as both a strategic and personal need. Foregrounding materiality by discussing things like camera sensors, carriers, and larger infrastructure is intended as a response to the discourse of the digital in popular culture which equates digital content with a kind of immateriality or effervescence that belies its material effects. Whether we speak of cloud storage or streaming video, digital content is often imagined as a light, flowing, ambient presence, there but not there, weightless, distributed, everywhere and nowhere. In that regard, I incorporate the approaches of critical infrastructure studies into this larger media ecology which remind us that "information cannot exist outside of given

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[62] Sy Taffel, *Digital Media Ecologies*, 1.

instantiations in material forms, whether they are hard drives, network wires, optical disks, etc."[63] Works like Hu's *A Prehistory of the Cloud* and Cubitt's *Finite Media: Environmental Implications of Digital Technology* assert the importance of refusing the temptation to analyze the digital without meditating on its material implications.[64]

The digital, whether we are referring to distribution networks or archives, is never immaterial. Every digital object is bound to a very material feedback loop built upon a "finite number of cables, terminals, computers, mobile phones, and other equipment" with its actual medium being electricity.[65] The more we take advantage of the flexibility offered through the digital (e.g., seemingly infinite reproducibility, ease of access, etc.), the more we contribute to a larger material network of energy hungry server farms, tantalum capacitors built from coltan produced through violent and exploitative mining operations, air pollution from the burning of e-waste for trace amounts of copper, and so on. The immaterial is always material. Furthermore, the ambience of the digital is additionally bound to larger politico-juridical frameworks which, I argue, cannot be separated from a larger focus on infrastructure specifically. After all, as Streeter, Decherney, Starosielski and others have illustrated, all media (both content and carrier) are shaped in/by the laws and politics of their time and place, this includes making a film, running fiber-optic cable, ripping copyrighted material, or establishing an archive.[66]

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[63] Jean-Francois Blanchette, "A Material History of Bits," *Journal of the American Society for Information Science and Technology* 62.6 (2011): 1042.
[64] Tung-Hui Hu, *A Prehistory of the Cloud* (Cambridge: The MIT Press, 2016).
Sean Cubitt, *Finite Media: Environmental Implications of Digital Technology* (Durham: Duke University Press, 2016).
[65] Boris Groys, "Art Workers: Between Utopia and the Archive," *e-flux* 45, May 2013, np.
[66] Thomas Streeter, *Selling the Air: A Critique of the Policy of Commercial Broadcasting in the United States* (Chicago: University of Chicago Press, 1996);
Peter Decherney, *Hollywood's Copyright Wars: From Edison to the Internet* (New York: Columbia University Press, 2012);

This approach to recognizing the material base of digital cinema is also personal. Having one foot in both academia and industry, being attentive to the material shifts undergirding cinema has been key to my professional and academic work. All too often, the specifics of these shifts are, at best, misunderstood in academic circles or, more often, ignored altogether. In highlighting technical and material specifics, I hope to not only paint a better picture of this changing ecology but also to reinforce the significance of a cross-pollination between theory and practice. After all, the ecology of digital cinema is made up of academic discourse and film production alike.

With that connection to production practice in mind, I incorporate some tenets of platform studies into this project as well. Examining the relationship between hardware and software at the level of specific configurations like video game consoles, or in the case of this project digital cameras, is a necessary step toward understanding cinema and its current technologies. As a combination of hardware and the software that is created according to the affordances of those hardware configurations, the hardware and software of platforms "influences, facilitates, or constrains particular forms of computational expression."[67] Different camera sensors combined with proprietary compression algorithms have become a significant means of shaping conceptions of quality industrially and culturally. Interrogating these "platforms" is significant for better understanding how and why quality is determined industrially at the level of production and what goes into the creation of cinematic artifacts technologically. This focus delimits the possibilities of misunderstanding digital technology and falling into some of the "post-cinema" traps previously discussed.

Nicole Starosielski, *The Undersea Network* (Durham: Duke University Press, 2015).
[67] Ian Bogost and Nick Monfort, *Racing the Beam: The Atari Video Computer System* (Cambridge: The MIT Press, 2009), 3.

While critical infrastructure studies and platforms studies serve as useful means of interrogating the larger structures undergirding (and often occluded by) the rise of digital networks, I also rely on the fairly closely related approach offered by certain media archaeologists. Less of a clearly defined field than both critical infrastructure studies and platform studies, I incorporate an attenuated version of a media archaeological approach defined by Ernst who states, "Media archaeology concentrates on the nondiscursive elements dealing with the past: not on speakers but rather on the agency of the machine."[68] Elaborating on this rather technodeterministic stance a bit, Ernst prods, "does a discourse favor the development of new technologies, or is this new discourse itself an effect of such a shift in technology?"[69] While recognizing the limitations of this binary, I find it necessary to take into consideration the technical specificity of the digital to, at the very least, offer a means of making sense of shifts in thinking about and through media.

Unlike Ernst, however, I recognize that media are also shaped in a larger discursive environment, propelled by marketing, legal battles, public opinion, and industry imperatives. Each of these nodes plays a part in the larger ecology that defines computational cinema and are not opposed to media archaeology. In this sense, the topos study of media archaeologists like Huhtamo, Kluitenberg, and Gunning also factor into my approach.[70] Recognizing that larger

[68] Ernst, *Digital Memory and the Archive*, 45.
[69] Ernst, *Digital Memory and the Archive,* 46.
[70] Erkki Huhtamo, "Dismantling the Fairy Engine: Media Archaeology as Topos Study," *Media Archaeology: Approaches, Applications, and Implications* (Berkeley: University of California Press, 2011);
Tom Gunning, "Re-newing Old Technologies: Astonishment, Second Nature, and the Uncanny in Technology from the Previous Turn-of-the-Century," *Rethinking Media Change: The Aesthetics of Transition* (Cambridge: The MIT Press, 2003);
Eric Kluitenberg, "On the Archaeology of Imaginary Media," *Media Archaeology: Approaches, Applications, and Implications* (Berkeley: University of California Press, 2011).

discursive networks intertwine with the affordances of media to alter how we hope, dream, imagine, and interact with media technologies, I place equal emphasis on technologies and the ways in which they are imagined and discussed in a larger sociocultural context.

Media archaeology also importantly reminds us that there is no smooth teleological pull of media technologies. Despite the praise of many early evangelists of digital media, it was not destined to be the nail in analog's coffin. It is not the answer to the filmmaking industries' woes, nor did it surface clothed in robes and carrying a scythe, destined to take cinema to the grave. The role of digital technology in relation to cinema is far more complex and bound up with sociocultural, political, legal, industrial, and technological currents as I will explore in greater depths in the following pages.

I ultimately embrace media ecology as a methodology precisely because it is an approach that acknowledges this complexity and allows for the examination of each of these different components. It is, at its core, a promiscuous methodology and one I find deeply relevant as a scholar/practitioner equally invested in industry, technology, and culture. Unlike media ecology, critical infrastructure studies is important for understanding the larger networks of mediation at play in our current moment but is less attuned to the cultural and artistic shifts that are influenced by (and influence) infrastructure. On the opposite side, platform studies is an important framework for analyzing artistic shifts based on unique/smaller configurations of hardware and software but scales poorly to larger, more entangled systems like cinema.[71] Media archaeology is

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[71] This of course depends on how we come to define platforms. The "platforms" of Bogost and Montfort in *Racing the Beam* are quite different in terms of their focus on materiality than, say, the "platforms" of Tartleton Gillespie whose *Custodians of the Internet: Platforms, Content Moderation, and the Hidden Decisions that Shape Social Media* (New Haven: Yale University Press, 2021) explores social media platforms through their industrial/operational characteristics.

broad in approach but tends to avoid analysis of media industries instead favoring media technologies and their effects on culture. My media ecology, conversely, scales up and down and recognizes the complex interplay between technology, culture, and industry.

Differentiating between the "images of ecology" and the "ecology of images," Ross explains that the former term encompasses depictions of environmental devastation while the latter term represents a network of social, economic, political, ethical, and technological relations involved in the production, circulation, and consumption of images.[72] It is this broad definition which I embrace in this project. Understanding cinema means acknowledging that it cannot be located in one sphere alone. It is not only dependent on unique technologies but also industrial practice. It is not only circumscribed by filmmakers but also by audiences. Its definition is shaped in courtrooms, on social media, in newspapers, *and* in archives. To understand cinema and how to "save" it from its endless fictional deaths and the very material deaths of cinematic artifacts, we need to be attendant to these entanglements.

Chapter Overview

Enjoying the breadth of scale and scope that a media ecological approach offers, these chapters vary quite a bit in content but still maintain some significant shared characteristics. All chapters address, to some extent, the ways in which quality as a mutable signifier is mobilized in different nodes of digital cinema's ecology to different ends. From marketing to preservation, quality as a term has served to drive the implementation and adoption of new cinematic technologies while also veiling more problematic externalities. One such externality is the increasing difficulty in ensuring long-term preservation of the very digital media that this new technology helps

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[72] Andrew Ross, *The Chicago Gangster Theory of Life: Nature's Debt to Society* (London: Verso, 1994), 171.

generate. In light of this, each chapter also addresses, to varying degrees, the ways in which digital technologies have altered the act of preserving cinematic artifacts into the future. These two keywords—quality and preservation—offer a means of interrogating structures within this larger ecology of digital cinema.

Chapter one examines how digital versatile discs were marketed around this notion of bringing theater quality to the home. However, the marketing of DVD technology as first and foremost one promising unparalleled quality opened the door to a new relationship between cinema and its audience, one built around the erasure of the mediating technology itself. The introduction of digital versatile discs marked a drastic shift in cinematic history as a technology built upon the erasure of its role as mediator. DVD was marketed first and foremost as a transparent technology that could bring the theater experience into the home. This move was not merely a neutral evolutionary advance in technology but rather a response to industry fears of VHS bootlegging. While much has been written about the significance of analog home video, I argue that DVDs have not received the scholarly attention they deserve. While there are indeed studies focused on various aspects of DVD as a mediating technology, or DVD's role as one example of digital cinema broadly, I approach the introduction of this technology holistically, exploring its technical specificity along with its lingering cultural and industrial impact.[73] Beyond changing how audiences came to understand their relationship with cinema, DVD also set the stage for larger battles over access and brought cinema into lockstep with new state

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[73] See *The Velvet Light Trap* 56, no. 1 (2005);
Chuck Tryon, *Reinventing Cinema: Movies in the Age of Media Convergence* (New Brunswick: Rutgers University Press, 2009);
Caetlin Benson-Allott, *Killer Tapes and Shattered Screens: Video Spectatorship from VHS to File Sharing* (Berkeley: University of California Press, 2013).

initiatives around copyright. Ultimately, DVD as a new mode of quality cinema was the first step toward conditioning audiences to embrace the increased access granted by streaming services which, in reality, translates to less access in that ownership, collecting, and sharing become increasingly less valued and even outlawed. Although various works address different aspects of this shift, my chapter seeks to bring together myriad histories of DVD to illustrate the larger ramifications of the introduction of this mediating technology.

Chapter two examines the complex failures and successes of file sharing networks reliant on the BitTorrent protocol and trading primarily in cinema. Recognizing that from its earliest days the networked nature of the Internet has functioned as a screen for projected hopes and desires, this chapter takes an honest look at digital file sharing from the perspective of preservation in the hopes of deflating some of the lofty rhetoric often embraced by file sharing communities. That said, it also examines the ways in which some of these communities can indeed function to slow the disappearance of particularly at-risk cinematic content. With film archives struggling to keep up with the ballooning costs of digital preservation and the complexities of copyright law limiting the possibility of preserving and making accessible untold cinematic artifacts, file sharing networks, like torrent index Karagarga, operate as a means of circulating and preserving hard to find content. Legally dubious cinephile file sharing networks like Karagarga rely on community standards around quality specifications (both technical quality and distinctions of taste) to determine what content can be indexed on the site. This chapter examines how these potentially problematic interpretations of quality cinema become necessary strategically to ensure the longevity of the films being indexed through Karagarga.

Similarly to chapter one, chapter three examines marketing hype around notions of quality cinema but this time primarily focusing on resolution and raw video capture. By looking at RED Cameras and its patent on the REDCODE RAW algorithm (a compression algorithm which reduces the file size of raw video data), this chapter follows the downstream effects of legal battles and marketing hype at the stage of image capture. Through evolving codecs (like REDCODE RAW), digital media markets reimagine the notion of quality as a quantifiable and temporary limit point that can be surpassed algorithmically rather than a shifting and historically situated signifier restricted/created by material constraints. In effect, developing and improving codecs has become a central concern of the film industry and a key battleground for the development of new technology. The results of this push for continued improvement are a long-standing rivalry between a handful of camera manufacturers effectively stifling improvement through patent limitations; an ever more unsustainable impact as computational/storage requirements dramatically increase leaving archives grappling with ballooning data storage demands; and an increasing penetration of the techno-utopian logic of Silicon Valley into the film industry itself.

Meditating on the ways in which the affordances of digital technology contradictorily promise resurrection through interpolation/computation *and* death through obsolescence, chapter four examines Lobster Film's costly digital restoration of the nearly lost color version of Georges Méliès's *A Trip to the Moon* (1902) alongside Guy Madden's database cinema project *Seances*. Both projects draw attention to the power of digital technology to create and modify photorealistic content regardless of an existing referent, yet both (intentionally or not) call into question the long-term viability of digital technology as a tool for truly preserving cinematic

artifacts. Relatedly, this chapter explores how resurrection and loss—the twins of digital technology—have come to shape the post production industry particularly through its recent push to embrace new color workflows like DaVinci Wide Gamut and ACES. Both workflows are created as a means of addressing obsolescence *and* assuming increasing quality standards through technological invention in future production pipelines.

Ultimately, each of these chapters circles back to questions of quality and media sustainability but highlights various aspects of the larger ecology of digital cinema in the process. From marketing hype, sensor specifications, compression and decompression algorithms, copyright and patent suits, gray market distribution, audience expectations, and streaming services, *Saving Cinema* serves as a means of highlighting various nodes in this larger ecology. Each of these nodes warrants greater scrutiny and could easily serve as the focus of volumes-worth of scholarship, but taking them together helps reveal, however subtly, the larger contours of digital cinema in its current state.

CHAPTER 1: The Living Death of Cinema: Cinephilia and the Emergence of DVD

> In the LaserDisc commentary for *Chasing Amy* (1997), I said,
> "Fuck DVD," because it was coming and about to change everything.
> - Kevin Smith[74]

In its March 2021 issue, *Harper's Magazine* tells us that "the art of cinema is being

systematically devalued, sidelined, demeaned, and reduced to its lowest common denominator,

'content.'"[75] If this argument sounds familiar, it should, it has been made before. Quentin

Tarantino and Ridley Scott spoke of the death of cinema in 2014 and 2016, David Cronenberg

and Nicholas Winding Refn reminded us in 2018 and 2019 that cinema has been dead for some

time, Sontag offered her eulogy in 1996, Sergei Eisenstein, Vsevolod Pudovkin, and Grigori

Alexadrov spoke of cinema's decline due to the introduction of sound less than a year after little

Jakie Rabinowitz told us that we "ain't heard nothing yet."[76] Scorsese has arguably been the most

vocal figure bemoaning cinema's death in recent years, penning not only the aforementioned

Harper's article but causing cinephiles and the general movie going public no shortage of debate

starters about cinema's demise over the past decade. If "cinema is gone" as Scorsese stated in

2016, are Netflix originals like the Academy Award favorite *Mank* (David Fincher, 2020)—a

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[74] Kevin Smith quoted in Tom Roston, *I Lost it at the Video Store: A Filmmaker's Oral History of a Vanished Era* (Raleigh: The Critical Press, 2015), 118.

[75] Scorsese, "Il Maestro.".

[76] Heather Saul, "Cannes 2014: Quentin Tarantino declares 'cinema is dead' ahead of *Pulp Fiction* screening," *The Independent,* May 25, 2014;
Morgan Jeffery, "Ridley Scott's turned down 'several' superhero films and thinks 'cinema mainly is pretty bad," *Digital Spy,* Dec. 31, 2016;
Geoffrey Macnab, "'Cinema is already dead,' says David Cronenberg," *Screen Daily,* July 13, 2018;
Susan Sontag, "The Decay of Cinema," *The New York Times,* Feb. 25, 1996;
Sergei Eisenstein, Vsevolod Pudovkin & Grigori Alexandrov, "Statement on Sound," in *Film Theory and Criticism 7th Edition,* eds. Leo Braudy & Marshall Cohen (Oxford: Oxford University Press, 2009), 315-317;
The Jazz Singer, directed by Alan Crosland (1927).

cinephile love fest if ever there was one—just "television," as Tarantino and Spielberg have suggested?[77] These declension narratives do not paint an accurate picture of a medium in decline but rather reveal a tendency to assert a reductive definition of cinema based around a particular discursive formation that is always only ever one piece of one iteration of "cinema." Claiming that cinema is dead, dying, or declining privileges a specific, often idiosyncratic, definition of the medium hinging on its technical (e.g., analog vs. digital) or aesthetic (e.g., silent vs. sound) dimensions, neither of which are sufficient in serving as the basis for "cinema."

With that in mind, this chapter turns back to one of cinema's many deaths. Much like the mortally wounded villain in a bad action film, this death has been an especially drawn out one. If we are to believe the cries from the endless procession of cultural critics *cum* pallbearers, the bullet hit late in 1996 and a fatally wounded cinema continues to limp into today, ready to drop at any minute. More specifically, the bullet in this case came in the form of a durable, 5-inch silver disc better known as DVD. While much has been written about the significance of analog home video, the introduction of sound and color, the move from nickelodeons to movie palaces, and the rise of streaming services, digital versatile discs are often pieced into film history in passing, and, more often than not, are represented as merely a slight variation on the VHS despite the fact that DVD players were the fastest-adopted new technology in the history of modern electronics.[78] It is true that VHS dramatically changed the relationship between content and spectator, producer and consumer, and made us rethink the nature of "access," but I argue in

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[77] Saul, "Cannes 2014";
David Sims, "Steven Spielberg's Netflix Fears," *The Atlantic,* March 27, 2018.
[78] Lance Whitney, "iPad Sales Outpacing iPhone in Initial Year," *CNET,* October 7, 2010.
Of course, as records are set to be broken, this distinction has since been surpassed by both the iPhone and iPad and yet this only further marks the significance of the DVD when one thinks about the cultural shifts brought about by these "disruptor" devices.

this chapter that unlike its analog predecessors, DVD marks a shift in popular thinking from cinematic content conjoined with mediating technology to "pure" cinematic content *carried*, rather than *mediated*. Prior to DVD, cinematic content was fundamentally connected, for better or worse, to the material substrate on which it circulated. The fine grain of 35mm film, the gate-weave and scratches of an old 16mm print, the ghosting and warble of a VHS, each of these various mediating technologies colored the look of the content it mediated more explicitly than DVD. Content, spectatorial experience, and mediating technology were inextricably linked. Motion pictures could not be understood outside of a particular technological mediating assemblage.

In this chapter, I map what amounts to an ecology of cinema as it shifted technologically and culturally after the introduction of DVD. More specifically, I examine implications of this shift in popular thinking regarding cinema, circulation, and mediation. I begin by looking at the ways in which the underlying technology of DVD and the marketing of that technology changed the relationship between cinema, spectators, and access. In theory, DVD not only allowed for increased access (like VHS before it) but as I argue, access to content via a medium that promised aesthetic neutrality. According to the marketing hype, films could finally be watched in the home without negative aesthetic artifacts introduced by the (re)mediating technology, a promise that incited fear for cinephiles embracing the theatrical experience as cinema proper. I then trace the larger cultural implications of this shift in thinking about access and quality. As audiences became more and more receptive to marketing practices promising "unmediated" access to cinematic content the way it was "intended," it drastically refigured and primed media consumers for a streaming market built around infrastructural invisibility and ephemeral access,

a shift, as I will discuss in further chapters, that negatively impacted preservation practice. The price, size, shape and built-in anti-piracy controls opened the door to ownership of "films" yet circumscribed what ownership means in the age of computational film. Finally, I examine the larger implications of this shift by briefly discussing the impact on cinephilic film collecting.

DVD, of course, is still a medium in the technological sense of the word, but it is a technology built and marketed around its own disappearance. While compression artifacts, layer changes, and skipping (perhaps due to a scratched disc) might be understood as the "color" of DVD technology, these aberrations are often attributed to a poor transfer or an otherwise defective disc and are not considered an essential quality of the medium itself. True or not, the discourse around DVD during its heyday as capable of bringing unsurpassed audiovisual quality into the home was predicated on its being a neutral carrier of data. Contrary to other mediating technologies, the stress on the quality of video and audio content which DVDs hold drastically re-figured the relationship between content and spectator. In effect, the discourse around home cinema would shift from medium as shaping the content to medium as passive carrier or, rather, one component of the artistically "neutral" infrastructure of the moving image.

Defined by Lisa Parks and Nicole Starosielski as "situated socio-technical systems that are designed and configured to support the distribution of audiovisual signal traffic," media infrastructures are frequently imagined as spatially confined, fixed in place, and often built on top of or alongside pre-existing infrastructure.[79] It is this quality that results in a kind of visible invisibility or camouflage through mundanity. So long as the content flows uninterrupted, the infrastructure itself is effectively invisible. While DVDs are made to move, to pass from store to

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[79] Lisa Parks and Nicole Starosielski, *Signal Traffic: Critical Studies of Media Infrastructures,* eds. Lisa Parks and Nicole Starosielski (Urbana: University of Illinois Press, 2015), 4.

consumer, case to player, and even to circulate via mail, their purpose and appeal is their

neutrality and invisibility as a mediating device. DVDs promise the smooth circulation of

"unmediated" content, direct access to art the way it was intended. In this way, the DVD itself is

not the object of desire but rather a mobile fragment of a larger infrastructure. Even its physical

appearance is one of invisibility. A strip of film bares its images to the naked eye, the tight wrap

of magnetic tape sits visible through the acrylic windows of the VHS, but the 5-inch silver disc

of the DVD offers no hints as to its operation. To be sure, this is a physical characteristic DVD

shares with its analog elder LaserDisc, but the latter's much smaller adoption rate, lower

perceptual quality, size, and quick obsolescence never allowed for the same cultural impact

regarding the broader shift in thinking about cinematic content and "unmediated" access.

As I argue in this chapter, this move is not merely symbolic, nor is it only significant as it

relates to more esoteric (often omphaloskeptic) debates about indexicality and the ontology of

cinema. Just as the introduction of DVD expanded the networks of access beyond any prior

home video format, it contradictorily kickstarted the process of veiling the larger infrastructure

(mediating assemblages) of cinema. While buying or renting a DVD involved handling a

physical object, the promise of that object (true or not) was that it would allow a kind of

aesthetically unmediated access to the content it held. This marketing myth of unmediated access

would come to fracture the conception of cinema as something restricted to the theater in a way

that VHS could not, introduce cinema and audiences into the fluidity of "immaterial" networks,

change the nature of film piracy, and spark new debates over the perpetual death(s) of cinema

which continue (relatively unchanged) to today. DVD, for the first time, promised a

(theoretically) transparent medium to the extent that typical limitations, drawbacks, and the

unique "color" introduced by other media were erased. DVD superficially marks the beginning

of the erasure of the medium of cinema itself. The death of cinema becomes the death of

cinema's (apparent) mediation. More significantly however, this promise of aesthetic integrity

offered by this medialess medium, would come to function primarily as a smokescreen for new,

more invasive attempts at market control, complete with overreaching anti-piracy protections.

This erasure should not be confused with what Bolter and Grusin describe as "an

insatiable desire for immediacy" or the dream of the "transparent presentation of the real" carried

through media history.[80] For all the marketing hype, DVD technology would not come to

fundamentally erase mediation, opening up the illusion of direct access to a kind of diegetic

"reality" or "total cinema."[81] Instead, DVD would alter the relationship between spectator and

the medium tied to distribution and access. The result is arguably the opposite of the promise of

"transparent immediacy" as defined by Bolter and Grusin. If transparent immediacy is

predominantly an aesthetic category that erases the interface in order to offer "direct,"

unmediated access to content—a more "immersive" spectatorial experience—DVD introduces a

mode of *infrastructural transparency*, erasing the technologies of circulation and offering

"transparent" access to the "intentional" aesthetics of mediation. To be sure, DVD's popularity

meant, in actuality, an increase in circulation/distribution but this increase was predicated on the

marketing myth that DVD was a conduit for direct access to content the way it was meant to be

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[80] Jay David Bolter and Richard Grusin, *Remediation: Understanding New Media* (Cambridge: The MIT Press, 1999), 21.
[81] Andre Bazin, "The Myth of Total Cinema," in *Film Theory and Criticism 7th Edition*, eds. Leo Baudry & Marshall Cohen (Oxford: Oxford University Press, 2009), 165.
For Bazin, cinema was founded on the impossible desire for immediate "illusion" of reality/imitation of nature. Bazin essentially sets up this notion of transparent immediacy in regard to cinema while Bolter and Grusin apply it to media more broadly.

seen rather than a mediating technology itself. In other words, DVD was not marketed around empowering viewers, fostering a sense of immersion, or dissolving any mediating apparatus, but rather allowing viewers access to content as "intended." DVD doesn't erase film as a mediating technology, nor does it promise to "[draw us] into the film" but reinforces particular conceptions of quality, authenticity, ownership, and access while erasing its role as a medium.[82]

The effects of this erasure of distributing mediating technology that begin with the introduction of DVD continue to shape the discourse around cinema and have larger material implications—from questions of preservation and judicial overreach, to environmental and labor concerns—which this dissertation will explore in subsequent chapters. Most importantly though, DVD represents the first iteration of algorithmic cinema. A mode of cinema defined not by image capture and playback but by calculation and optimization. For all its promised transparency and quality, algorithmic cinema (DVD included) is, in fact, heavily mediated by computational processes. With algorithmic cinema, the audio and video is not untouched but rather stripped of information deemed irrelevant or redundant to create a smaller data stream, a process which can, theoretically, be improved with the creation of more efficient compression algorithms but a process nonetheless that, more than any other mediating technology, is invisible to its audience. This invisibility leaves a space open for both hopes and fears. For a consuming public, DVD technology represented the promise of unlimited improvements in quality and accessibility in the home; for cinephiles of old it represented the loss of the sacred space of cinema; for Hollywood directors it represented a new degree of power; for the film industry it

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[82] Bolter and Grusin, *Remediation*, 150.

represented the promise of control *and* the threat of anarchy; for the hacker it represented a

challenge; and for congress and courts, it was merely a technology guarding copyrighted content.

The New Space(s) of Cinema

"As everyone knows, the movie business isn't what it used to be."[83] So begins screenwriter

Daniel Fuchs's short story for *The New Yorker* written in 1954 as television gained ground as an

alternative popular medium and the effects of the Paramount Decrees rattled the industry.

Despite the unique circumstances of that particular historical moment, such a statement might

serve as the only consistent through-line of cinema itself. For a medium touted as first and

foremost a "modern" one, reliant on and reflecting shifts in technological and aesthetic trends, it

should come as no surprise that its power rests in its mutability. Of course, like Fuchs's panicked

screenwriter protagonist longing for simpler times, it seems as if those with the deepest ties to

cinema have the most difficulty accepting what is arguably its only axiom: change.

Most recently, this change has been spurred on by a shift in the material substrate

underlying the medium itself. The move from analog, film-based capture, distribution, and

exhibition, to digital, algorithmic capture, distribution, and exhibition, has served as the latest

catalyst for the nostalgia of the cinephile. It is no coincidence that one of the most influential of

cinema's obituaries was written in 1996, the same year DVD (digital versatile disc)—the first

easily accessible digital carrier—entered the world stage as a popular format.[84] In her *New York

Times*' article, "The Decay of Cinema," Sontag bemoans the "ignominious, irreversible decline"

of cinema.[85] For Sontag, true cinema is a particular technocultural and aesthetic assemblage of

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[83] Daniel Fuchs, "The Golden West," *The New Yorker,* July 1954, 21.
[84] DVD was first introduced in Japan before making its way to the United States in 1997.
[85] Sontag, "The Decay of Cinema."

big screen; darkened theater space amongst anonymous strangers; and slow, contemplative pacing. More than an artform, it is an experience of astonishment and wonder predicated on the larger-than-life images that sweep the viewer away. Sontag nostalgically laments, "You wanted to be kidnapped by the movie—and to be kidnapped was to be overwhelmed by the physical presence of the image…. To be kidnapped, you have to be in a movie theater, seated in the dark among anonymous strangers."[86]

For all its poetic bluster, Sontag's eulogy betrays what she implicitly understands to be the most insidious change facing "the movies," specifically their oncoming digitization. If the spectator of "true cinema" is necessarily afflicted with a kind of Stockholm syndrome, desperately wanting to be "kidnapped" by the larger-than-life images, the DVD promised to flip captor and victim promising a new degree of interactivity and quality unrivaled by previous formats. Not only did DVD, unlike its home video predecessors, promise (if not deliver) quality matching what one might expect to experience at the movie theater, it also promised a new degree of interactivity surpassing the interactive power of VHS. Only one month prior to "The Decay of Cinema," *The New York Times* published its own take on the rising format:

> [L]ater this year, the 'next VCR' will be introduced and more room will be needed for another [home entertainment] component (it's worth it) …. DVD, in addition to looking and sounding as good as the film in your local movie theater, has tremendous flexibility. The disks can hold up to eight different language soundtracks and a variety of movie endings; they also offer parents the ability to control how much sex and violence their children see.[87]

Not only does this article equate the quality of image and sound reproduction rendered by the DVD as on par with the cinema itself, but it also stresses the power of interactivity and flexibility

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[86] Sontag, "The Decay of Cinema."
[87] David J. Elrich, "A Video System Shakes the Walls," *The New York Times,* Jan. 18, 1996.

pitting the DVD against the earlier democratic format of VHS. The power of the spectator to

pause, skip, switch languages, add subtitles, watch alternate endings, and filter content, all

without ever needing to be kind and rewind taps into earlier cinephilic anxieties about spectators

intervening in the artistic vision of the auteur. The "kidnapped" becomes the kidnapper.

Although Sontag's anxieties might be superficially understood as mirroring earlier cinephile

pessimism around the VHS, the differences between the two carriers, the analog VHS and digital

DVD, and the corresponding difference in their implications for "cinema" register in Sontag's

piece and in popular and academic discourse about the cinematic medium more broadly. Of

specific note is Sontag's focus on the disappearing "space" of the cinema.

The space in which cinema can happen, already challenged by VHS, was further

expanded and confused through the introduction of DVD. While VHS promised access, it did not

promise quality, an important consideration that fundamentally changes how the spaces of

cinema are conceptualized in Sontag's argument as well as others' claims. For all its radical

potential as a democratizing force in media, VHS was sold first and foremost as a medium of

access that came with obvious pitfalls and its cinephile critics made that characterization well

known. The case of VHS offers an interesting moment of perceived rupture in the history of

cinema as a technocultural assemblage. Predating Sontag's famous treatise on the subject of

cinephilia and its demise, a 1992 *Film Comment* essay written by Frank Thompson argues for a

specific mode of cinema *as* cinema. Thompson opines, "By embracing video to the exclusion of

real film exhibition, we're consciously and voluntarily surrendering many of the things that make

film unique and wonderful, in exchange for convenience."[88] *The Society for Cinema Studies'*

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[88] Frank Thompson, "Life with Video" *Film Comment,* March 1992, 77.

1991 "Task Force on Film Integrity" came to a similar conclusion in their "Statement on the Use of Video in the Classroom" stating, "No film can be adequately presented by its video version."[89]

What both critiques share is a defense of film from primarily an aesthetic perspective. For Thompson and the Task Force on Film Integrity, what is at stake is the original artistic intent of the director and the quality of the picture itself, and not so much a perversion of cinema as experience. The Task Force highlights the "noticeable degradation" that comes from transferring film to VHS as resolution, contrast, aspect ratio, and color reproduction fall far short of 35mm film standards.[90] Coming to the defense of video, Royal S. Brown critiques "The Statement on the Use of Video in the Classroom " and its quick dismissal of the format by drawing attention to the poor quality of 16mm prints often available (when they are available) to classroom instructors. Brown notes that alternative analog video formats, like the short-lived LaserDisc, are neglected in this analysis and often even VHS copies are at the very least accessible and often not much worse in quality than more costly and often degraded 16mm prints. What's telling, however, is Brown's admission that "What video cannot yet provide…is the theatrical 'experience,' since the maximum screen size for preserving the visual qualities one finds in the laserdisc format in particular is around thirty-five inches."[91] This shortcoming in quality, a central drawback of analog home video, is precisely what DVD relies on as a differentiating factor.

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[89] Society for Cinema Studies Task Force on Film Integrity, "Statement on the Use of Video in the Classroom," *Cinema Journal 30*, no. 4 (Summer 1991): 3-6.
[90] Society for Cinema Studies, "Statement on the Use of Video," 3.
[91] Royal S. Brown, "In Praise of Video: A Response to "Statement on the Use of Video in the Classroom," *Cinema Journal 31,* no. 4 (Summer, 1992): 70.

Contrary to the marketing of VHS, DVD placed quality and the "theatrical experience" as

central selling points and access factored in only insofar as one was "heightening the movie

theater experience at home."[92] One might compare Betamax—the higher quality, quickly defunct

competitor of VHS whose slogan, "Watch Whatever, Whenever" stressed the "time-shifting"

power of the format—with Toshiba's "This is DVD" string of advertisements beginning in 1997.

While the former highlights ease of access, the ability to make TV and, to a lesser extent,

Hollywood, work around the viewer's schedule, there is no stress on quality or even on

experience beyond convenience. There is no promise of "shaking walls" from pristine audio or a

"high quality" image on par with cinema.[93] Rather, the analog video revolution is one of access

and convenience letting "viewers overturn television's tyranny [and] appeal[ing] to the American

love of freedom."[94] In Toshiba's advertisements however, quality is central. Quick cuts

alternating between cinematic explosions and shocked close ups of the faces of spectators in

single shots are interspersed with intertitles stating, "Bullets whiz faster on DVD, screams are

louder on DVD, aliens are slimier on DVD, everything is better on DVD, the picture is 3 times

sharper, the sound is infinitely clearer, how come you're not on DVD?"[95] Early reviews similarly

stressed the massive improvement in quality. In the 1997 article "DVD's Debut," Wall Street

Journal correspondent Anne Midgette gushes about DVD's "seductive" quality:

> The picture is clearer, sharper and has more depth; the color is stronger, focused and
> doesn't bleed. On Stereo Exchange's state-of-the-art equipment, filtered through a line

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[92] Philips Magnavox (1997), *Audience in movie theater watches as image moves from theater screen, to wall, and finally floats into a house appearing on the home television* (30 seconds), [Television advertisement], 1997.
[93] Elrich, "A Video System Shakes the Walls."
[94] Eric Gelman, "The Video Revolution," *Newsweek,* August 6, 1984, 51.
[95] Toshiba (1999), *Everything is Better on DVD*, (30 seconds), [Television Advertisement], 1999.

quadrupler that increases resolution to inconceivable levels, the picture can probably be proven to be a theoretical improvement over reality. An Actress' hands in a demo disk appeared in such detail that every pore, every hair, every wrinkle was clearly visible.[96]

The marketing of quality here changes the terms of the debate laid out by Thompson and *The Society of Cinema Studies'* Task Force. If digital video by way of DVD offered consistent quality on par with a theater experience and if the problem with home video was framed primarily in terms of quality, then to what extent does cinema necessitate a traditional theatrical experience at all? Sontag's stress on representing cinema as a particular technocultural assemblage with the space of the theater central to this conception owes much to the anxiety generated by DVD's promise of consistent quality beyond the theater walls. The now ubiquitous prompt shared by countless DVD advertisements to "bring the magic home" might be understood as a threat to the theater and, by extension, to a certain conception of cinephilia. How can one be a devout "apostle of cinema" if the altar of cinema is gutted? Where can we worship the "religion" of cinema if not in quiet rapture in a darkened theater space?[97]

For many, the answer was quite simply to convert the home into a private theater:

By 1997, approximately thirteen million households in the United States were equipped with multichannel audio-video systems characteristic of home theater. By 2000, this figure rose to twenty-two million, or more than 20 percent of homes; early 2004 saw home theater's penetration grow to 30 percent.[98]

While this dramatic increase owes much to the increasing availability of relatively inexpensive equipment, the latent promise of movie theater quality content brought into the home via a 5-inch, priced-to-own disc became a driving factor. In article after article discussing the growth

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[96] Anne Midgette, "DVD's Debut," *The Wall Street Journal*, April 21, 1997.
[97] Sontag, "The Decay of Cinema."
[98] Barbara Klinger, *Beyond the Multiplex: Cinema, New Technologies, and the Home* (Berkeley: University of California Press, 2006), 22.

of the "home theater system" in the late-1990s and early-2000s we find accounts of viewers

purchasing high-definition televisions and surround sound systems to "unlock" the experience

offered by DVDs. In an article highlighting the family drama created by increased arguments

over access to the home theater, Fernando Manalo recounts that he "bought a new 50-inch rear

projection TV for his den a couple of years ago…to spend more time watching super-sharp

DVDs on the couch."[99] For (ironically named) David and Ally Sonntag who "spend almost every

weekend on the couch watching a DVD," the affordances of DVD technology in conjunction

with their home theater system allow them to opt out of the "public privateness" of the cinema

experience.[100] Of their new cinema experience, the Sonntags state, "It's better than listening to

the guy with the cellphone or the lady with the cold who's sneezing and coughing."[101] Similarly,

in an article highlighting dwindling movie theater attendance owing to the shorter release

window from theater to DVD, Jill Davidson praises the possibilities afforded by DVD stating,

"My sofa doesn't have little badly behaved children kicking my seat and shouting at me."[102] In

yet another article Katy McLaughlin goes so far as to argue that DVDs have ushered in a period

where "gadgets wreak havoc on people's living rooms." In her 2002 article, McLaughlin notes

that "sales of DVD players recently surpassed VCRs for the first time, putting a new strain on

entertainment centers that haven't changed much in design since the demise of Betamax."[103] For

McLaughlin, the rise of the DVD ushered in an era of the home theater which includes multiple

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[99] Reed Albergotti and Gary McWilliams, "The Elephant in Your Living Room," *The Wall Street Journal*, November 12, 2005.

[100] Albergotti and McWilliams, "The Elephant in Your Living Room."

[101] Albergotti and McWilliams, "The Elephant in Your Living Room."

[102] Kate Kelly, "The Multiplex Under Siege," *The Wall Street Journal,* December 24, 2005.

[103] Katy McLaughlin, "New Gadgets Wreak Havoc on People's Living Rooms," *The Wall Street Journal,* July 25, 2002.

speaker set ups, large, unwieldy (and increasingly widescreen) TVs, and a rat's nest of wires, unfortunately, the furniture market was slow to keep pace with this change resulting in a living room design nightmare.

Beyond functioning merely as a format promising to (if not actually capable of) bringing movie theater quality content into the home, digital versatile discs threatened to usurp traditional notions of the space of cinema in altogether different ways. The technology undergirding DVDs forced cinema into a new discursive formation which necessitated a reframing of cinema from fixed artifact to networked object. Relying on digital data rather than analog signals as most other home video formats did, reshaped cinema in the popular imagination moving it from rarefied object to be experienced in a particular space and in a particular way to a networked, distributed object. DVD's role in shifting cinema toward its new life as networked object can be understood in multiple ways. The first, and most obvious, DVDs rely on digitized video/audio content. Minuscule pits and lands (gaps between pits), of about .4 microns in thickness each, are stamped onto 5-inch circular discs as a kind of permanent binary etching. More durable than analog media that requires physical contact between a playhead and magnetic tape, and drastically smaller in scale, DVDs can physically circulate far easier than alternative analog home video formats like VHS and LaserDisc which gave rise to rent-by-mail services like Netflix. Second, the process of transcoding moving image media from analog transcription to binary code moved cinema into the space of virtuality. Already a hugely significant component of popular culture, the virtual conjures up images of a flattened plane of existence where all media and ideas commingle and circulate, freed from material constraints.

Whereas computer hard drives rely on flipping magnetic polarity and solid-state drives on non-volatile NAND flash (essentially transistors that can hold a positive charge regardless of applied power), these digital storage technologies are designed to be impermanent and easily overwritten. Despite misguided assumptions that computers represent the possibility of a kind of permanent archive of knowledge, it is in fact the impermanence and rewritability designed into their components which make computers such versatile machines. In contrast, DVDs represent a marriage between analog transcription and digital spatial economy. Like photography (or cinematography for that matter), the material substrate of digital versatile discs registers a permanent change to its surface. The pits and lands are fixed creating a kind of binary relief, a physical manifestation of a language only speakable by machines. Although rewritable DVDs would of course come into existence, the format was intended to represent digital permanence (a contradictory term) and that is by design.

Born in the wake of the infamous Betamax Supreme Court case which effectively green-lit the use of analog home video for "time-shifting," or recording content aired on television for later viewing, the introduction of DVD in the late-90s was fundamentally a studio driven attempt to skirt the newly codified rules regarding fair use. After nearly a century of inactivity around the topic, Congress outlined the "limitations on exclusive rights" in section 107 of Public Law 94-553 on October of 1976 stating, "The fair use of a copyrighted work, including such use by reproduction in copies or phonorecords or by any other means specified by that section, for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright."[104]

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[104] "Public Law 94-553, An Act: The General Revision of the Copyright Law," Public law 94-553, An Act: The General Revision of the Copyright Law § (1976).

Drawing on this recent codification, the Supreme Court overturned the Ninth Circuit Court in a contentious 1984 ruling arguing that time-shifting is, in fact, in the public's interest as it increases access to knowledge. Highlighting the revolutionary appeal of analog home video in a bite fit for an advertiser, Justice John Paul Stevens praised the technology for giving viewers the ability "to watch two simultaneous news broadcasts by watching one 'live' and recording the other for later viewing."[105] The majority decision bolstered the claims that home video technology was ushering in a radical democratization of the media landscape and, as such, the heads of the one-to-many model of "old media" would need to cede space to their newly empowered audiences.

According to Peter Decherney, we might read Justice Stevens's praise as illustrating the ways in which analog home video technology offered the public something that media companies alone never could:

> VCR came to be seen as a revolutionary machine, one that fulfilled the promise popular leisure had held since the mid-nineteenth century, when working-class laborers clamored for 'Eight hours of what we will.' Consumers were finally free to enjoy their leisure time as they wanted, when they wanted, and in the privacy of their own homes.[106]

Burned by the majority decision and further put out by the growing video rental market which initially grew in spite of Hollywood's best efforts thanks to the first sale doctrine, DVD's arrival onto the scene was guided by the film industry itself.[107] If analog video forced Hollywood's hand into entering the home video market, digital video would serve as a careful rectification of what appeared to be a flattening power imbalance between producer and consumer.

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[105] Sony Corp. v. Universal City Studios, Inc., 464 U.S. 417 (U.S. Supreme Court January 17, 1984).

[106] Decherney, *Hollywood's Copyright Wars,* 174.

[107] Lucas Hilderbrand, *Inherent Vice: Bootleg Histories of Videotape and Copyright* (Duke University Press: Durham, 2009), 26.

DVD's "permanence" was part of this strategy. After a range of failed attempts at reigning in analog video time-shifters and bootleggers alike through everything from easily bypassed anti-copying technology, to high-profile raids, Hollywood set its sights on producing an alternative to analog video designed to claw back some of the "revolutionary" power of VHS.[108] First, unlike analog video which was relatively easy to duplicate and was built around spectatorial control, DVD was designed with copy-protection in mind. Developed by a consortium of ten companies and spurred on specifically by Warner Home Video president Warren Lieberfarb, copy-protection served as the principal concern. In fact, heavyweights Paramount, Disney, and Fox initially refused to release their content on DVD unless more robust copyright protections were put in place.[109] The result was the implementation of the Content Scrambling System (CSS), the Analog Protection System (APS), and the Copy Generation Management System (CGMS).[110] As imperfect as these copy-protection systems were, they would remain effective for the first three years of the format's life, a surprisingly good run particularly considering that VHS's Macrovision copy protection could be bypassed quite simply by using an older VCR or purchasing an after-market image stabilizer.[111]

In addition to the "permanence" of content implemented through anti-copyright measures, the improved quality of DVD technology would become a key draw for filmmakers

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[108] Hilderbrand, *Inherent Vice*, 26;
Dennis Bartok and Jeff Joseph, *A Thousand Cuts: The Bizarre Underground World of Collectors and Dealers Who Saved the Movies* (University of Mississippi Press: Jackson, 2016), 17.
One high profile example is the raid of actor Roddy McDowell's residence by the FBI in 1975.
[109] James Greenberg, "Private Sector; The Would-Be King of the DVD," *The New York Times,* November 24, 2002.
[110] Jeffrey A. Bloom, Ingemar J. Cox, Ton Kalker, Jean-Paul M. G. Linnartz, Matthew L. Miller, and C. Brendan S. Traw, "Copy Protection for DVD Video," *Proceedings of teh IEEE* 87, no. 7 (July 1999): 1268.
[111] Decherney, *Hollywood's Copyright Wars*, 208.

who had otherwise been hostile to home video's low resolution, incorrect aspect ratios, and signal degeneration after repeat viewings. Recognizing this potential, Lieberfarb aggressively recruited filmmakers as vocal supporters of the new format with Francis Ford Coppola stating, "Warren didn't create DVD technically, but he presented it to people like myself and the film industry. I view him as kind of a hero."[112] Ultimately, Lieberfarb would send DVD players along with Warner's first 40 DVD releases to 300 directors, producers, and actors to promote the higher quality format that could not be manipulated, degraded, and copied as easily as its analog counterpart. Contradictorily, while the quality and anti-piracy specifications of DVD would lead to a growing segment of filmmakers and studios embracing the notion of "cinema in the home," for cinephiles like Sontag and others, the space of the home was already controlled by the "electronic hearth," cinema's longtime rival, television.[113] For cinephiles whose roots traced back to the auteur theory popularized by Andrew Sarris in the United States which trumpeted the largely French conception that a film is the product of the singular vision of the director, it was easy to find the faults in analog home video which often bastardized content for the sake of access.[114] When it comes to DVD and the slew of directors in support of the technology, the cinephile argument shifts from perversion by format to perversion by space.

No essay reflects this fear around cinema's "decay" as a product of shifts in space more so than Godfrey Chessire's "Death of Film/Decay of Cinema," a 1999 follow up to Sontag's article.[115] Unlike Sontag, who bemoans the "decay of cinema" without explicitly linking her

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[112] Greenberg, "Private Sector."

[113] Lynn Spigel, *Make Room for TV*: *Television and the Family Ideal in Postwar America* (Chicago: University of Chicago Press, 1992), 38.

[114] Andrew Sarris, "Notes on the Auteur Theory," *Film Theory & Criticism 7th Edition,* eds. Leo Braudy and Marshall Cohen (Oxford: Oxford University Press, 2009), 451-454.

[115] Godfrey Chessire, "Death of Film/Decay of Cinema," *New York Press,* July 1999.

anxieties to digital cinema per se, Chessire's disapproval of digital cinema is clear, and this

disapproval is centered on its relocation from theater to home and home to theater, or more

generally, its new permeability as a digital object. More attuned to the larger implications of a

move toward digital production, distribution, and exhibition than Sontag, Chessire nonetheless

paints a reductive picture of the digitization of cinema equating it with the televisualization of

cinema. Digital cinema, according to Chessire, is nothing more than "film by television," an

argument oft repeated by contemporary critics of streaming services.[116] The result of which is

more than simply the loss of celluloid as a material carrier, but aesthetic shifts which will

increasingly blur the line between cinema and television.

Like Fuchs's statement that "everyone knows the movie business isn't what it used to

be," Chessire similarly sounds the alarm on what he identifies as a dramatic shift in the entire

makeup of cinema.[117] Unlike Fuchs, however, Chessire is not crafting an argument as a laborer

whose livelihood is at stake but rather as a cinephile whose object of desire is. Additionally,

unlike Fuchs, Chessire's anxiety and urgency could not take on more of a perfectly melodramatic

tone ironically in line with the spectacle movies he often derides throughout the piece:

> You are standing on a summer's day on a lovely beach, and you are doing what millions
> of others just out of eyeshot are doing. You are looking at the sand squiggling between
> your toes. You are perusing the broken shells just beyond your toes and the foamy
> wavelets curling against the shore nearby. You are sighing contentedly, enjoying the halo
> of warmth the sun has planted on your head. You are not looking up. This is curious,
> because if you were looking up you would notice something: there's a tidal wave the size
> of the Empire State Building curved directly overhead, about to crash down and change
> you and the world you live in irrevocably, forever. It's funny that people don't look up.

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[116] Chessire, "Death of Film/Decay of Cinema.";
Saul, "Cannes 2014.";
David Sims, "Steven Spielberg's Netflix Fears," *The Atlantic,* March 27, 2018.
[117] Fuchs, "The Golden West," 21.

Maybe it has to do with the Millennium. Maybe people are afraid that if they look up, or talk about what they think might be about to happen, then the next couple of years will turn out to be dauntingly weird and, well, millennial. I haven't read any articles concerning the enormous changes about to occur in our media environment, which is why I'm writing this one.[118]

The tidal wave of the digital Chessire discusses coincides with the growth of the DVD market, the early adoption of digital projection, the increasing prevalence of digital file sharing and, significantly, Netflix as a new distribution outlet. More than anything, what these new practices growing from the affordances of digital technology represent for Chessire is a kind of media and spatial porosity. An easy yet detrimental back and forth between film and television, the theater and the home, a celluloid film and its binary representation. Owing to its robustness, smaller scale, and proof of concept for the digitization of cinema, DVD expanded the networked possibilities of cinema and, as such, introduced audiences and critics alike to the potentialities of digitally networked cinema, for better or worse. While Netflix, in particular, is often discussed in regards to its forced "cultural trespassing" on the global stage, its earliest iteration marks an affront to the separation of home and theater so cherished by cinephiles the world over and, more importantly, a shift from movies as artform and medium to movies as artform and infrastructure.[119] As a small, passive, and durable carrier of digital content that is inexpensive to manufacture ($1 per DVD versus $2.50 for a VHS in the late 1990s), DVDs could circulate via mail relatively inexpensively, a physical specification Netflix would come to take advantage of when creating a new kind of on demand rental market.[120] If not yet "arriving in pristine condition

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[118] Chessire, "Death of Film/Decay of Cinema."
[119] Ramon Lobato, *Netflix Nations: The Geography of Digital Distribution* (New York University Press: New York, 2018), 58.
[120] Greenberg, "Private Sector."

over phone wires at your beck and call," Netflix nevertheless represented the new networked infrastructure of cinema.[121]

The Networks of DVD

Founded by Reed Hastings and Marc Randolf in 1997, it was Randolf whose background in the mail-order business would help shape Netflix's early rent-by-mail model. Appreciating the peer-to-peer connection of direct mail and looking to replicate the success of Amazon's book selling model, Randolf saw an opportunity to create a market that then dominant rental companies like Blockbuster and Hollywood Video would refuse to consider for fear of cutting into the revenue of their brick-and-mortar locations. The initial difficulty for Randolf and Hastings was linked to the medium of home video itself. VHS was large, prone to degeneration, and expensive to manufacture. DVD, in comparison, was small, durable, and cheap, a necessary characteristic of a format that was intended to be a sell-through commodity. Whereas the primary business model for the VHS rental market was built around video stores purchasing copies of VHS tapes priced at around $70 with only select offerings being released at a lower cost for the sell-through market, DVD was intended to bypass the rental market as much as possible.[122] Ultimately, Lieberfarb's vision of DVD as an impulse purchase paid off.[123] Although initially controversial given the profitability of the rental market, the DVD became incredibly successful as a sell-through product. In 1996 alone, Americans spent $8.7 billion on renting videos and $7.5

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[121] Chessire, "Death of Film/Decay of Cinema."
[122] Daniel Herbert, *Videoland: Movie Culture at the American Video Store* (University of California Press: Berkeley, 2014), 40.
[123] Greenberg, "Private Sector."

billion on purchasing videos. By 2001 however, the overall market for home video was $18.7 billion, and rental revenue constituted only $8.4 billion of this amount."[124]

Relying on the economical size and durability of DVDs, characteristics intended to allow for cheaper manufacturing to break out of the rental market model, Netflix instead forced home video into a larger networked environment. Randolf's love of the peer-to-peer directness of postal mail, or what he refers to as "cutting out the middleman," effectively ushered cinema into the age of immaterial networks.[125] Regarding the space and practices of the video store, Herbert reminds us, "The late fee was always an economic manifestation of the geography of video rental, as it was the price one paid for not going back to the public space of the store 'on time.'"[126] Removing late fees, presenting viewers with an unparalleled selection impossible to maintain in the space of a single video store, and transporting the film straight to the viewer's home effectively shattered the notion of material space and the cinema. No longer would one have to travel to the theater; walk down the cramped, curated aisles of the video store; or chat awkwardly with the cinephile video store clerk about his favorite Bergman flick.

Of course, the very material components of the immaterial network of Netflix's rental model would often reveal itself through disruption. As Latour notes, "In the case of crisis, or, more generally, in the case of 'network interruption,'…the two senses of the word 'network' (what is in place and what puts it in place) converge."[127] The network, in the case of Netflix constitutes the circulation of video from one node (distribution center) to another (the home), a

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[124] Herbert, *Videoland*, 41.
[125] Gina Keating, *Netflixed: The Epic Battle for America's Eyeballs* (New York: Portfolio/Penguin, 2012), 19.
[126] Herbert, *Videoland*, 44.
[127] Bruno Latour, *An Inquiry into Modes of Existence: An Anthropology of the Moderns* (Cambridge: Harvard University Press, 2013), 32.

seemingly immaterial network as the renter need only make a selection using her computer and, at some predetermined time, the DVD will arrive in the home. On the other hand, the network of Netflix is much larger and includes fiber optic cable, servers, myriad distribution centers, the postal service, and more. Despite Randolf's insistence on "customer service and timeliness of delivery" renters were often confronted with a number of inconvenient disruptions from shipping delays to damaged discs.[128] During these moments of disruption the network would reveal itself as material and yet, these brief revelations more closely aligned Netflix with the immaterial networks of the Internet and cinema's decades old rival, television. Content moved to and from the home relatively seamlessly save for temporary moments of rupture, in this case, DVD itself was merely another piece of the infrastructure carrying digital content to the screen and ceased to be an artistic medium.

The new ease of flow, the ability to effectively have films appear in the space of the home and disappear just as easily, in conjunction with the quality promised by DVD and home theater systems, posed a serious challenge to the traditional separation of space between cinema and television, public and private. Although the history of film is certainly incomplete without discussing its rivalry with television since the domestic medium hit the market in the 1940s, the new immaterial flow of cinema and the quality of experience in the home flattened the distinctions between the two further in the mind of cinephiles like Chessire who sounds the alarm about this new porosity and increasing blurring between "cinema" proper and television:

> What will people see at the local megaplex after the [digital] revolution? My guess is that the choices will include attractions such as…*Monday Night Football*, *The Home Shopping Network Super Sale*, the NBA playoffs, Seinfeld's last episode, Brittany Spears

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[128] Keating, *Netflixed*, 19.

with the Rolling Stones (still touring, thanks to cryogenics) at the Hollywood Bowl, *Jerry Springer's National Town Meeting*, *The Western Hemisphere Championship Wrestling Finals*, Prince William's wedding, the *Three Tenors Do MTV's Spring Break*, etc…and, oh yeah, the movie of the week.[129]

Despite his cheeky hyperbole, Chessire pinpoints the two fundamental factors influencing this shift as being related to the new possibilities afforded by the network logics of the digital and the quality of the home theater experience. Without the "limitations of film as a technology" the most important factors for movie programmers will be "1) that digital theaters will have all the capacities of television, including live transmission and 2) the need to give people something sufficiently different from the home TV experience to justify the admission charge."[130] The result? An inversion of television and cinema spectatorial practices. Clearly a victim of the marketing hype surrounding DVD and the home theater, Chessire bemoans what he imagines will be a complete reversal of media experience. Whereas viewers typically "watch TV as if in a group, even when alone, and view movies as individuals, even when accompanied by others," the new shift in cinematic space owing to the quality and accessibility of home video content will result in a 180-degree reorientation.[131] "People wanting to watch serious movies that require concentration will do so at home…people who want to hoot and holler, flip the bird and otherwise have a fun communal experience courtesy of *Oprah* or *Scream: Interactive*, say, will head down to the local enormoplex."[132]

This narrative of a reversal of the space of cinema and television, predicated on the quality affordances of DVD and its proof-of-concept for the continued digitization of cinema,

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[129] Chessire, "Death of Film/Decay of Cinema."
[130] Chessire, "Death of Film/Decay of Cinema."
[131] Chessire, "Death of Film/Decay of Cinema."
[132] Chessire, "Death of Film/Decay of Cinema."

seems to affect Chessire, Sontag, and others with a kind of cinematic amnesia. As Richard

Butsch notes, the space of the cinema became "quiet" through an earlier discursive and economic

shift, the introduction of sound coupled with the great depression. Shifting from local theaters

where raucous audiences often made up of community members would interact and, quite

frequently, shape the content on offer (both materially and phenomenologically through a kind of

interactive approach to viewership), the introduction of sound came along with the necessity for

taming audience engagement.[133] Chessire's cinephilia then is predicated on an experience of film

that itself is constructed technologically, industrially, juridically, and culturally to revere the

media object at the expense of alternative possibilities inherent in the medium itself.

Highlighting one significant shift in cinema's constantly shifting history, Butsch observes, "The

norm of silence was given legal sanction in 1939, when a New York court upheld the right of

audiences annoyed by talkers in the audience to give them a 'Bronx Cheer.'"[134] For Butsch, this

ruling signifies a shift from a "right to free expression" to a "right of silence" sanctifying cinema

as a medium of engrossed (subdued) spectatorial engagement or what we might better

understand as Sontag's "kidnapped" mode of viewership.

DVD as Safe Cinema

Beyond changing the spaces in which cinema occurred, DVD also changed the degree and types

of access and ownership associated with the cinematic medium. DVD represented what might

best be understood as "safe cinema." Safe cinema is an apt term in this context because it

succinctly paints a picture of the medium as envisioned by various parties. For collectors, the

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[133] Richard Butsch, "American Movie Audiences of the 1930s," *International Labor and Working-Class History* No. 59 (Spring 2001), 107.
[134] Butsch, "American Movie Audiences," 116.

carrier represented the most durable, affordable, high quality, and easily accessible format in which to own movies. Safe, here, applies both to the context of preservation—the content is relatively safe from the typical defects and decay of earlier carriers—and the context of access—collectors of cinema in other formats often had to go to extreme (often legally questionable) lengths to obtain their collections and, as a result, were frequently made example of by the MPAA and FBI. As we will see, DVD bootleggers were not given a free pass, but being priced as a sell-through commodity with a stress on quality and additional features, collecting through legal channels (at least in the context of the United States) was crafted into a more appealing and easier prospect. This, of course, was by design but these new collecting habits reveal DVD's role as one arbitrary piece in the new infrastructure of algorithmic cinema.

Safe also refers to control of content. Contradictorily, I use safe here from both a viewer and industry perspective. As a technology that promised easy and precise skipping from one part of a movie to another via chapters, DVD technology offered viewers the ability to bypass what they might perceive as obscene or offensive material. While VHS successfully made its way through legal challenges over time-shifting, the notion of "skipping" through the contents of DVDs came under-fire in 2002 via the Directors Guild of America v. CleanFlicks lawsuit and again in 2003 via Huntsman v. Soderbergh. Regarding the former, Decherney notes that the outcome of this battle was essentially a new image of film studios as the sole defenders of the embattled American artist. In actuality, studios, which had been creating modified versions of films for airplane and television exhibition for decades, were joining up with directors to defend "the studios' right to be the sole-entities that could mutilate their work."[135] The results ultimately

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[135] Decherney, *Hollywood's Copyright Wars*, 154.

helped feed a growing image of copyright law as a moral rights issue which would add fuel to the anti-piracy fire growing around the digital media industry.

As a corollary, "safe" also refers to the authorized circulation of content. DVD was intended as an anti-piracy format from the start, an object safe from bootleggers and film "pirates." The successes and failures of the film industry to reign in and control piracy as it relates to DVD technology drastically influenced future formats and fights over the circulation of digital video and forced film studios to rethink cinema as restricted to a given, physical, carrier. Despite its emergence as a technology intended to break the bootlegging/time-shifting possibilities inherent in VHS, the lawsuits DVD Copy Control Association v. Bunner and Universal City Studios v. Corley made it clear that film sharing and distribution had entered a new, networked phase and the studios responded in turn.

These three areas of "safety" overlap to varying degrees around the notion of ownership. Despite the rise of services like Netflix, DVD quickly found its place as a sell-through commodity as intended, with big box stores like Best Buy, Target, and Walmart devoting expansive floor space to the format. The speed at which the home video market shifted from renting to ownership is astounding. As Herbert notes, "By mid-1998, merely a year after the introduction of DVD players, Best Buy had sold over one million movies on DVD."[136] Only three years later, Walmart would claim over $3 billion in DVD sales accounting for more sales than any other retailer and, in effect, qualifying it as "the biggest 'movie theater' in the United States" in terms of sheer revenue.[137] By 2002, video rental behemoth Blockbuster held 40 percent of the $9 billion U.S. video-rental market. That same year, Walmart claimed 28 percent of the

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[136] Herbert, *Videoland*, 41.
[137] Herbert, *Videoland*, 41.

$14 billion video-retail market reinforcing its role as the "biggest customer of the Hollywood studios" and prompting Blockbuster to refocus on retail sales with the hope of "tripling its share of the fast-growing movie-purchase market."[138] The aggressive shift in a relatively short time frame from the scarcity of home content prior to Betamax and VHS' promise of "access," to the home video revolution—which, in actuality, usually meant borrowing or copying "bastardized…often pan-and-scanned, or bad versions" of movies on VHS—to owning, relatively inexpensive, "quality" content on DVD, changed the collecting world and through it, revealed DVD as merely an infrastructural conduit of cinema and a proof of concept for more "immaterial" streaming content.[139]

In his oft cited work on bibliophilia and his passion for book collecting, Benjamin describes the intense connection between memory, time, and objects. For Benjamin, the act of collecting essentially brings three temporal registers into contact, the first, is the memory of acquisition. Gazing through a collection, Benjamin recounts the precise means, method, and experience around obtaining Balzac's *Peau de chagrin* and Ritter's *Fragmente aus dem Nachlass eines jungen Physikers*. The thrill of the auction, the strategy of the passive bid, or the back-room deal, all deeply imbue the object itself with a unique meaning and affective resonance. The second temporal register is that of loss, death, and disappearance. A temporality of pastness not grounded in an actual past experience but instead in a kind of virtualized loss. Benjamin notes, "One of the finest memories of a collector is the moment when he rescued a book to which he might never have given a thought, much less a wishful look, because he found it lonely and

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[138] Martin Peer, "Blockbuster's New Pitch: Why Not Buy That Movie?" *The Wall Street Journal,* November 1, 2002.

[139] Joe Swanberg quoted in *I Lost it at the Video Store*, 138.

abandoned on the market place and bought it to give it its freedom."[140] Saving a text from

disappearance, or, perhaps saving oneself from a missed opportunity further colors the object as

it sits passively on one's shelf. And finally, the temporality of the present, of access, which, for

Benjamin's collector seems a distant third in significance. Access, for Benjamin, is not about

actually "accessing" the content so much as embracing and holding the object in your

possession. Benjamin highlights this dichotomy between collecting and access when discussing

the practice of indefinite "book borrowing" as a mode of acquisition for the collector, "The book

borrower of real stature whom we envisage here proves himself to be an inveterate collector of

books not so much by the fervor with which he guards his borrowed treasures and by the deaf ear

which he turns to all reminders from the everyday world of legality as by his failure to read these

books.[141]Access as a temporal mode of the present is little more than a superficial pretext for

collecting and does not say much about the jouissance of collecting, the complex affective mix of

joy, loss, possibility, and failure that settles over the collector and infuses the objects lining their

shelves.

Despite the increase in access via home video formats like VHS and later DVD,

collecting movies has a long history replete with stories of cinephiles navigating the same

temporal liminality as Benjamin but often cinephilia and collecting came with another layer,

illegality. In *A Thousand Cuts: The Bizarre Underground World of Collectors and Dealers Who*

Saved the Movies, Bartok and Joseph document a history of film collecting prior to the

dominance of home video formats. Bartok and Joseph's text reads like a crime thriller. From FBI

stings to mob threats, big money deals and an endless amount of ingenious thievery, owning high

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[140] Walter Benjamin, *Illuminations* (New York: Harcourt, 1968), 64.
[141] Benjamin, *Illuminations*, 62.

quality versions of films prior to the introduction of DVD often meant navigating an

underground network of shady characters and back-room bargains.[142] After the infamous 1974

FBI raid of actor Roddy McDowall's "$5,005,426" film collection; the drawn out legal battle

between American International Pictures Incorporated and amateur collector Evan H. Foreman;

and the criminal charges leveled against collectors Jeff Joseph, Peter Dyck, Woody Wise, and

others in 1975, the dangers of film collecting were well known.[143] The risks inherent in collecting

pristine prints would lead cinephile—and melodrama actor extraordinaire—Rock Hudson to

build a hidden film vault masked as a fireplace to throw off the scent of the FBI.[144] The joy of

owning quality "home video" prior to DVD was inextricably linked with the rush and threat of

loss. Many collectors were drawn to collecting not simply by the novelty of watching a film at

home, but by the possibility that those very prints could wind up lost to time both through

neglect and material decay, but additionally through institutionally sanctioned thievery. Moving

pictures bound to any analog carrier are, in that regard, never "safe."

Elsaesser notes that this fear of loss is a central tenet of early modes of cinephilia.

According to Elsaesser, cinephiles are "always ready to give into the anxiety of possible loss, to

mourn the once sensuous-sensory plenitude of the celluloid image, and to insist on the

irrevocably fleeting nature of a film's experience."[145] These examples of early celluloid

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[142] Bartok and Joseph, *A Thousand Cuts*, 183.
[143] Bartok & Joseph, *A Thousand Cuts*, 45.
Foreman was ultimately sued in 1971 by American-International Pictures, Columbia Pictures
Industries, Metro-Goldwyn-Mayer, Twentieth Century-Fox Film Corporation, Walt Disney
Productions, Universal City Studios, and United Artists Corporation on the charge of copyright
infringement.
[144] Bartok and Joseph, *A Thousand Cuts*, 9.
[145] Thomas Elsaesser, "Cinephilia or the Uses of Disenchantment: The Meaning and Memory of
a Word," *Cinephilia: Movies, Love and Memory* (Amsterdam: Amsterdam University Press,
2005), 27-28.

collectors bear out Elsaesser's claim that loss is an important affective component of cinephilia. Although loss is a temporal mode discussed implicitly in Benjamin's account of bibliophilia, the relationship between cinematic object and cinephile versus book and bibliophile is quite different. For Benjamin, loss factors in as a missed opportunity or the disappearance of a book assuming one fails to acquire it in time. For cinephiles, loss is a central component of the medium. As previously discussed, Usai points out that cinema is fundamentally built around its own destruction.[146] Given its material base and the operation of the apparatus itself, from film stock, to projector, each viewing of an analog film results in material degradation and decay and moves the object one step closer to death. This isn't merely an issue with celluloid but is a central characteristic of other analog video formats like VHS. For the latter, the contact between playhead and magnetic tape degenerates the quality of the signal leading to any number of artifacts associated with analog video technology. Ultimately, for the collector of analog content, we find two overarching trends: the collector who obsessively strives to find copies of films in as pristine a condition as possible and the collector who embraces the "aesthetics of access" as a significant component of the content itself.[147]

Unsurprisingly, we find myriad stories of those collectors on the hunt for pristine copies giving up collecting altogether with the introduction of DVD. Reflecting on the celluloid collecting habits of cinephiles, Wilson recounts the somewhat tragic story of John McElwee whose obsessive film collecting spanned decades and survived myriad run-ins with the FBI and

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[146] Usai, *The Death of Cinema,* 67.
Discussing preservation as an "alien act" contrary to the "unstable nature of the carrier," Usai notes that, "each project of preservation of the moving image is therefore, *strictu sensu*, an impossible attempt to stabilise a thing that is inherently subject to endless mutation and irreversible destruction."
[147] Hilderbrand, *Inherent Vice*, 131.

sketchy back alley deals only to be killed by DVD. For McElwee, the goal of the hunt was always "to enjoy the best moving image possible."[148] A sentiment shared by many early collectors of celluloid. Wilson notes that McElwee has given up collecting, "Now that he can get that image on DVD, there is no more reason to collect."[149] Prominent collector/dealer Dave Barnes makes a similar admission. Dismissing his former habits of obtaining pristine celluloid prints by any means necessary, Barnes quips, "*The Mysterious Mr. M*, *Flash Gordon*, *Buck Rogers*, *The Great Alaskan Mystery*—I have them on DVD now. Cost me ten dollars for a DVD. Used to pay four hundred dollars for a serial years ago."[150] Unlike the deep meaning inscribed in the physical book for Benjamin's bibliophile collector, for McElwee and others, the goal is transparent mediation: access to the "best moving image possible."[151] Without succumbing to the same kinds of material decay as analog carriers, owning DVDs promises unlimited "safe" access to high quality content. Through the possibility of repeat viewing with little to no material impact on the content itself, the urgency around collecting, tracking down, bargaining for, and even stealing the perfect print vanishes. Ease of access gives way to indifference to format and the floodgates open to a new world of streaming content.

Klinger makes note of this shift toward DVD collecting that McElwee, Barnes, and others have come to embrace but she mis-attributes the appeal of the new format, assuming that such collecting practices represent a kind of masculinist technophilia rather than the promise of transparent mediation:

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[148] Eric G Wilson, "The Most Dangerous Hobby in the World: Film Collecting in the Digital Age," *VQR* 85, no. 2 (2009).
[149] Wilson, "The Most Dangerous Hobby."
[150] Dave Barnes quoted in Bartok and Joseph, *A Thousand Cuts*, epub 5.9.
[151] Wilson, "The Most Dangerous Hobby."

> Within the high-end collecting sensibility, films from different national traditions, canons, and eras are transformed into signs of the technical proficiency and potential of the contemporary arts of electronic and digital reproduction. Particularly in this sense, this kind of cinephilia is inextricable from technophilia in home film cultures. In turn, technophilia is made possible by acts of consumption that enable collectors to experience such rapport with machines and mass cultural artifacts.[152]

McElwee, Barnes, and others stress the technical appeal of DVD technology only in its ability to deliver a relatively high-quality representation of content through legal channels. In essence, a certain mode of cinephilia lives on even as the traditional medium of cinema dies. DVD, then, is merely a pass-through medium for these cinephiles, its power is in its absence, invisibility, longevity, and legality, its lack of apparent mediation. In this way, DVD was sowing the seeds of its own downfall by undercutting the importance of the distribution medium carrying the content even among cinema's most ardent amateur collectors. Rather than continuing on with the love of collecting, DVD ushered in the fundamental shift from collecting to the false promise of pure, unmediated, access always stewing underneath the digital. In this new cinema environment, it is not about owning content but having access to the cleanest (often fleeting) content. A contradiction which, in some ways, returns us to cinema's roots as unstable and ephemeral, yet the promise of everlasting quality often masks this new mode of digital ephemerality.

Klinger's misguided assumption is open to even greater scrutiny when considering the enthusiastic collector community focused on VHS as a cinematic medium. While DVD sales have plummeted since the introduction of streaming services with little to no fanfare, a die-hard community of VHS collectors continues to circulate the analog medium that, for all intents and purposes, died off in the late 1990s. Investigating the appeal of this obsolete format among its collectors and distributors (who often are one and same when it comes to VHS), Herbert notes,

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[152] Klinger, *Beyond the Multiplex*, 85.

"These companies literally and figuratively valorize materiality, reminding us that our engagements with media and technology are as physical as they are visual."[153] Indeed, for Josh Schafer, founder of the VHS focused publication and distribution company *Lunchmeat,* materiality is the primary appeal of the medium. Schafer states, "There's just a connection with physical media. It's real…There's this human connection thing…. It's in front of you. It's there. It's actually there."[154]

Of course, we should not confuse Schafer's comment of materiality with the materiality of the object itself. VHS is certainly appealing to a subset of collectors for its cover art, clunky box aesthetic, and oddly pleasing heft, but DVD similarly offers a materially present and effectively obsolete object, yet few (if any) publications and fan networks are singing its praises after the rise of streaming services. The materiality Schafer and others are more invested in is the color and character the medium has on the content itself. Hilderbrand refers to this color of the medium as the "aesthetics of access," or the often unique artifacting associated with the degradation that comes through repeat viewings of a particular VHS tape as a result of the direct contact of the playhead on the magnetic tape.[155] This particular VHS aesthetic not only foregrounds the materiality of the medium itself but even contradictorily meshes with Sontag's insistence that "cinephilia implies that films are unique, unrepeatable, magic experiences."[156] Each VHS viewing, like celluloid before it, is unique in that the wear and tear of the playback medium comes to color and shape the content on display. The very act of physical decay, as Usai

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[153] Daniel Herbert, "Nostalgia Merchants: VHS Distribution in the Era of Digital Delivery," *Journal of Film and Video* 69, no. 2 (January 2017): pp. 3-19, https://doi.org/10.5406/jfilmvideo.69.2.0003, 17.
[154] Josh Schafer quoted in Herbert, "Nostalgia Merchants," 16.
[155] Hilderbrand, *Inherent Vice*, 131.
[156] Sontag, "The Decay of Cinema."

notes, is precisely what makes cinema cinema. Each time a film passes through a projector, it slowly succumbs to a series of micro-abrasions, scratches, and other forms of damage essentially progressing the specific print ever closer toward its death. Thus, despite its dismissal as an inferior medium, VHS remains appealing precisely because it shares this connection of loss and decay with its cinematic predecessors. In contrast, the relatively "safe" format of DVD, a hardier object not subject to material decay on playback, separates it from traditional cinematic media in turn introducing its audience to a new mode of "immaterial" cinema complete with a false sense of "permanence and abundance" as I will explore further in chapters two and four.

Kaba and Ozalpman's 2020 study on film collecting practices in the digital age bares out this claim that VHS is prized as a collector's medium because of its imperfections whereas DVD has largely been superseded by streaming. Interviewing numerous self-described cinephile collectors, the theme of VHS as a materially present medium best suited for collecting brings these collectors together. For one collector, contrary to DVD, video cassette approximates the feeling of "watching an original film because it is a tape and it makes you feel like it is a real film."[157] Although this is a sentiment that would certainly cause the Society for Cinema Studies' 1990's task force a conniption, it nevertheless reaffirms the notion that, unlike DVD, VHS retains a closer bond to celluloid precisely because of its material deficiencies as a carrier. In contrast, DVD becomes a non-medium through its transparent mediation. Summarizing their findings, Kaba and Ozalpman note, "Although DVDs offer many extra facilities of alternative cuts, director's commentary, better picture quality, etc…, collecting DVDs is different than

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[157] Sibel Kaba and Deniz Özalpman, "Non-Theatrical Film Experience and Film Collecting Practices in the Digital Age," *Quarterly Review of Film and Video* 38, no. 4 (November 2020): pp. 354-368, https://doi.org/10.1080/10509208.2020.1769429, 362.

collecting video cassettes. [Collecting video cassettes] provides collectors a feeling of authenticity and originality in their collected films."[158]

Evaluating the relationship between film viewer and carrier (e.g., VHS, DVD, celluloid, etc.) is more than just an interesting phenomenological study. How viewers think about, engage with, and experience the particularities of a given carrier of cinema often come to shape the types of legal battles that play out around "the movies" more generally. DVD's emergence is certainly reflective of this. The result of the introduction of DVD marks a kind of whiplash in modes of spectatorship and industry attempts at reigning in spectatorial control. In a short span, film viewing practices move from Sontag's "golden years" when audiences were essentially at the whim of big distributors and exhibitors—and if you were lucky to live near a major city, small theater programmers—to home video by way of VHS— when access to content was "democratized"—and then back to a kind of tightening of the reigns of access by way of DVD. More specifically, while anyone could walk into a Best Buy and purchase any number of DVDs, the format was crafted in such a way as to fundamentally limit access and ownership through various mechanisms.

DVDs promised "unmediated" access to quality content, but the degree of access was circumscribed from the start by technological and legal means. One means of limitation was simply the lack of recording options. For many years, recording and duplicating content via DVD was impossible. After the introduction of DVD recorders in 2000 (approximately three years after DVD players hit shelves in the US), the clunkiness and difficulty of the technology often made it far less desirable for the traditional time-shifters of the VHS era. In a *Wall Street*

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[158] Kaba and Ozalpman, "Non-Theatrical Film Experience," 362.

Journal article highlighting the disappointing sales of DVD recorders, Panasonic market manager Tony Jasionowski attributes the lack of sales to the complexity of use, a claim supported by DVD recorder owner Chet Flynn who complains, "I was going to take videotapes of my kids playing soccer and burn them on a DVD, but it's so much work. They assume everyone is technically savvy."[159] Even after five years on the market, DVD recorders gained little traction with the general public owing to their complexity along with the ease of access of purchased or rented DVDs.

For those with a more solid command of the technological landscape like Jon Lech Johansen—creator of DVD decryption software DeCSS—access was limited through legal channels. As noted, DVD was envisioned, from an industry perspective, as a Hansel and Gretel format. By that I mean that its more enticing features were fundamentally a means of entrapment that presaged the "control society" of the oncoming Web 2.0 generation. By providing a high quality, easily accessible, and affordable alternative to VHS, DVD was constructed as a secure means of allowing home entertainment and access while aggressively cracking down on illegal duplication, bootlegging, and piracy. DVD is rife with access control systems limiting playback to particular regions through its Regional Playback Control ("RPC") algorithm, and blocking copying and sampling of content through the Content Scramble System ("CSS"). The Content Scramble System is an algorithm designed to restrict copying through a (relatively short) 40 bit encryption scheme.[160] As a point of comparison, typical encryption schemes like the Advanced Encryption Standard ("AES") use, at minimum, a 128 bit key. The ease with which 40 bit

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[159] Gary McWilliams, "DVD Recorders as Hot Gifts? It's Unlikely," *The Wall Street Journal,* November 23, 2005.

[160] Alex Eaton-Salners, "DVD Copy Control Association v. Bunner: Freedom of Speech and Trade Secrets," *Berkeley Technology Law Journal* 19, no. 1 (2004), 272.

encryption can be cracked through brute force and plaintext attacks, as well as through reverse engineering, proved an irresistible target for Johansen who created and publicly released his DeCSS anti-encryption program to the masses in October of 1999.[161]

Despite the best efforts of the DVD Copy Control Association—a consortium responsible for CSS and made up of representatives from major film distribution companies—CSS proved to be a poorly designed algorithmic lock that, rather than deter would-be "pirates," attracted the attention of amateur hackers and computer enthusiasts ultimately leading to DeCSS becoming a quasi-viral computer program(s). Downloadable copies of DeCSS proliferated throughout the web and instructions for decrypting CSS appeared in publications ranging from *Wired Magazine* to the *Wall Street Journal*.[162] DeCSS source code was enshrined on T-Shirts, cheekily embedded as dataglyphs in images [fig. 1.1], and even served as the lyrics of one of MP3.com's short-lived "folk-music" chart topping songs titled "Descramble" by Joseph Wecker.[163]

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[161] Eaton-Salners, "DVD Copy Control Association v. Bunner," 272.
[162] Victor C. Clarke, "DVD Hacking for Dummies," *Wired*, 1 June 2001;
David Hamilton, "Banned Code Lives in Poetry and Song—Critics of DVD Copyright Ruling Say the Constitution Protects Posting Program in All Forms," *The Wall Street Journal* 12 April 2001.
[163] "Court to Address DeCSS Shirt," *Wired,* 2 August 2000;
"The Gallery of CSS Descramblers,"
https://www.cs.cmu.edu/~dst/DeCSS/Gallery/Stego/efdtt-dataglyphs.gif;
Peter Maass, "The Supercool Top-Secret DVD-Decoder Song," *The New Yorker*, 23 October 2000, 92.
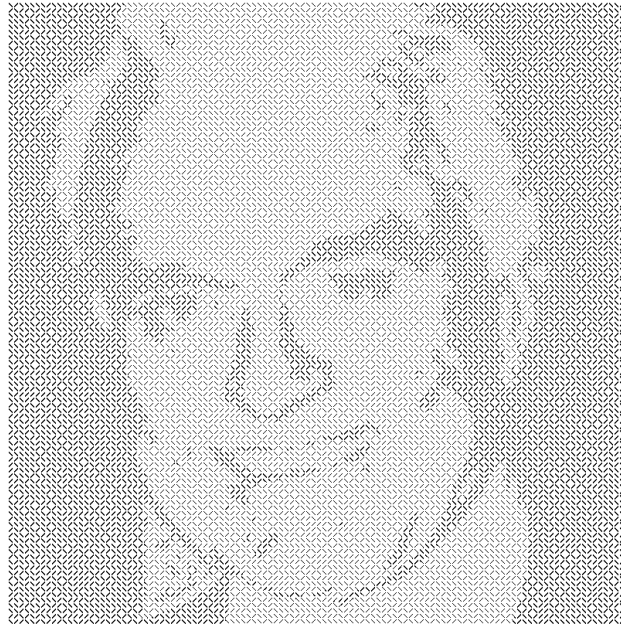
Figure 1.1: DeCSS program "efdtt" inscribed in dataglyphs as a picture of MPAA head Jack Valenti.[164]

Although the status of VHS as a recording and duplicable medium had been effectively established through *Sony Corporation of America v. Universal Studios Incorporated*, the promise of DVD as a "safe" medium from an industry perspective was still up for debate even in light of the ease with which its technological locks had been picked. In an effort to reestablish DVD as a "safe" medium for the industry (that is, one free from the rampant duplication and piracy plaguing VHS), the DVD Copy Control Association and the major film studios cast a wide net in filing a lawsuit against hundreds of people who published or posted any form of the DeCSS program.[165] The DVD Copy Control Association's decision to file suit on the grounds that sharers of DeCSS programs and source code were infringing on "trade secrets" was initially successful in Santa Clara, California's superior court with an injunction granted restricting the

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[164] Dave Touretzky, "Steganography Wing of the Gallery of Css Descramblers," Steganography Wing of the Gallery of CSS Descramblers, 2003, https://www.cs.cmu.edu/~dst/DeCSS/Gallery/Stego/.
[165] Eaton-Salners, "DVD Copy Control Association v. Bunner," 273.

defendants from making DeCSS information broadly available. However, the decision was quickly appealed by defendant Andrew Bunner resulting in the appellate court ruling in favor of the defendants arguing that DeCSS was "available to anyone interested in obtaining it," hence, it was so widely accessible that it did not meet the definition of a trade secret at the time an injunction was requested.[166]

In a shift of tactics, the sharing of DeCSS source code and downloadable programs was challenged again, not on the grounds that it impinged on trade secrets but rather that it ran afoul of the Digital Millennium Copyright Act's strict anti-circumvention provisions. *Universal City Studios Inc. v. Corley* would serve as the successful payoff of years of Hollywood lobbying in an effort to make it illegal to bypass digital encryption with the appellate court ruling in favor of the plaintiff arguing that Eric C. Corley's inclusion of DeCSS source code on his public facing website was in violation of the DMCA. Despite the defendant's claim that computer code was protected speech per the First Amendment, the provisions of the DMCA flattened any nuance and instead resulted in what the courts viewed as a clear cut case of illegal anti-circumvention tactics. Complete with overly broad anti-circumvention provisions, Congress passed the Digital Millennium Copyright Act in 1998 making "it illegal to disable or bypass the copy protection of DVDs and other digital media or to traffic in anticircumvention tools."[167] This new approach to duplication and "piracy," now tested and successful through *Universal City Studios Inc. v. Corley,* changed the nature of access, control, and fair use of copyrighted media content. While rulings around fair use have often been messy and unpredictable, the DMCA served to remove fair use from the equation entirely:

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[166] Eaton-Salners, "DVD Copy Control Association v. Bunner," 279.
[167] Decherney, *Hollywood's Copyright Wars*, 202.

> [F]air use is inexact, approximate, and fluid. In other words, it's analog. The DMCA and especially extralegal technologies to prevent duplication (such as Content Scramble System encoding on DVDs or the absence of a record button on players) instead operate as binary laws: either it's legal or it's not; either it's functionally possible or it's not. These are distinctly digital ways of regulating users' activities and attempts to copy and share media.[168]

As Hilderbrand indicates, DVD, and the upholding of CSS as protectionable under DMCA regulations set the stage for a future of digital media, and more specifically, served to alter public perception around how we come to understand ownership and access of digital media. *Universal City Studios Inc. v. Corley* might be read as one catalyst in the march toward our acquiescence of immaterial media. If we do not truly own our digital media, why should we bother owning our digital media at all?

Although the DVD format was designed as a "safe" carrier for the film industry itself—as a difficult to copy/bootleg, sell-through object—the promise of special features, higher quality visual and audio specifications, and the growth of the "director's cut" would also serve to rally a significant number of directors around the carrier's promise of securing the conception of the auteur as a unique visionary. Contradictorily, the 5-inch disc was often marketed around the ability of viewers to easily skip through content by way of chapters. This friction between the intent of control on the part of the studios and the promise of control as a marketing ploy would spill over in the 2002 *Director's Guild of America v. CleanFlicks* case.

In an attempt to entice the local Mormon film viewing population and spurred on by its founder Ray Lines's own affiliation with the Church of Jesus Christ of Latter Day Saints, Utah based company CleanFlicks purchased DVDs and subsequently rented and sold heavily censored copies. A CleanFlicks film might have anywhere from a handful of audio and video edits to tens

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[168] Hilderbrand, *Inherent Vice*, 19.

of minutes worth of removed content. Commenting on his removal of nudity from *Schindler's List* (Steven Spielberg, 1993), Lines's states, "Every teenager in America should see that film. But I don't think my daughters should see naked old men running around in circles. You can watch that film and know people were humiliated, traumatized and put through hell even after we cut out what we cut out."[169] Lines was not alone in his moral crusade, ClearPlay, Trilogy Studios, Family Shield Technologies, Clean Cut Cinemas, Family Safe Media, EditMyMovies, Family Flix, and Play It Clean Video were all involved in their own approaches to editing Hollywood films like *Titanic* (James Cameron, 1997) and *Saving Private Ryan* (Steven Spielberg, 1998).[170]

As Decherney recounts, one of the more ambitious of these startups, Trilogy Studios, was rebuffed in its attempts to market its services to Hollywood and, rather than face an uncertain future around copyright infringement, filed a preemptive lawsuit along with the aforementioned companies against twelve Hollywood directors including Steven Spielberg in hopes that the courts would deem its practices as a case of fair use.[171] Any hope of a ruling in their favor was quickly jeopardized by a countersuit claim filed by the Directors Guild of America, along with powerhouse directors like Robert Altman, Steven Soderbergh, John Landis, and Michael Mann.

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[169] Ray Lines qtd. in Michael Janofsky, "Utah Shop Offers Popular Videos With the Sex and Violence Excised," *New York Times*, 31 January 2001;
Schindler's List, directed by Steven Spielberg (1993);
Titanic, directed by James Cameron (1997);
Saving Private Ryan, directed by Steven Spielberg (1998).
[170] Civil Action No. 02-M-1662: Robert Huntsman and Clean Flicks of Colorado, L.L.C., v. Steven Soderbergh, Robert Altman, Michael Apted, Taylor Hackford, Curtis Hanson, Norman Jewison, John Landis, Michael Mann, Phillip Noyce, Brad Silberling, Betty Thomas, Irwin Winkler, Martin Scorsese, Steven Spielberg, Robert Redford, and Sydney Pollack (The United States District Court for the District of Colorado July 18, 2003).
[171] Decherney, *Hollywood's Copyright Wars,* 151.

Central to the counterclaimants' argument was that through the modification and distribution of works bearing the well-known names of directors like Soderbergh and Spielberg, companies like CleanFlicks were in violation of the Lanham Act, a 1946 federal statute which protects against both trademark infringement and false advertising. The counterclaimants argue, "Because the aforementioned conduct [modifying films] wrongly associates the Director Counterclaimants and other DGA members with altered feature films in violation of the Lanham Act, the Director Counterclaimants seek the same relief with regard to each Plaintiff and Proposed Counterdefendant."[172]

While Decherney locates the significance of this case in "a new alliance" between filmmakers and studios representing "a complete capitulation" on the part of directors, the ruling also offered yet another push away from material carriers as desirable or necessary.[173] Following the court's decision that CleanFlicks and its codefendants were indeed in violation of U.S. copyright law, Utah congressman Orrin Hatch orchestrated what would become the Family Entertainment and Copyright Act of 2005. The legislation consists of The Artist's Rights and Theft Prevention Act—which essentially attempts to crack down on piracy by outlawing the recording of screens in movie theaters—and the Family Movie Act which gave the greenlight to "on-the-fly" editing of film content during playback.

Ultimately, CleanFlicks' approach to editing content and redistributing censored DVDs was outlawed, but codefendants ClearPlay, Family Shield, and Trilogy Studios relied on a different method of censorship. Known as the "Huntsman Methodology," ClearPlay, Family Shield, and Trilogy Studios used software to temporarily skip, mute, and mask "objectionable"

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[172] Civil Action No. 02-M-1662, 6.
[173] Decherney, *Hollywood's Copyright Wars*, 154.

content in real time during playback, a technique sanctioned as acceptable through the Family Movie Act.[174] The CleanFlicks case marked yet another shift away from the idea of ownership of any tangible media object and, through legislative backing, furthered the push toward the embrace of a kind of ephemeral access over ownership. Modifying, lending, renting, tangible media generally falls under the protection of the first-sale doctrine of copyright law— "a provision that allows owners of tangible copies of media works to use, rent, resell, or dispose of the object as they see fit without paying additional royalties to the rights owner."[175] Although ClearFlicks moved far beyond the bounds of the first-sale doctrine by duplicating, modifying, and reselling content, digital content has sufficiently muddied the first-sale doctrine given the ease of duplication and transference to alternative tangible carriers.

Key here beyond limitations and impossibility of embracing the first-sale doctrine in the digital age is the fact that ClearPlay and the other companies relying on the Huntsman Technology operate solely when DVDs are played via the disk drive of a computer. The state sanctioning of playback manipulation and ephemeral censorship via software further erases the significance of the carrier itself. Just as challenges around DeCSS effectively painted the limitations of fair use in a post-DMCA age, the sanctioning of ClearPlay's use of ephemeral software manipulation over CleanFlicks' reselling of tangible goods further moved the needle toward an embrace of immaterial and ephemeral access over ownership. Indeed, ClearPlay is still operative but its website boasts playback censorship of myriad films based on Netflix, Amazon, HBO Max, Apple TV+, and Disney+ a move that might easily have been predicted based on the Family Entertainment and Copyright Act.

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[174] Civil Action No. 02-M-1662, 6.
[175] Hilderbrand, *Inherent Vice*, 57-58.

DVD furthered the process of medium erasure in relation to cinema this time through a restriction on material access and control in exchange for ephemeral access and control. This tradeoff, between a materially accessible access and immaterial ephemeral access all based around medium erasure fundamentally prefigured the current "death of cinema." More than a medium, DVD was a magic trick. Like the vanishing lady of Georges Melies's eponymous 1896 film, DVD was, from the outset, positioned to disappear. It is a medium built around its own erasure, an erasure reinforced through law, politics, and popular culture alike. Of course, just as in the Melies film, the lingering remnants of its skeleton, in this case an infrastructural base, is slowly beginning to reappear through scholarship that refuses to believe that what we are witness to in the era of streaming is cinema's ghost. The remainder of this dissertation will explore some of the lingering material, technological, cultural, and legal implications of cinema after its "death" by DVD.

CHAPTER 2: **Archiving Loss: File Sharing and Digital Preservation**

Shifts in the material substrate of cinema not only change how audiences come to understand

their relationship with, and access to, cinematic content. Media are more than just the means of

distributing messages, they are also vehicles for storage and processing. The move to a reliance

on digital technology as the foundational component of the contemporary cinematic medium has

contradictorily opened the door to greater degrees of access by the average spectator—owing to a

superficial streamlining of processing and distribution—while simultaneously exacerbating the

difficulties of long-term storage. Film preservation poses unique technical challenges and each

shift in cinema's material makeup changes the stakes, best practices, and possibilities of film

archiving as each new medium carrying cinema distributes its weight differently among this triad

of distribution, storage, and processing. At a moment when films are perhaps most easily and

widely accessible due to the rise of streaming services and the seemingly effortless transfer of

digital files, film preservation is at perhaps its most uncertain moment in its short history. Digital

technology increases the complexity of film preservation owing to its far more limited

capabilities as a long term storage medium but it opens the door to a new mode of preservation

through perpetual distribution and access, something that runs counter to traditional approaches

to film preservation.

This chapter is an honest exploration of the potential of digital file sharing technology

like the BitTorrent protocol to function as a means of supporting film archives in the age of

digital abundance. I begin by drawing attention to the shortcomings of traditional modes of

digital file sharing as a broad solution to preservation and access concerns. Despite the

techno-utopian myth of file sharing networks as decentralized and productively anarchic

(non-hierarchical), I detail the various limitations and externalities of quick, easy, (often

ephemeral) access particularly at a moment when superficially ephemeral and seamless access via streaming services is the dominant, legitimate mode of film circulation (and a bane to archives). Typical strategies of file sharing mirror this approach and do little to functionally preserve or perpetuate content despite myriad academic and pop cultural screeds claiming such outcomes. I then analyze the negative effects on working archives that the promise of easy access through digital streaming and file sharing platforms have exacerbated. I end by examining the operation and best-practices of private torrent index website Karagarga as an exceptional case and a potential example of how file sharing technologies and networks can indeed function as stopgap methods of preservation with the implementation of proper practices. A promise we might call "swarm archiving," Karagarga exists as a community of anonymous cinephiles illegally circulating and, as I argue, preserving at risk cinematic content through a network of perpetual leechers (downloaders) and seeders (sharers). Unlike most file sharing websites, Karagarga's strict community and quality standards mirror many legitimate archives' "best practices" but rely on the networked infrastructure of the BitTorrent protocol to preserve content through perpetual circulation.

Access, Circulation, and Preservation

In 1932, Joan Crawford sparked a fashion craze by sporting a white dress complete with over-sized puffed and ruffled sleeves. Cited as "the most dramatic evidence of motion picture influence on fashion behavior," this dress was not something Crawford wore off the silver screen, but rather was central to her character, Letty Lynton, in the eponymous film directed by Clarence Brown.[176] While the dress became an iconic artifact of an era, the film itself, sadly,

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[176] Charlotte Cornelia Herzog and Jane Marie Gaines, "'Puffed Sleeves Before Tea-Time:' Joan Crawford, Adrian and Women Audiences," in *Stardom: Industry of Desire*, ed. Christine Gledhill (London: Routledge, 1991), 77;
Letty Lynton, directed by Clarence Brown (1932).

succumbed to a different fate. Shortly after its 1932 release, *Letty Lynton* would be locked away for good, losing a copyright infringement challenge levied on behalf of playwrights Edward Sheldon and Margaret Ayer Barnes who penned the play *Dishonored Lady* which *Letty Lynton* took (too enthusiastically it seems) as its inspiration. Despite a streaming environment which, as of this writing, hosts an ever-changing line up of approximately 15,000 titles (if we consider the largest five providers), neither Netflix, Prime Video, Hulu, HBO Max, nor Disney+ can allow audiences a view of Lynton's iconic dress in context. Similarly, one cannot find a copy of *Letty Lynton* among the user generated content of YouTube as the platform's aggressive ContentID algorithm quickly flags and removes any bootlegged iterations of the film that find their way into its seemingly endless collection of media.

The difficulty of accessing a film like *Letty Lynton*—a Hollywood star vehicle which arguably stands in as one of the most influential films in history from both a fashion and star studies perspective—is not unique but points to the gaps in the libraries of streaming platforms who have consistently marketed themselves as purveyors of near unlimited content [Fig. 2.1]. Considering these gaps in content is not simply an exercise in snobbery intent on challenging the importance of streaming services but rather a necessary way of untangling the often overlooked ecology of distribution, access, preservation, and technology. With this ecology in mind, I highlight in this chapter the often fraught yet intertwined relationship between streaming services, film archives, and BitTorrent trackers set on freely circulating hard to find content. BitTorrent, as a communication protocol, is a significant force behind the distribution of content ranging from operating systems, to videogame downloads, to backend server updates. The protocol's ability to allow for the transfer of large amounts of data relatively quickly between multiple peers has made it an essential technology of the digital age and one which deserves far

more attention in academic and popular press alike. Despite its power and utility, discussions of the BitTorrent protocol are often reduced to questions of piracy and illegal distribution. While I will be taking up those concerns in this chapter to some extent, I also examine how this protocol can, and does, foster alternative (albeit temporary) solutions to the problems of digital preservation.
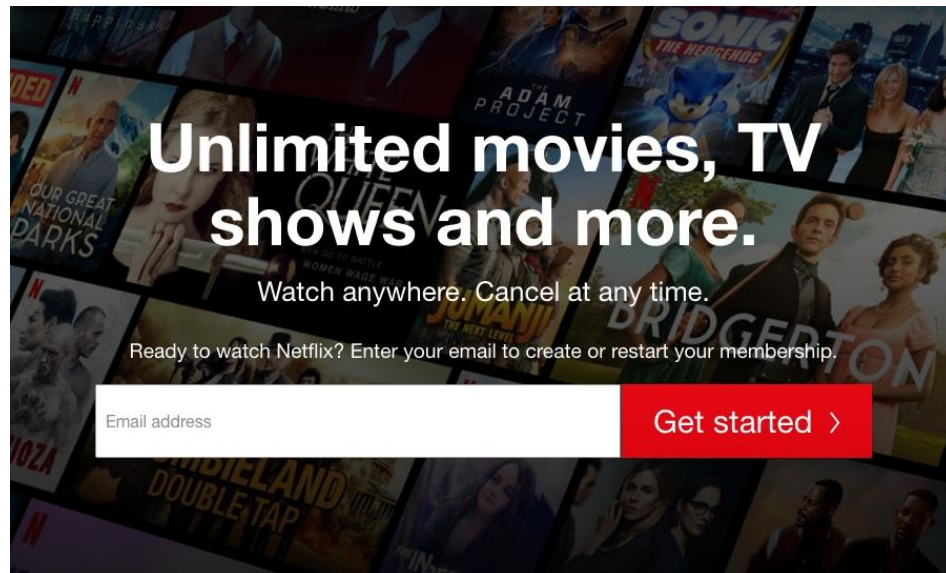
Figure 2.1: Netflix online advertisement promising unlimited access.[177]

While streaming services offer audiences easy access to content and offer studios a promising solution to "the piracy problem," the false promise of choice and ease of access weighs heavily on film archives whose preservation work in the age of digital abundance grows increasingly difficult and depressingly undervalued. In this new environment, private peer-to-peer trackers like Karagarga make use of a tragically under-examined technology (the BitTorrent protocol) to slow the disappearance of films through a system of continued circulation. The preservation status of *Letty Lynton* may be unclear, your average Netflix viewer may never see Joan Crawford enter the scene in her Adrian dress, but for users of the private

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[177] "Unlimited Movies, TV Shows, and More.," Netflix, accessed October 16, 2022, https://www.netflix.com/.

tracker Karagarga, the film remains alive, preserved, and accessible, living on no fewer than 137 different hard drives, in locations ranging from California to Belgrade.

Despite the power of BitTorrent trackers like Karagarga, this chapter also serves as a corrective to the overly optimistic narratives often trumpeting the empowering and community building effects of file sharing writ large with little attention paid to the vast differences between specific file sharing networks or even the differences between users within a given network. As a participant observer in Karagarga and similar private file sharing networks, I have a particular interest in rectifying some misconceptions (both overly negative and overly optimistic) about the way file sharing operates. There has been a persistent trend in academic discourse, often filtered through second-hand journalistic accounts of file sharing, to draw attention to these networks as either hotbeds of computer crime or instead to celebrate the "radical tactics" of these networks as a counter to the off-the-rails overreach of contemporary copyright law and the limitations of distribution networks.[178] This can be linked most famously to Lessig's work but its central tendencies might just as easily be attributed to the enduring influence of the "Californian Ideology" laid out by Barbrook and Cameron which itself was convincingly connected to the failed student led "revolution" of the late 1960s and the awkward communitarian/libertarian ideology left in its wake as documented by Turner and others.[179] In Barbrook and Cameron's 1996 text, they describe the Californian ideology as an "anti-statist gospel of hi-tech libertarianism: a bizarre mish-mash of hippie anarchism and economic liberalism beefed up with lots of technological determinism."[180] Surprisingly, this ideology seeps into academic discourse

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[178] Henry Warwick, *The Radical Tactics of the Offline Library* (Amsterdam: Institute of Network Cultures, 2014).

[179] Fred Turner, *From Counterculture to Cyberculture: Stuart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006.

[180] Richard Barbrook and Andy Cameron, "The Californian Ideology," *Science as Culture* 6, no. 1 (1996): pp. 44-72, https://doi.org/10.1080/09505439609526455.

around the potentiality of file sharing (as this chapter will explore) even as the academy

continues to offer up the most scathing critiques of the Silicon Valley ideologues touting the

power of technology to free the masses from the shackles of authoritarian control.

Admittedly, copyright law in the United States is absolutely oppressive and skewed to

benefit large corporations and their control over intellectual property. It is hard to deny that the

Digital Millennium Copyright Act in particular essentially served as a hand-off of Copyright

enforcement responsibility from the courts to the corporations who would benefit the most from

it. That said, a history of media and its audiences has shown that file sharing networks are far

more complex and far less politically concordant than the revolutionary narratives embraced by

the (unwitting) Californian ideology apostles would have it seem. Furthermore, the technology

undergirding these networks and the ways in which they allow for the highlighting of wrongs

(whether copyright overreach, political repression, racism, etc.) through slightly less policed

processes of communication and "sharing" are often taken as radical and revolutionary in and of

themselves which marks its own form of technological determinism. As Frost illustrates, often

"hashtag activism"—or in the case of file sharing, anti-copyright rhetoric—becomes the story

while change itself is an afterthought.[181] A platform which easily solicits attention to a cause is

not the same as a concerted, organized, effort at producing change—this is particularly true when

considering the draconian "terms of use" we all often unwittingly enter into simply to spread our

messages of resistance. Likewise, breaking a law does not necessarily carry with it the

intentionality of challenging a law. It is time to move past the all too simplistically applied

framework of "tactics" as a means of homogenizing all instances of file sharing into a uniform

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[181] Amber A'Lee Frost, "The Poisoned Chalice of Hashtag Activism," *Catalyst* 4, no. 2 (2020);
Also see Andreas Bernard, *Theory of the Hashtag* (Cambridge: Polity, 2019).

block of political and radical action.[182] This applies to file sharing networks in many of the same ways as social media platforms.

With that in mind, I approach file sharing as a multifaceted endeavor. There are myriad ways to "share a file" and even within those broader categories, there are myriad ways in which a given technique can operate within specific networks. Rather than broadly focus on the latent potential of file sharing and "piracy" making use of the BitTorrent protocol, I put forth a critique of the often overly general assumptions about the power of file sharing taking into account the pitfalls of the practice before looking specifically at the private tracker Karagarga. Moving from a general and realistic account of the limitations of file sharing as a radical tool for preservation, access, and politics, to a specific file sharing network (Karagarga) in action, allows for a better sense of how this community navigates the shortcomings of file sharing and what those techniques might mean for the preservation of cinema in an era of digital abundance.

The Shortcomings of File Sharing

File sharing communities operate for myriad reasons beyond a simple desire for convenience and to rip off creators. While stories about "pirates" destroying the music and film industries make for gripping headlines, the motivations for file sharing are as diverse as its participants. File sharing sites that trade primarily in academic texts typically locked behind institutionally priced paywalls like LibGen and SciHub are still complicit in copyright infringement but the motivations behind such sites are quite different from YTS.mx (formerly YIFY group). LibGen, SciHub, and YTS.mx all share copyrighted content but the former operate to make available to its users articles and content from scientific/academic journals in an attempt to foster broader access to knowledge while the latter circulates the latest Hollywood films. Regardless of whether

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[182] Michel de Certeau, *The Practice of Everyday Life* (Berkeley: The University of California Press, 1984)*,* 37.

one believes in the cause and motivation behind services like SciHub, there is a difference in kind that is lost when file-sharers are reduced to "pirates" without interrogation. Similarly, file sharing communities like Karagarga perpetually circulate cinematic content as a means of building and preserving a library of hard to find and often undervalued media artifacts.

Despite the goals of BitTorrent trackers like Karagarga, file sharing, strictly speaking, is not preservation. According to the Library of Congress, "Preservation encompasses all efforts—including conservation—to keep and maintain or improve the condition of collections to counter man-made damage or the natural effects of time."[183] Preservation is a continuous and intentional process. It necessitates careful planning and often incorporates conservation, restoration, and reconstruction into the overall preservation process. It is not just a matter of store and ignore, but instead determining what conditions might best ensure the longevity of the object as well as to restore that object to as close to its original state as possible.[184] As Gracy notes, the typical process of film preservation in particular includes a series of steps: selection, acquisition of funding and resources, inspection and inventory of deposited items, preparation and duplication at labs, storing master and access copies, cataloging, and providing access to the film.[185] Preservation, even relying on a hearty analog format like safety film, is never an easy process and for it to be truly effective, it cannot be left to chance. While attitudes continue to change regarding the effectiveness of cold, climate-controlled storage versus the copy to preserve approach, both approaches are nevertheless reliant on a degree of planning, foresight, funding, and control to truly ensure the longevity of the object being preserved. Oversight and centralization are typically key components of effective preservation.

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[183] "Frequently Asked Questions," *Library of Congress*, https://www.loc.gov/preservation/about/faqs/general.html#difference.
[184] Marilyn Deegan and Simon Tanner eds., *Digital Preservation* (Cambridge: Facet, 2006), 3.
[185] Karen F. Gracy, "Documenting the Process of Film Preservation," *The Moving Image* 3, no. 1 (2003): pp. 1-41, https://doi.org/10.1353/mov.2003.0005.

File sharing, by contrast, is about access and decentralization. File sharing is the opposite of the cold storage room, temporarily lightening the heavy load of time which slowly turns the nitrate print into a combustible sludge in a space of controlled darkness. File sharing is a process of its own but one which does not halt the object in a particular moment of being. Instead, it induces the object's continual becoming. Every hand turning a page leaves a mark, however hard to discern. Short of bitstream drive imaging, every file shared digitally becomes its own unique copy complete with unnoticed ambient data. And, like Claude Shannon's observations on the general system of communication, every transmission is prone to a certain degree of entropy and random disturbance otherwise known as "noise" effectively shaping the "transmission/data" in the process.[186] Drawing on Shannon's mathematical theory of communication (which in many ways serves as the foundation for digital communication and spawned the field of information theory) helps position questions of preservation and file sharing in a more appropriate context particularly when considering the role of digital media. To Shannon, noise must be considered, from the outset, as a constituent part of communication that must be coped with in order for a message to be properly received, decoded, and understood.[187] Importantly, communication can be considered as taking place across space, but just as easily across time.

What constitutes noise in the context of file sharing (or transmitting data from one person to another) varies with the medium as well as in how the information source and destination are

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[186] Claude Shannon, "A Mathematical Theory of Communication," *Bell System Technical Journal* 27, no. 3 (July 1948): pp. 379-423.

[187] Although noise is inherent in every communicative act, it is not always an impediment to message creation as so often framed. As Krapp has illustrated, what might typically be considered noise in the context of normative models of communication across certain media, might just as well become the very content of the message itself. Errors, glitches, and noise often considered as problems to be overcome can just as easily serve as the basis for artistic/meaning production.
Peter Krapp, *Noise Channels: Glitch and Error in Digital Culture* (Minneapolis: University of Minnesota Press: 2011).

interpreted. Shannon's dictum, which accounts for information source, transmitter, signal, noise, receiver, and destination, can be understood both as a means of interrogating the transfer of information technologically between users but it also applies just as well when thinking through the transfer of information across time. The message process of file sharing, specifically as a mode of preservation, accounts for both the physical transfer of a message (e.g., a digital file) from an information source (e.g., swarm/seeder) over a carrier (e.g., fiber optic cable) to a receiver (e.g., leecher) but also the transfer of the message into the future. We can look at the technology of file sharing to understand how noise might shape the message in the present tense while also recognizing that file sharing as a mode of preservation comes with its own noise affecting the successful transmission of the message across time.

Even beyond the technical aspects undergirding communication channels, as previously noted, Kirschenbaum reminds us, the materiality of media extends beyond their immediate carriers. Intellectual property, incompatible standards, obsolescence, IPOs, sell-outs, buy-outs, etc. are all essential properties shaping a given medium regardless of its physical carrier.[188] Keeping this broader network and the dual schemes of file sharing as a mode of preservation in mind, what "noise" permeates the process of file sharing, and, beyond that, what noise increases entropy in file sharing across time (as a form of preservation)?

Contradictorily, the largest introduction of noise in the communicative channels of file sharing across time is that of redundancy. For Shannon's general system of communication, redundancy is an essential part of combating noise and allowing for effective data compression. The more redundancy built into a message the less information needs to reach the receiver for the message to remain legible. Shannon notes that the English language, for example, is 50 percent

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[188] Matthew G. Kirschenbaum, *Mechanisms: New Media and the Forensic Imagination* (Cambridge: The MIT Press, 2008), 106.

redundant.[189] The amount of redundancy is of course a somewhat subjective interpretation as degrees of redundancy are useful in establishing the channel but, regardless of approach, there is no doubt a certain degree of acceptable loss in communicating using the English language that still leaves a message relatively easily decodable due to contextual cues and the general structuring logics of the language. For example, the implication/meaning of a message like "Hello, it is nice to meet you" could easily be understood if the message received was, "Hllo, nce t meet u." Due to the limited statistical variation of letter/word configurations in the English language, along with contextual cues, decoding the message becomes a relatively simple task. The redundancy of the language allows for a greater certainty that the meaning of the message will come through even in light of a high amount of noise being introduced into the communication channel. This system of communication, relevant to file sharing as well as general language, will be revisited in relation to compression algorithms in chapter three.

Redundancy is of course also central to preservation and yet in the world of file sharing it can effectively limit an object's life expectancy. The use of step contact printers to make copies of decaying film has been standard (albeit contested) practice in film archives for decades. These copies are well looked after and often stored away in climate-controlled vaults to ensure their longevity. In a proper archive, redundancy is just another technique for ensuring the survival of cultural artifacts.[190] With file sharing however, redundancy can just as easily reduce the odds of longevity. The two challenges redundancy poses for preservation in file sharing networks are visibility and false security.

It should come as no surprise that the more a file is shared, the more visible it becomes. In the context of preservation, this seems like an obvious advantage. A file shared with 200,000

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[189] Shannon, "A Mathematical Theory of Communication," 14.
[190] Leo Enticknap, *Moving Image Technology: From Zoetrope to Digital* (New York: Wallflower Press, 2005), 191.

users seems far more secure than one limited to only a handful of locations. However, as the annual "Review of Notorious Markets for Counterfeiting and Piracy" shows, the greater the visibility of a file sharing network, particularly one engaging in the unauthorized circulation of copyrighted material, the more precarious its content. The Office of the United States Trade Representative's 2021 annual report zeros in on the most heavily trafficked torrent trackers and indexes like The Pirate Bay, 1337x, and RARBG which has resulted in these sites being subject to blocking orders in myriad countries.[191] The Pirate Bay in particular has been raided twice since 2006, a point of pride for founders and anti-copyright advocates Peter, Neij, and Svartholm.[192] Despite the raids disrupting the site's service only temporarily, the resiliency of the tracker (now torrent index) and the BitTorrent protocol undergirding it should not be misinterpreted as a marker of the site's ability to preserve the media the service indexes.

A quick browse through The Pirate Bay's torrent index reveals that a majority of files have zero seeders. This reality of the torrent index is a key complaint found across forums devoted to file sharing. As opposed to other protocols/systems like Usenet that rely on distributed servers rather than direct peer-to-peer exchange to enable file sharing, seeders are essential for the accessibility of media relying on the BitTorrent protocol. Examining some of the most "upvoted" responses to a question posed on the Q & A website Quora regarding the lack of Pirate Bay seeders sheds some light on how the community largely understands the platform as one of tenuous access as opposed to long-term preservation. In response to the question, "Why are there so many links on The Pirate Bay with no seeds?" user Max Johnson replies:

Seeding is like something of a good deed, the seeder gains nothing from it by doing so

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[191] Office of the United States Trade Representative, "2021 Notorious Markets for Counterfeiting and Piracy," 2021 Notorious Markets for Counterfeiting and Piracy" § (2021), 17-33.
[192] Quinn Norton, "Secrets of the Pirate Bay," Wired (Conde Nast, August 16, 2006), https://www.wired.com/2006/08/secrets-of-the-pirate-bay/.

(there may be other motives but we are gonna ignore them). So unless if the seeder has a good internet connection or some other means to seed without much hassle, you won't find many people seeding every file. Also seeders might have seeded the file and when too much time has passed since they started seeding, they will just stop seeding the file. Please also remember that many people do not have proper internet connection facilities like you (just assuming you have proper internet connection since you seem bothered by no seeders).[193]

User Terry Hurlbut adds to the discussion:

I'm going to assume, based on the reality of what The Pirate Bay represents, that the seeders and all existing downloaders (except the greedy ones who download and do not seed) have had their respective Internet Service Providers serve notice upon them that if they do not cease and desist at once from seeing copyrighted content to a torrent, leaching therefrom, or otherwise participating therein, the ISPs will cancel their service.[194]

These two responses reveal the ways in which seeding is framed as an altruistic endeavor that comes with its own challenges and risks. On the one hand, seeding requires the seeder to maintain a copy of the file in an accessible location. If a visitor to The Pirate Bay is looking to access a copy of the latest Marvel film, they will have to first download the file from a network of seeders making them a temporary leecher. Once the download is complete, our Pirate Bay visitor who so desperately wants to view their newly acquired copy of *The Avengers 16* has the option of simply opening the file on their computer and removing their machine as a seed in the network. Doing so creates one less seeder but also frees up some of the user's computational and network resources and delimits the chance of the user being flagged for copyright infringement. Regardless of whether the user chooses to seed or not, the file is accessible on the user's personal hard drive until they choose to remove it. Alternatively, the user might decide to add their resources to the growing swarm of seeders thus (potentially) increasing the download speed for new leechers and ensuring that more anxious Marvel fans can see Captain America return from the dead for the sixth time to fight off a new alien threat.

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[193] "Why are there so many links on The Pirate Bay with no seeds?" *Quora,* (September 2020), https://www.quora.com/Why-are-there-so-many-links-on-The-Pirate-Bay-with-no-seeds.
[194] "Why are there so many links on The Pirate Bay with no seeds?"

Typically, in the latter scenario, it's considered good practice to seed to a 1:1 ratio. If the file downloaded is two gigabytes for example, then the file should remain seeding until the user seeds (uploads) an equivalent amount of data, in this case, two gigabytes worth. Of course, as the Quora responders point out, this is rarely the case. Not only is there little to no incentive for users to continue seeding, but doing so comes with potential, well-documented risks and burdens. The Motion Picture Association of America and the Recording Industry Association of America largely lost public sympathy during their most aggressive period of copyright suits targeting average users to the tune of 17,587 file sharers sued by the RIAA from 2004 to 2007 alone.[195] However, a shift in tactics has placed the burden on Internet Service Providers to police their users. In a 2011 agreement between the MPAA and the RIAA and Internet Service Providers AT&T, Cablevision, Comcast Verizon, and Time Warner Cable known as the Copyright Alert System (or the "six strikes" program), the primary ISPs of the day agreed to a "uniform procedure for notifying customers about repeat instances of digital copyright infringement."[196] Although the most aggressive approaches taken through the Copyright Alert System have been "retired" as of 2017, users are still often hounded by ISPs who frequently monitor peer-to-peer network traffic.[197]

As Quora responder Hurlbut—perhaps a bit too assuredly—notes, ISPs can and do contact and eventually block users accused of illegally downloading and uploading copyrighted material. In an environment where large swaths of users are restricted to a very limited number

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[195] "RIAA v. The People: Five Years Later," *Electronic Frontier Foundation* (30 September 2008) https://www.eff.org/wp/riaa-v-people-five-years-later.
[196] Ben Sisario, "Internet Providers to Help Thwart Online Piracy," *The New York Times* (7 July 2011).
[197] See "The 'Six Strikes' Copyright Surveillance Machine," *Electronic Frontier Foundation,* https://www.eff.org/issues/six-strikes-copyright-surveillance-machine;
Jacob Kastrenakes, "'Six Strikes'
 Anti-Piracy Initiative Ends After Failing to Scare Off 'Hardcore' Pirates," *The Verge* (30 Jan. 2017), https://www.theverge.com/2017/1/30/14445596/six-strikes-piracy-system-failed-ending.

of operating ISPs for their specific locals, being blocked from using a specific ISP is equivalent

to being barred from the Internet in general. Furthermore, anti-piracy companies like Rivendell

who, at the time of this writing, have sent 500 million DMCA takedown requests, continue to

target websites like The Pirate Bay and others in attempts to disrupt service and send a message

to its users about the negative implications of "piracy."[198]

It stands to reason that the number of seeders is quite low on a torrent index like The

Pirate Bay which has remained the most visited torrent index (previously a torrent tracker) for

over a decade. The Pirate Bay's visibility makes it, at least superficially, an easy target and a

threat risk from the position of the average user. Continuing to seed to ratio necessitates a time

and resource commitment that only increases the chance of being flagged by an ISP. This

commitment also varies drastically and increases exponentially if the file being shared is not as

in demand at a given moment. One might be able to more quickly reach a 1:1 seed ratio for the

latest film from the Marvel Cinematic Universe than *Dallas Buyers Club* (Vallee, 2013) and yet

the latter film has still been the cause of numerous copyright infringement lawsuits and ISP

action.[199] Thus, even calculated decisions about what films one should seed to ratio can in no

way guarantee impunity for the seeder. The lack of obvious incentives and the threat of legal

action (however limited that threat might be statistically) often outweighs the

pseudo-anarcho-libertarian ideology underlying the drive to freely circulate copyrighted content.

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[198] Andy Maxwell, "Rivendell Has Now Sent Half a Billion DMCA Takedown Requests to Google," *Torrent Freak* (25 Jan. 2020), https://torrentfreak.com/rivendell-has-now-sent-half-a-billion-dmca-takedown-requests-to-google-200125/

[199] Emily Jackson, "Nobody Gets Sued for Illegally Downloading Movies, Right ..." (Financial Post, September 6, 2018), https://financialpost.com/telecom/media/massive-infringement-movie-rights-holders-are-suing-illegal-downloaders-and-winning..

Similarly, redundancy in this context also further influences decisions on whether to seed a file by creating a false sense of security. If, upon completion of a download, the file has a healthy pool of seeders, there is even less incentive to remain seeding in light of the aforementioned risks. Users on Reddit's /r/torrents thread, for example, debate seeding strategies with a general consensus emerging that you should keep seeding as long as possible with the caveat that you can "ditch a torrent if it hasn't uploaded much after a day or two and it already has tons of seeds (i.e., if my seeding doesn't appear to be 'needed')."[200] Of course, as the /r/torrent Reddit community should know after Reddit's decision to erase a decade of /r/piracy posts, what appears to be a well-seeded or secure file can quickly disappear and the importance of a single user deciding to seed can quickly become relevant.[201]

In a more technologically oriented examination of the introduction of noise in the case of file sharing networks, it is important to consider the channels of communication as well as the initial quality of the message being sent. More specifically, in a digital environment making use of the BitTorrent protocol, decentralization comes with a series of problems (as well as benefits) that are less prevalent when considering a centralized network. Firstly, while the BitTorrent protocol is robust and not prone to failure, there is no immediate way to investigate the actual properties of the file being shared before the process is complete. The .torrent file which initiates the link between seeder and leecher contains only enough information to facilitate the connection between peers along with file size and some additional metadata which ensures that the delivered file is consistent with the requested file (SHA-1 hash). Knowing that the description provided in the tracker or index accurately (and truthfully) describes the file being downloaded is an

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[200] Razieltakato, "When should I stop seeding?" *Reddit*,
https://www.reddit.com/r/torrents/comments/3kyec7/when_should_i_stop_seeding/
[201] Matthew Gault, "Reddit's Piracy Subreddit is Purging a Decade of Posts," *Vice* (08 April 2019),
https://www.vice.com/en/article/qvygwq/reddits-piracy-subreddit-is-purging-a-decade-of-posts.

impossibility. In a decentralized system with no oversight, the fundamental challenge is ensuring that the requested file is indeed correct based on the description provided by the torrent tracker or index.

There are of course various ways to critically examine the description provided on the tracker or index and corresponding file size data to lower the risk factor, but there is still no guarantee that the description will be accurate. For example, if a user is trying to download a feature length film and the .torrent file indicates that the file size is two megabytes, it can be pretty assuredly assumed that the file itself is not a film, which would be much larger. Reading user comments is also a helpful way of determining what file might be accurate to its description, but not every .torrent file includes accompanying user comments and, as is well known by now, comments themselves must be taken with a grain of salt. It is also possible to "scrape" the torrent to better investigate other files indexed on a given tracker which sometimes leads to red flags (similar, unrealistic seed counts on multiple torrents, etc.) but this process is not intuitive and often does not lead to a clear conclusion regarding the veracity of a file. The MPAA also has a long history of uploading their own fake torrents to entrap unsuspecting file sharers.[202]

And finally, the sheer quantity of .torrent files associated with various iterations of particular files makes any selection via a fully decentralized tracker or index a gamble due to the dramatic variance in quality. As of this writing, The Pirate Bay includes approximately 100 different entries for *Avengers: Age of Ultron* (Whedon, 2015). Many of these entries are duplicate resolutions. As I will illustrate in chapter three, resolution is not in and of itself an adequate indication of quality. Every rip of the film necessitates a series of choices regarding video codec, bitrate, frame rate, audio codec, sample rate, bit depth, etc. each altering the overall

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[202] Ernesto van der Sar, "MPAA Caught Uploading Fake Torrents," *TorrentFreak* (11 Jan. 2007). https://torrentfreak.com/mpaa-caught-uploading-fake-torrents/

perceived quality regardless of resolution. There are myriad points where noise can be introduced into the process of digital file sharing and this noise increases exponentially in a wholly decentralized network. Decentralization, even in light of all its potential benefits, is messy.

Focusing on the introduction of noise as it relates to file sharing and digital file sharing in particular is important to better ground the process in its material reality. Decentralized file sharing is perhaps the most effective means of distribution, as has been noted by both filmmakers and media scholars including Herzog, Lobato, and Crisp, but it is a poor political platform and, in and of itself, is not an effective means of preservation.[203] But, this reality is often what is missing in discussions about its potential which results in a muddying of its actual value. The "radical" promise of decentralization hyped by the Californian Ideology sticks to discourse around file sharing networks effectively trapping them in a perpetual state of imagined futures severed from the present. For example, in her book *Rogue Archives: Digital Cultural Memory and Media Fandom,* De Kosnik argues that fan-archivists and pirate-archivists represent the future of digital media preservation. In the case of the former, De Kosnik draws on Williams's critique of the "selective traditions" of archives which suggests that institutional archives "grant priority to the culture that supports the narratives and identities of the dominant group."[204] De Kosnik argues that the decentralization offered by the Internet has resulted in a unique moment in which "memory has fallen into the hands of rogues, and what this explicitly means is: memory

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[203] Martin Blaney, "'Piracy is the Most Successful Form of Distribution,' says Werner Herzog," *Screen Daily* (16 April 2019);
Ramon Lobato, *The Shadow Economies of Cinema: Mapping Informal Film Distribution* (New York: Bloomsbury Publishing Inc., 2012);
Virginia Crisp, *Pirates and Professionals: Film Distribution in the Digital Age* (London: Palgrave, 2015).
[204] De Kosnik, *Rogue Archives*, 21.

has fallen into female hands, into queer hands, into immigrant and diasporic and transnational hands, into nonwhite hands, into the hands of the masses."[205]

De Kosnik's rhetoric could fit, almost unmodified, in John Perry Barlow's classic 1996 treatise "A Declaration of the Independence of Cyberspace."[206] Barlow vociferously defends the freedoms offered by the "ungoverned" network of cyberspace:

> Governments derive their just powers from the consent of the governed. You have neither solicited nor received ours. We did not invite you. You do not know us, nor do you know our world. Cyberspace does not lie within your borders. Do not think that you can build it, as though it were a public construction project. You cannot. It is an act of nature and it grows itself through our collective actions. […] We are creating a world that all may enter without privilege or prejudice accorded by race, economic power, military force, or station of birth.[207]

Both Barlow and De Kosnik similarly misinterpret the power of the superficial affordances created by an underlying network of mediation. Despite the promise of the ungovernable and "fan run" spaces of the Internet, Mueller reminds us, "In digital networks, there can be no direct connection from one computer to another. Between peers stands levels of mediation—protocols, algorithms, interfaces, language—often grouped into a single software package."[208] For all its radical potential, the Internet is not a wholly ungoverned space removed from the material, political, and economic realities of the day. De Kosnik's "fan archives" are prone to disappearance just like the aforementioned /r/piracy thread. Like the redundant noise of file sharing, the "rogue archives" De Kosnik discusses—which are defined as constantly available; zero barriers to entry; no pay wall; no copyright restrictions; and content not contained in "traditional memory institutions"—draw the ever-watchful eye of the culture industry

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[205] De Kosnik, *Rogue Archives,* 22.
[206] John Perry Barlow, "A Declaration of the Independence of Cyberspace," Electronic Frontier Foundation, 1996, https://www.eff.org/cyberspace-independence.
[207] Barlow, "A Declaration of the Independence of Cyberspace."
[208] Gavin Mueller, *Media Piracy in the Cultural Economy: Intellectual Property and Labor Under Neoliberal Restructuring* (London: Routledge, 2019), 119.

particularly when they exceed the bounds of the cyberspace playground. Suntrust v. Houghton

Mifflin; Salinger v. Colting; Castle Rock and Paramount v. Carol Publishing; Warner Brothers v.

RDR Books; etc. all serve as reminders that De Kosnik's fan archives are only allowable so long

as they remain beneficial to the culture industry at large either as free advertising, free labor, or

both.[209] The radical openness and lack of checks and balances, while politically powerful,

delimits the potential of these rogue archives as functional, sustainable archives in the traditional

sense.

In a summation of the misidentification of new media as a radical space free from the

shackles of the real, Turner notes the tendency that runs through the early works of Marshall

McLuhan, Stewart Brand's Whole Earth Catalog, Barlow's manifesto and beyond:

> McLuhan's simultaneous celebration of new media and tribal social forms allowed
> people like Stewart Brand [founder of the Whole Earth Catalog] to imagine technology
> itself as a tool which to resolve the twin cold war dilemmas of humanity's fate and their
> own trajectory into adulthood. That is, McLuhan offered a vision in which young people
> who had been raised on rock and roll, television, and the associated pleasures of
> consumption need not give those pleasures up even if they rejected the adult society that
> had created them. Even if the social order of technocracy threatened the species with
> nuclear annihilation and the individual young person with psychic fragmentation, the
> media technologies produced by that order offered the possibility of individual and
> collective transformation.[210]

Indeed, McLuhan's cold war rhetoric finds its rebirth in De Kosnik's article, "Piracy is

the future of Culture: Speculating about Media Preservation after Collapse." In this article De

Kosnik builds from the framework she establishes in *Rogue Archives* to argue that "media

piracy" will assuredly prove itself as the most resilient mode of preservation post-collapse.

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[209] De Kosnik, *Rogue Archives,* 2;
Each of these cases deals with issues of fan adaptations that seep beyond the borders of
innocuous fan sites. In each case, a work of fan content was monetized resulting in copyright
challenges by the original content producer with rulings in favor of the original copyright holder.
Fan labor functions as free marketing often until fans attempt to make money off of their labor.
[210] Fred Turner, *From Counterculture to Cyberculture: Steward Brand, the Whole Earth Network,
and the Rise of Digital Utopianism* (Chicago: The University of Chicago Press, 2006), 54.

Collapse here is left to the imagination but, like Barlow, there is a framing related directly to power. While never explicitly foreclosing on what "collapse" might entail (particularly a collapse that still allows for Internet functionality and the average "pirate archivist" access to their hard drives and functioning computers indefinitely), De Kosnik does mention that we might imagine collapse in relation to colonialism. "For those of us who come from a colonized country—or an indigenous people who have suffered genocide and forced relocation, or a formerly enslaved people—collapse is a significant episode in our personal, familial, community, and ethnic histories."[211] Barlow takes up a similar positioning:

> These increasingly hostile colonial measures place us in the same position as those previous lovers of freedom and self-determination who had to reject the authorities of distant, uninformed powers. We must declare our virtual selves immune to your sovereignty, even as we continue to consent to your rule over our bodies. We will spread ourselves across the Planet so that no one can arrest our thoughts.[212]

Without diminishing the lingering effects of colonialism, the rhetoric of both De Kosnik and Barlow is one of rhetorical political positioning that only skews the stakes. For De Kosnik in particular, her article's focus is on pirate archivists preserving industrial output, but this focus remains overly vague. Relating "collapse" and "pirate archivists" with colonialism belittles the indigenous knowledge networks that have functioned for millennia and have truly relied on "peer-to-peer" approaches to preservation using the only technology that we can assume will remain with us in the wake of total collapse: language. Equating an amateur network of file sharers and "pirates" reliant on "the master's tools" (in this case protocols, network infrastructure, hardware, etc.) with a subjugated population is an unnecessary rhetorical move that undermines serious discussion of the potentials of the technology. Furthermore, it ignores (or

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[211] Abigail De Kosnik, "Piracy is the Future of Culture: Speculating about Media Preservation after Collapse," *Third Text* 34.1 (2020), 64.
[212] Barlow, "A Declaration of the Independence of Cyberspace."

worse, buries) the perpetual, slow-motion "collapse" of current archival practice which will be addressed below. Just as Barlow and the Californian Ideology apostles unflinchingly embrace new technology as savior, here De Kosnik does the same even as she attempts to subvert its typical techno-geek associations. The unfortunate results of this overestimation and unnecessarily politicized rhetoric around file sharing is a fuzziness regarding how file sharing networks actually operate and what the affordances of the technology undergirding such networks might be.

The Dialectic of Distribution

Despite the often-radical political claims associated with decentralized file sharing networks, the sad reality is that most of these networks function far more symbiotically with the industries they supposedly undermine than many would be willing to admit. Although industry, "pirate," and academic rhetoric often suggests a clear antagonism between file sharers and the industries they "undermine," the relationship between the two are often surprisingly concordant. From the days of Napster to the present, data suggests that those participating in illegal file sharing also feed back into legitimate sales of content, often in greater numbers than traditional consumers. The earliest cries from the RIAA about revenue loss were disproven by Forrester Research, Inc. whose 2002 report detailed that 31 percent of music consumers frequently download music and burn CDs. These same users, targeted as pirates set on wrecking the music industry, also buy 36 percent of all CDs.[213]

Beyond direct sales, these same file-sharers often function as a form of unwitting advertising for the industries themselves. As Krapp notes, often the first line of high-quality pirated content comes directly from the industry via Hollywood screeners—pre-release copies of

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[213] Andrew Orlofski, "Missing RIAA figures shoot down 'piracy' canard," *Register* (16 Dec. 2002).

films sent to award judges and critics.[214] Despite these high-profile leaks making content available often prior to theatrical release dates, the leaked films themselves continue to shatter box office records. One example is Peter Jackson's 2014 fantasy epic *The Hobbit: The Battle of the Five Armies*. Jackson's film was downloaded 500,000 times in the first 24 hours of being leaked but still managed to pull in a massive $956 million in worldwide receipts, making it 2014's second highest grossing film and the 30th highest grossing film of all time.[215]

As blockbuster releases shift to streaming platforms in the wake of the coronavirus pandemic, the potential for unauthorized circulation as free advertising continues. Assuming that there will be an increased desire for physical interaction post-pandemic, De Kosnik goes so far as to suggest that Disney's reliance on streaming original, high-production value content in fact presupposes piracy as a means to further its advertising reach exacerbating the desire for its in person offerings:

> People will want to go to places—and do and see and smell and taste and touch things—after a prolonged period of restricted movement and limited socializing. People will also seek to populate their social media feeds with photos and videos of themselves in unique and exciting environments. Disney parks' attendance was always going to go gangbusters after the pandemic, but with Disney feeding fresh media content to hundreds of millions of households *during* the pandemic—both via Disney+ *and* via pirate networks—the Mouse is nurturing a powerful collective longing to enter into Disney-themed spaces as soon as health protocols allow.[216]

With Disney's hit show *The Mandalorian* representing one of the most torrented television shows to date, with little direct anti-piracy push back or clear policy from Disney themselves, this theory may hold some water.[217]

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[214] Peter Krapp, "The Most Reliable Source of Piracy: The Hollywood PR Machine," *Scroll* (19 Feb. 2016).

[215] Krapp, "The Most Reliable Source of Piracy."

[216] Abigail De Kosnik, "2021 Will Launch the Platinum Age of Piracy," *Wired* (12 Dec. 2020).

[217] Lauren Thiesen, "Disney + and The Mandalorian Are Driving People Back to Torrenting," *Vice* (15 Nov. 2019),

Regardless of whether or not Disney's master plan incorporates piracy as a mode of free

advertising, it is important to note that the majority of illegal file sharing is not a direct challenge

to the industry and its consumerist imperatives but rather a node in the mesh-work of

distribution. Even with all the Manichean positioning of anarchists vs. capitalists, free

knowledge vs. the ivory tower, file sharers vs. industry moguls, decentralization vs.

centralization, the reality is far less clear cut.[218] Informal distribution—that is networks of

circulation that operate outside State and corporate regulated networks—accounts for a huge

margin of media access globally and often these networks thrive precisely due to the

shortcomings of formal distribution channels.[219] These informal economies are not merely

leeches sucking away cash blood from media industries but often extend the reach of these

networks into markets that would otherwise be impossible to penetrate.[220] Director Werner

Herzog has even gone so far as to describe informal distribution as "the most successful form of

distribution worldwide." Herzog continues, "If you don't get [films] through Netflix or

state-sponsored television in your country, then you go and access it as a pirate."[221] Herzog

happily notes that "pirate" access has led to an increase in fan outreach about his back catalog, an

https://www.vice.com/en/article/bjwexw/disney-and-the-mandalorian-are-driving-people-back-to-torrenting.

[218] Siva Vaidhyanathan, *The Anarchist in the Library: How the Clash Between Freedom and Control is Hacking the Real World and Crashing the System* (New York: Basic Books, 2004).

[219] Ramon Lobato, *The Shadow Economies of Cinema: Mapping Informal Film Distribution* (New York: Bloomsbury Publishing Inc., 2012)*, 4.

[220] Lawrence Liang, "Porous Legalities and Avenues of Participation," *Sarai Reader 2005: Bare Acts* (Delhi: The Sarai Programme CDDS, 2005);

Ramon Lobato, *The Shadow Economies of Cinema: Mapping Informal Film Distribution* (New York: Bloomsbury Publishing Inc., 2012);

Kavita Philip, "Keep on Copyin' in the Free World?," *Postcolonial Piracy*, 2014, pp. 149-178, https://doi.org/10.5040/9781472519450.ch-007..

[221] Martin Blaney, "'Piracy is the Most Successful Form of Distribution,' says Werner Herzog," *Screen Daily* (16 April 2019).

admission that places into relief the complex interaction between illegal file sharing, industry imperatives, and the creators of the media being distributed.

This reality deflates lazy claims that piracy reflects a one-to-one relationship with revenue. For example, while Statista.com predicts that piracy will cost TV and movie providers $52 billion in revenue worldwide in 2022, a study of piracy in Indonesia notes that while the number of Indonesians accessing illicit piracy websites fell 55% since 2019, only 16% of former "pirates" have shifted to formal paid distribution channels.[222] Predicting "lost revenue" assumes that all users of a file sharing network are financially and geographically positioned to access content through legitimate channels. Beyond that, it assumes that the content being accessed has an essential market value that all users find acceptable. A file sharer might be interested in viewing the latest episode of *The Mandalorian* for little to no financial investment but that very same sharer might find the concept of shelling out $10 per month USD for a Disney+ subscription to access the show a laughable proposition.

These lazy correlations also ignore the very volatile nature of the media industry more generally. As Sterne illustrates, media industries (like all industries) are prone to crisis. Before blaming digital file sharing for slipping revenue, the record industry was blaming "the failed promise of disco" and home taping in the 1970s.[223] Arguably, it makes more sense to look at the elevated sales of the record industry during the 1990s and early 2000s as an aberration owing to the "resale and repackaging of back catalogs" with the introduction and broadly popular appeal of CDs (a short-lived carrier).[224] The fact of the matter is, there is not a clear correlation between

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[222] K Oanh Ha and Claire Jiao, "Disney (DIS), Netflix (NFLX) Battle Piracy in Southeast Asia," Bloomberg.com (Bloomberg, March 3, 2021), https://www.bloomberg.com/news/articles/2021-03-03/disney-dis-netflix-nflx-battle-piracy-in-southeast-asia..

[223] Sterne, *MP3: The Meaning of a Format*, 185.

[224] Sterne, *MP3: The Meaning of a Format*, 185.

illegal file sharing and legitimate consumption of media. Nor is there a truly accurate means of predicting market volatility particularly in an industry that is constantly plagued by gaping holes in its geographical reach owing largely to the complexity of negotiating copyright on an international scale coupled with shoddy market analytics determining where to focus distribution efforts. Like Herzog's comment suggests, often illegal distribution channels become the only means of accessing a given media object in a given local and/or the only financially viable means particularly given the absurd rise in streaming services and their regular price increases.

It is also important to note that this relationship between formal and informal distribution networks is a dialectical one from a technological and market perspective. Informal file sharing prompts formal technological and market shifts which in turn incite new responses from informal networks. As chapter one illustrates, the introduction of Digital Versatile Discs marks an early example of this dialectic at work. In response to the legally green-lit use of time-shifting home video (which of course entailed bootlegging of copyrighted content), DVD was developed as a technology meant to draw consumers away from the easily copied format toward an opaque, carefully policed technology which, in theory, would be far more difficult to duplicate. Of course, the Content Scramble System put in place to prevent duplication was easily bypassed spawning the next wave of distribution technology intent on maintaining complete control over the content being accessed, namely over-the-top services.

While OTT is generally associated with Netflix, Hulu, Disney+, etc., its origins begin with failed services like Movielink, a joint venture between Sony Pictures Digital Entertainment, Warner Bros., Universal Pictures, Paramount Pictures, and Metro-Goldwyn-Mayer Inc. and CinemaNow Inc., owned by Lions Gate Entertainment.[225] More than just interesting services

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[225] Anna Wilde Matthews, "Hollywood Studios Launches Paid Service for Online Movies," *The Wall Street Journal* (11 Nov. 2002).

intended to offer viewers more convenient means of access, these services were birthed to counteract the growing file sharing communities cropping up in the wake of DVD decryption strategies becoming highly publicized. Movielink is a response to "the wide availability of free movies through peer-to-peer services."[226] By making a platform that offers "reliable technology, fast download times and helpful customer service," Movielink's CEO Jim Ramo hoped to stave off continued growth in movie piracy by appealing to "customers who are frustrated by the free services."[227]

The same trend has played out in the music world in which we see the media industry as largely a reactive force. Once it becomes clear that quashing file sharing through litigation is not viable, media industries opt to compete by offering, as Ramo suggests, "reliable technology." Often, such technology is first visible as a proof-of-concept through file sharing channels. The MP3 which represented the first viable trade-off between quality and file size for early Internet users, gained its status largely through early adopters like file sharing community The Internet Underground Music Archive founded in 1994 which allowed unsigned bands to post and share their music. IUMA made use of MP3 technology only after a hacker reverse engineered a command line program used as a sales tool for MP3 adoption called L3Enc.[228] Even as MP3 file sharing began to take off, rather than adopt competing platforms or technology, as Sterne notes, the first instinct was to try to make it stop through litigation. If the industry believes its own numbers, this strategy has largely been unsuccessful and yet, it took nearly a decade since the birth of IUMA for a viable paid alternative to arise via iTunes in 2001 and nearly two decades for a streaming audio service like Spotify to become a more "reliable technology" (re:

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[226] Matthews, "Hollywood Studios Launches Paid Service for Online Movies."
[227] Matthews, "Hollywood Studios Launches Paid Service for Online Movies."
[228] Sterne, *MP3: The Meaning of a Format*, 202.

superficially seamless) to usurp the ease and reliability of audio file sharing using BitTorrent, Gnutella, file-lockers, or other "illicit" technologies.

Although streaming services superficially extend access, or at the very least, present a more attractive option to users who might otherwise be enticed to share copyrighted files from their homes, the effects are often short-lived due to market maneuvers that drive many back to file sharing. While illegal file sharing trended down in all categories except Ebooks from 2012 to 2017, the numbers are once again on the rise arguably owing to an increase in streaming platforms coupled with annual price increases.[229] With a streaming environment now consisting of platforms like Netflix, Hulu, HBO, Disney+, Apple TV+, Paramount+, Discovery+, Peacock, CrunchyRoll, Shudder, Amazon Prime Video, YouTube Red, and the Criterion Channel to name a few, and many of those producing exclusive content, the costs associated with accessing premium streaming material is overtaking the costs of premium cable which led many users to cut the cord in the first place. The result is a reverse in the downward trend with BitTorrent use once again rising since late 2018.[230] It isn't difficult to see the effects of multiple premium streaming services on piracy play out in real time. HBO's massively popular original series *Game of Thrones* smashed illegal file sharing records in 2015 with a recorded 1.5 million illegal downloads in an eight-hour period.[231]

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[229] Ernesto Van Der Sar, "Ebook Piracy Grows, Contrary to the Trend," TorrentFreak., October 12, 2019, https://torrentfreak.com/ebook-piracy-grows-contrary-to-the-trend/.

[230] Karl Bode, "The Rise of Netflix Competitors Has Pushed Consumers Back toward Piracy," VICE, October 2, 2018, https://www.vice.com/en/article/d3q45v/bittorrent-usage-increases-netflix-streaming-sites; Brian Feldman, "Piracy Is Back," Intelligencer (Intelligencer, June 26, 2019), https://nymag.com/intelligencer/2019/06/piracy-is-back.html.

[231] Mikey O'Connell, "'Game of Thrones' Finale Breaks Piracy Record," The Hollywood Reporter (The Hollywood Reporter, June 10, 2013), https://www.hollywoodreporter.com/business/business-news/game-thrones-finale-breaks-piracy-565697/.

There is a fundamental push and pull between legitimate industry distribution practice and illegal file sharing networks, but this relationship is far more dialectical than antagonistic when analyzing results. Both approaches to access rely on technological and market developments instituted in response to changes made on the part of the other node in the dialectic. The mistake is assuming that either approach seamlessly operates without the other and/or bypasses the worst tendencies of its competitor. Of this relationship between "legitimate" and "illegitimate" distribution networks, Mueller notes:

> Pirates did not destroy intermediaries, but merely developed technologies that would, they hoped, replace obsolete intermediaries such as record labels and industry trade organizations such as the Motion Picture Association of America (MPAA). Instead, new commercial cybermediaries, such as Netflix and Spotify, have usurped this role, and many artists experience greater exploitation and less power than before the disruption of the music industry, and are still impelled to sign unfavorable recording contracts.[232]

Rather than lost corporate gains and artistic revenue the real negative consequences of this relationship between formal and informal distribution are felt most intensely in the archives.

Archives and File Sharing

The dialectic between "legitimate" and "illegal" distribution has nonetheless fed the myth and desire for easy, unlimited access to media content. Access has always been a central component of media preservation and archival practice, but the significance of its role has often been contested. Historically, the underlying tension between access and preservation shaped not only the discourse around archives but more importantly archival practice itself. It is easy to get lost in the weeds of lofty rhetoric and theoretical perturbations when it comes to discussing archival access. The frequent and often misused citations of both Derrida's "archive fever" and Foucault's archive as part of his archeology of knowledge tend to position archival access as first and foremost a question of power. A typical exchange then might end with unlimited archival access

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[232] Mueller, *Media Piracy in the Cultural Economy*, 120.

being the only equitable solution to a power differential based on the accumulation of knowledge. If the archive for Derrida is effectively understood as "*arkhe*"—or the "origin of power"—with an *archon* or magistrate overseeing access to the roots of this power, then it is easy to make the abstract leap from the archive as a theoretical locus of power to materially existing archives as spokes of power overseen by archivist magistrates of their own.[233] As Cook explains, "the archive" (singular) has progressively become the typical nomenclature when discussing cultural memory and the effect has been an erasure of "archives" and the "internal concepts and processes that animate actual archivists working inside real archives […] or the distinct body of professional ideas and practice those archivists follow."[234]

Similarly, Foucault's concept of the archive as fundamentally the entirety of the possible within a given episteme seems to equate possibility, itself a representation of power (i.e., some have far more possibilities available in a given episteme than others), with the "archive."[235] Of course, both Derrida and Foucault are speaking to the abstract origins and structuring forces of particular historical moments and psyches and are not directly concerned with the small film archive down the block whose decisions regarding access are materially conditioned by funding structure, preservation best practices, copyright limitations, and shifting clientele. Ruminating on the relationship between knowledge and power is important but it will not halt the spread of vinegar syndrome or fix a corrupted hard drive. Nor does it adequately take into account what Cook considers to be the four core archival functions: appraisal and acquisition; arrangement, processing, and description; preservation; and public programming."[236] Furthermore, these

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[233] Jacques Derrida, *Archive Fever: A Freudian Impression* (Chicago: The University of Chicago Press, 1995), 2.
[234] Terry Cook, "The Archive(s) Is a Foreign Country: Historians, Archivists, and the Changing Archival Landscape," *The American Archivist* 74, no. 2 (January 2011): pp. 600-632, https://doi.org/10.17723/aarc.74.2.xm04573740262424, 601.
[235] Michel Foucault, *The Archaeology of Knowledge* (London: Routledge Classics, 2002), 145.
[236] Cook, "The Archive(s) Is a Foreign Country, 602.

generalizations of "the archive" do little to address the technological and economic challenges facing working archives.

Beyond archival theory, however, the question of access and preservation has embedded itself in the discourse of archival practice but less as a means of negotiating power and more as a practical debate around archival best practices. In the world of film preservation, two titans of archival practice served as the representatives of both sides of this access versus preservation debate. In the corner of access, we have famed Cinematheque Francaise founder Henri Langlois. Langlois was not only invested in saving films but in ensuring that they came to serve their intended purpose, namely being screened for audiences. Preservation for Langlois was always in service of ensuring accessibility over time rather than ensuring the preservation of the cinematic artifact for its own sake. Langlois, like so many contemporary cinephiles, was also a pirate, scrounging, bartering for, and sometimes stealing copies of films to ensure their longevity (a necessary practice particularly with the Nazi party laying waste to countless films during Langlois's early years of preservation during WWII).[237] His love of cinema drove his mission to preserve *and* share it.

In the other corner we have Ernest Lindgren, founding curator of the United Kingdom's National Film and Television Archive. For Lindgren, who witnessed the early years of the film industry and the studios' complete disregard for maintaining prints after initial screenings, preservation was necessary not to supplement the already saturated market of access but rather to ensure a historical record for future study. Lindgren's archival policy made the extent of this desire to preserve quite clear:

No preservation film is projected in any circumstances, even within the Archive's own

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[237] Penelope Houston, *Keepers of the Frame: The Film Archives* (London: British Film Institute, 1994), 4.

premises. The film is there as a master copy, and as such it is inviolable. In thirty years no-one has substantiated any complaint of the misuse of a film, and we have never yet lost a single one.[238]

The debate is of course fraught and not easily resolvable particularly when it comes to analog film. It is true that access necessarily degrades film stock and repeat access or, more frighteningly, incorrect usage exacerbates scratches and other forms of degradation. The International Federation of Film Archives' (FIAF) own "Code of Ethics" makes Lindgren's focus on preservation over access a central goal. Article 1.2 states, "Archives will not sacrifice the long-term survival of materials in their care in the interests of short-term exploitation. They will deny access rather than expose unique or master materials to the risks of projection or viewing if the materials are thereby endangered."[239] On the other hand, as Leo Enticknap notes of Langlois, he perhaps presciently recognized that "the funding and the will to carry out preservation work could only be secured by generating interest in film heritage" which, by extension, meant reminding tax payers and financiers of the value in the artifact being preserved.[240] In the case of film, this necessarily means access. Increasingly, this debate is shaped by shifts in exhibition and broader market practices which, regardless of want, archives are not immune to.

In *From Grain to Pixel: The Archival Life of Film in Transition* Fossati reminds us that the archival field is not an autonomous body but rather part of a larger network that includes "film archives, the commercial film industry, politicians and policy makers, hardware and software manufacturers, film labs, and archival film audiences."[241] Understanding this ecology

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[238] Ernest Lindgren qtd. In Ivan Butler, *To Encourage the Art of the Film: The Story of the British Film Institute* (London: Robert Hale, 1971), 72.
[239] "1. The Rights of Collections," *FIAF Code of Ethics,* https://www.fiafnet.org/pages/Community/Code-Of-Ethics.html.
[240] Leo Enticknap, "Have Digital Technologies Reopened the Lindgren/Langlois Debate?," *Spectator* 27, no. 1 (2007), 13..
[241] Giovanna Fossati, *From Grain to Pixel: The Archival Life of Film in Transition* (Amsterdam: Amsterdam University Press, 2009), 151.

allows us to better recognize the pressures faced by existent film archives beyond simply

conserving and preserving content regardless of FIAF's code of ethics. Discussing the material

difficulties faced by publicly funded film archives specifically, Sabine Lenk argues that

consistently shrinking budgets lead public-facing archives to hold frequent screenings to recoup

costs and keep up with growing budgetary demands. In an effort to meet the expectations of an

audience now conditioned by engagement with pristine digital, on demand, content, these

archives typically do not screen damaged or imperfect prints so as not to dissuade a broader

paying public from attending. The effect of these "publicly funded archives that systematically

omit 'problematic' prints from their programs" is inquiry by "increasingly budget-sensitive

municipal or government benefactors" as to why this unused analog material should be kept at

all?[242] The pressure of putting the archive to work as a means of satisfying financial backers and

justifying the use of taxpayer dollars places an additional burden on traditional film archives

initiated from forces outside the archive itself yet nonetheless influencing decision making about

content preservation and conservation internally.

Alexander Horwath's controversial statement at the 61st FIAF Congress prefigured this

reality. Horwath argued that "digital rhetoric" has increasingly infiltrated archival practice such

that the role of archives (and museums) is now largely understood as an appendage of the market

rather than "a critical, ethical, and political tool, which stands in direct opposition to whatever

social mood or climate or ideology is hegemonic at a given time."[243] The need to essentially

compete with streaming platforms to prove legitimacy is one very unfortunate side effect of this

adoption of language. For Horwath, three terms are representative of this shift (or shift to come),

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[242] Sabine Lenk, "Archives and Their Film Collection in a Digital World; or, What Futures for the Analog Print?," *The Moving Image: The Journal of the Association of Moving Image Archivists* 14, no. 2 (2014): https://doi.org/10.5749/movingimage.14.2.0100, 106.
[243] Alexander Horwath, "The Market vs. The Museum," *Journal of Film Preservation*, no. 70 (2005).

namely "content," "access," and "user." The word play which moves us from "artifacts" to "content" serves to veil the materiality of the artifact being preserved and likens the material to the "free flow of content" which is inseparable from the "free flow of capital."[244] This seamless flow decontextualizes the artifact and erases both the critical ongoing work of preservation as well as the often-unique existence of a given artifact.

Similarly, the words "access" and "user"—key buzzwords of digital streaming platforms and digital culture more broadly seeping into archival and museum parlance—create the conditions for a "user-driven" approach to the archive and museum erasing the fact that curatorial practice is an "active and poetic process."[245] Despite ongoing critiques about the politics of curatorial practice, Horwath insists that it is precisely this hands-on, active role taken by archivists that gives archives their importance. At a moment when culturally insensitive, racist, homophobic, and sexist content is being removed from commercial circulation, the role of the museum and of the archive, to retain visible versions of disputed content is critical precisely as an enduring reminder of the ways in which artifacts serve as the conditions of larger cultural debates. Void of curatorial positioning, a racist film is a racist film. In a larger, carefully crafted context, that same film might serve less as a perceived, dismiss-able, cultural aberration and corporate blemish than a window onto more uniform structures of feeling during a given historical moment which is far more valuable for educating audiences and rectifying injustices.

Whether bowing to the pressures of digital rhetoric as Horwath would assert or embracing the affordances of digital media to further the visions of Langlois, archives have nevertheless adopted more commercial approaches to digital access to some extent with a particular up-tick during the pandemic. The International Federation of Film Archives'

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[244] Horwath, "The Market vs. The Museum," 7.
[245] Horwath, "The Market vs. The Museum," 7.

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"Programming and Access to Collections Commission" has even gone so far as to establish a database of affiliate archives who have visible online presences and on demand content. These affiliate archives' approaches range from the no-frills YouTube channel of Film Archive Thailand to the Netflix-like "Eye Film Player" of the Netherlands' Eye Film Museum.

Regardless of the approach, the need for more public facing content driven by the "ease of access" promised by the rhetoric of digital apostles (from Barnow to Bezos, The Pirate Bay to Netflix, etc.) leaves archives embroiled in new struggles over preservation and access:

> While the new online video sites have little in common with classical moving image archives and do not seek to force their forebears out of business, they deliver many millions of digital objects every day to millions of dispersed patrons. These new sites lead to a public misperception about what archives ought to be doing and what they actually do. This may mean that fewer younger scholars and media makers look to established archives for research and production. It is also likely to cause some archives to retrench, to become more closed to newer kinds of access and use (as a way of differentiating from online parvenus).[246]

Overall, the digital rhetoric which promises quick, easy access to an endless stream of content is the antithesis of good archival work. Often slow, careful, expensive, discerning, and focused on the material base of the artifact being preserved, archivists are nevertheless confronted with increasing pressure to render their services more visible to a digital audience. A survey of 21 working archives by the Academy of Motion Picture Arts and Sciences found that the majority of these archives have shifted toward digital preservation in response to a desire to "provide digital access to their holdings," driven primarily by user and donor requests.[247] In large part, this is driven by the enduring promise of internet freedoms we can trace from Barlow through De Kosnik. Streaming services, public torrent trackers, and content platforms like YouTube all feed into a popular delusion that Kristin Thompson refers to as "The Celestial

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[246] Rick Prelinger, "Archives and Access in the 21st Century," *Cinema Journal* 46.3 (Spring 2007), 116.
[247] "The Digital Dilemma 2," *The Academy of Motion Picture Arts and Sciences,"* (2012), 49.

Multiplex."[248] A media specific revision of the Celestial Jukebox, imagines a future where all films are easily accessible at the click of a button. Thompson is rightly skeptical about such a possibility and cites the lack of a coordinating body and capital, shifting technological standards, and legal difficulties as key detriments to the realization of the celestial multiplex but the idea has nonetheless remained a significant force in the popular psyche. As Cook notes, this dream shapes the ways in which archives operate for better or worse creating a "rush to standardization, digitization, and outreach programs stressing numbers of 'hits' and clients rather than substance."[249]

Even as myriad archives shift to a more visible online presence, the celestial multiplex is nowhere near a reality. Currently, the majority of FIAF affiliate streaming activities "focus on less-known, out-of-copyright works, with an emphasis on early cinema and films of local/regional interest, as well as so-called 'ephemeral' film forms, with playlists, collections, and even entire platforms devoted to amateur films and home movies, newsreels, advertisements, trailers, outtakes and screen tests, and student films."[250] Some of the limitations are quite obvious, to start, half of U.S. films made before 1950 have been lost and upwards of 90 percent of those made before 1929.[251] This just represents the United States, the numbers are even more staggering for countries with more hot and humid climes or those that have had their archives suffer at the hands of various political regimes.

Beyond the obvious factor of out-right absence of content, there is the exorbitant cost of digitization and long-term storage that cash-strapped archives must grapple with. Despite the

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[248] Kristin Thompson, "The Celestial Multiplex," *Observations on Film Art* (27 March 2007), http://www.davidbordwell.net/blog/2007/03/27/the-celestial-multiplex/ .

[249] Cook, "The Archive(s) Is a Foreign Country," 605.

[250] Oliver Hanley, "The Best Seat in the House? Observations on Online Viewing and Access to FIAF Affiliates' Collections," *Journal of Film Preservation* Vol. 104 (April 2021), 92-93.

[251] Marty Perlmutter, "The Lost Picture Show: Hollywood Archivists Can't Outpace Obsolescence," *IEEE Spectrum* (28 April 2017).

embrace of digital preservation, only 3 of the 21 archives surveyed by The Academy of Motion Picture Arts and Sciences for their *Digital Dilemma 2* publication "implemented some level of digital preservation or curation policies."[252] The archives actively digitizing and preserving digital content who do not yet have digital preservation policies in place cited lack of funding, lack of technical infrastructure, lack of trained staff, and lack of institutional support as key detriments.[253] These realities illustrate the difficulty in maintaining digital content even as popular sentiment and shifting technical considerations propel archives toward embracing digitization. Although Lobster Films' approximately half-million euro restoration and digitization of Georges Méliès's *Le Voyage Dans La Lune* is an extreme example of such expenses, the up-front costs of digitizing an analog film still carry well into the thousands. More difficult to grapple with are the long-term costs of preserving digital video, whether natively digital or digitized content. Whereas analog film archives often followed the "do no harm" approach to conservation (often termed "store and ignore"), digital content offers far greater complexity. The Association for Library Collections and Technical Services defines digital preservation as a combination of "policies, strategies and actions to ensure access to reformatted and born digital content regardless of the challenges of media failure and technological change. The goal of digital preservation is the accurate rendering of authenticated content over time."[254]

The costs of ensuring "accurate rendering" over time in an era built on rapid technological change with myriad file formats, codecs, resolutions, color spaces, etc. to choose from are astounding. While archivists have, by and large, moved away from storing digital content on hard drives due to their instability, the new storage medium of choice Linear Tape

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[252] "The Digital Dilemma 2," *The Academy of Motion Picture Arts and Sciences,"* (2012), 54.
[253] "The Digital Dilemma 2," 55.
[254] "Definitions of Digital Preservation," *ALCTS Preservation and Reformatting Section Committee Working Group on Defining Digital Preservation* (24 June 2007).

Open (LTO), poses its own set of problems. LTO, a magnetic tape storage solution for computer data that, theoretically, has a shelf life of approximately 50 years, has already seen nine generations in 22 years of its existence. Each new generation offers increasing storage space but, like much of our digital technology, is limited in its backwards compatibility to a mere two generations, with the second generation serving in a "read only" capacity.[255] Vice president of global media archives and preservation services for Warner Bros., Steven Anastasi has suggested that the practical shelf-life of LTO is closer to seven years given its limited backwards compatibility.[256]

What this means for working archives is increasingly necessary large expenses to migrate "archived" content from one iteration of LTO to the next. With a single LTO cartridge costing approximately $115, a large archive that needs 50,000 cartridges would need to spend approximately $5.45 million on media migration with each second new generation of LTO. This price does not include the cost of an autoloader needed to operate LTO drives at scale. All told, estimates to store a single feature film following proper protocols run to about $20,000 per year. A hefty sum particularly when considering the cash limitations of non-profit archives in particular.

Another massive impediment for the dream of the celestial multiplex is that of copyright. Every user of streaming services recognizes that not all films are available at all times. That said, the rhetoric of the digital, which promises a kind of flattening of global markets (McLuhan's "global village" comes to mind), has contradictorily shed light on the politics and messiness of "seamless" content delivery. Take, for example, the issue of geo-blocking in which content licensed for distribution in one national market is off limits in another national context. While it

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[255] "Roadmap," Ultrium LTO, September 6, 2022, https://www.lto.org/roadmap.
[256] Steven Anastasi quoted in Marty Perlmutter, "The Lost Picture Show.".

is easier to imagine drastic differences in access between two very different economies and cultures, the discrepancy of access is quite pronounced even within closely knit blocs like the European Union. Users familiar with the Netflix Global Search platform uNoGS—a tool allowing users to search by title to reveal in what countries particular films are streaming on Netflix—are no doubt familiar with the drastic differences in content availability. As uNoGS makes clear through its visual results, these differences are quite pronounced [fig. 2.2]. Officially, a November of 2020 short-term review of geo-blocking by the European Commission noted that, on average, a European consumer has access to only 14% of the films available online in the EU-27 with the average user from Greece having access to only 1.3% of films available online in the EU.[257]
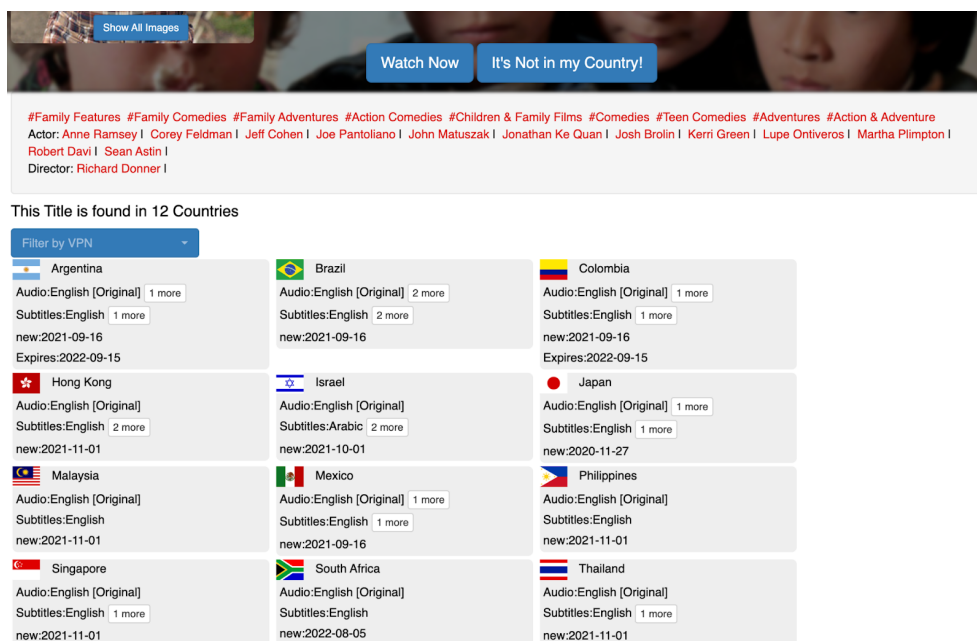

Figure 2.2: uNoGS search results for *The Goonies* (Richard Donner, 1985)[258]

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[257] "Commission publishes its short-term review of the Geo-blocking Regulation," *European Commision* (30 November 2020), https://web.archive.org/web/20210120134149/https://ec.europa.eu/digital-single-market/en/news/commission-publishes-its-short-term-review-geo-blocking-regulation.
[258] "Welcome to Unogs!," Netflix Global Search on uNoGS, accessed October 16, 2022, https://unogs.com/.

While commercial markets continue to clamp down on VPN use as a means of skirting geo-blocking, archives struggle under an even more onerous copyright regime which limits the possibility of access even as digital access becomes more and more of a priority.[259] In *The Greatest Films Never Seen: The Film Archive and the Copyright Smokescreen*, Claudy Op Den Kamp reminds us that simply "owning" the physical medium does not, in any way, imply ownership of the copyright.[260] Works overseen by film archives often fall into one of four categories: 1. The archive owns the rights (rare); 2. Nobody owns the rights; 3. A third party (known or unknown) owns the rights. 4. Nobody owns the rights, but the material is behind institutional layers (digital access is policed for business reasons). A film like *Letty Lynton* is a more cut and dried example of how copyright affects legal access but, just as problematic are orphan works, or works with an unknown third party rights holder.[261] Because of the potential uncertainty around provenance/ownership/copyright or the outright difficulty in negotiating rights to make content public, Op Den Kamp notes, "the works that are most frequently made public are the ones that are easiest to digitize—that is, works that (aside from restoration issues) have a secure legal provenance."[262] To be sure, even the aforementioned EYE's impressive Netflix-esque interface hides the fact that it holds the rights to less than 5% of its collection and, in effect, its digital offerings are far from complete.

The limitations imposed on archives butts up against the new imperatives to make "content accessible" for the average "user." Like Horwath's warnings regarding the rhetoric of digital, Ray Edmondson stresses how archives continue to shift in light of current cultural and

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[259] Ramon Lobato, *Netflix Nations: The Geography of Digital Distribution* (New York: NYU Press, 2019) loc. 2334-2366 kindle edition.
[260] Claudy Op Den Kamp, *The Greatest Films Never Seen: The Film Archive and the Copyright Smokescreen* (Amsterdam: Amsterdam University Press, 2018), 26.
[261] Op Den Kamp, *The Greatest Films Never Seen*, 45.
[262] Op Den Kamp, *The Greatest Films Never Seen*, 25.

market demands, "The provision of access, in its many analogue and digital forms, is the visible evidence—and often political justification—of publicly-funded audiovisual archiving."[263] With the drive for visible and accessible content rapidly becoming a key concern along with the increasingly unsustainable price of digital preservation, the curatorial process becomes even more fraught:

> Pressure on archives to generate revenue, to be conscious of their image, and to introduce 'user pays' strategies are signs of an age in which heritage preservation seems increasingly expected to pay its own way. The fashions and dictates of the marketplace add ethical and managerial challenges. Taking into consideration the 'use value' of the collection is a component of developing a sustainable vision.[264]

Beyond the pressures this imposes on archives, the net results no doubt ripple through culture in ways that are far less easily quantifiable. Cook reminds us that perhaps the most significant act of determining historical meaning "occurs not when the historian opens the box, but when the archivist fills the box, and, by implication, through a process of archival appraisal, destroys the other 98 or 99 percent of records that do not get into that or any other archival box."[265] In the case of films of uncertain provenance, independent cinema, less financially successful/market worthy films, and less aesthetically appealing content, archives are less inclined to retain such material. Even large, studio archives like the USC run Warner Bros., Archive flags content as "manage"—that is, preserve for the long term—and "perishable"—material that will not be migrated. These decisions are based on "how successful the film has been, how popular its stars are, and whether the film could have enduring (or cult) appeal."[266] Smaller public archives like EYE rely on staff members to "make a decision on what

[263] Ray Edmondson, *Audiovisual Archiving: Philosophy and Principles* (Paris: United Nations Educational, Scientific and Cultural Organization, 2016), 5.
[264] Edmondson, *Audiovisual Archiving*, 5.
[265] Cook, "The Archive(s) Is a Foreign Country," 613.
[266] Perlmutter, "The Lost Picture Show"

to preserve based on their own tastes and personal insights."[267] Both archives function on opposite ends of the spectrum (private studio archive, public archive) but both face material limitations and have found ways of culling their collections to survive.

Expanding on this reality of curation and appraisal, Caroline Frick notes that publicly funded archives are routinely bound by the national politics of the day. In "Repatriating American Film Heritage or Heritage Hoarding? Digital Opportunities for Traditional Film Archive Policy," Frick argues that film archives maintained by The Museum of Modern Art, the US Library of Congress, and the New Zealand Film archive, to name only a few, are commonly caught up in media repatriation practice as a means of building cultural capital that, contradictorily, rarely results in exhibition or open availability of the obtained repatriated content. What is at stake in this process of returning and exchanging nationally specific heritage content is a necessary reduction and circumscription of what content might conceivably appear in specific archives ultimately based on value assumptions regarding what content best speaks to and for specific archives.[268]

Gaps in archival holdings (and in the celestial multiplex) are even more pronounced when considering independent productions which make up, on average, approximately three quarters of annual production output.[269] Already often struggling with limited funds, many independent productions result in little to no guaranteed and prolonged afterlife beyond their initial (often limited) theatrical, film festival and/or streaming rounds. In its 2012 survey, The Academy of Motion Picture Arts and Sciences found that 82 percent of respondents stored their

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[267] Op Den Kamp, *The Greatest Films Never Seen*," 39.
[268] Caroline Frick, "Repatriating American Film Heritage or Heritage Hoarding? Digital Opportunities for Traditional Film Archive Policy," *Convergence: The International Journal of Research into New Media Technologies* 21, no. 1 (September 2014): pp. 116-131, https://doi.org/10.1177/1354856514560999.
[269] "The Digital Dilemma 2," 9.

masters on hard drives with only 8 percent reporting regular migration of the content. Over 60 percent of respondents reported never migrating at all with over half of those respondents stating that they had not given much thought to the process.[270] Approximately one decade later, and the outlook remains rather bleak. In my own brief survey, the majority of the filmmakers questioned upload their masters to a cloud storage service like Google Drive while (some) retain a local hard drive of the master as a redundant copy. Still others have cited that their distributor retains the master on their servers, but they remain (justifiably) suspicious of the long-term viability of that solution. Both studies illustrate that long term preservation of audiovisual artifacts deemed significant enough for preservation by brick-and-mortar archives and content that does not find its way into those collections are equally at risk in a user-focused digital era still stoking the myth of the celestial marketplace.

Karagarga

As institutional film archives increasingly turn toward digitization practices, the stakes of BitTorrent trackers become increasingly clear. As a means of reducing overhead; incorporating unproblematic, digitally accessible material to increase funding; and working against the rapid decay of celluloid and polyester prints, film archives enact a double selection process. The initial curation of the archive (i.e., what content is worth saving) is reenacted as "what content is worth digitizing and migrating?" Furthermore, the very process of digitization as a means of expanding the life of archived material ignores the inherent ephemerality of digital media itself. From obscured material components (hard drives, server farms, computational power, etc.) all prone to failure, to LTO's forced, generational obsolescence, to the immaterial shifts in format and file type which could render older formats unreadable, lasting preservation of digital files is anything but certain.

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[270] "The Digital Dilemma 2," 16.

Rather than rely on vague general accounts of file sharing networks as supplemental

archives or imagining a post-catastrophe world where pirate archivists save our cultural heritage,

looking at the private BitTorrent tracker Karagarga and its functionality offers a more direct

means of analyzing the ways in which file sharing networks can offer more than easy ephemeral

access and can serve as viable supplements to the *enduring catastrophe* of digital preservation.

Instead of simply challenging intellectual property right claims like many "pirate" sites,

Karagarga shares more similarities with institutional archives than radical peer-to-peer networks

intent on sharing any and all content and offers a feasible solution to some of the most limiting

restrictions placed on brick-and-mortar archives. As an invite only tracker, Karagarga restricts its

user-base, carefully monitoring the "seeding/leeching" of each member to ensure that its users

are dedicated to assisting in the maintenance of the archive itself. Furthermore, whereas most

torrent trackers do not limit the quality or type of files made available, Karagarga follows strict

upload policies ensuring that all seeded films meet specific quality standards. These

specifications include ensuring that appropriate bitrates are utilized during the encoding process

to achieve optimal visual and aural clarity without adding unnecessarily to file size, checking the

frame rate against the original source material, decombing content to mitigate potential

interlacing, and properly encoding with the correct source aspect ratio in mind.[271] Such policing

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[271] *Bruno321*, "Quality control before uploading a new torrent," *Karagarga* (1 March 2022),
https://forum.karagarga.in/index.php?showtopic=42346.
See below for a short excerpt on quality specifications posted to the Karagarga rules forum:
Make sure your upload follows the rules. Some things very often gotten wrong:
- for DVD encodes, check the encoding settings (no me=hex, subme=2, format profile: Main, for
example) and make sure it's anamorphic (the "display aspect ratio" line in mediainfo cannot
equal the Width divided by the Height). Make sure you didn't include the same audio channel
several times. If there are several, distinct audio channels, you should clearly label them (with
mkvtoolnix) and they should fall within the rules. PCM audio is not allowed, it should be
transcoded.

tactics result in a dedicated user-base of cinephiles primarily working in the film industry or academia, which becomes clear in the forums, comments, and structuring of the Karagarga website itself that includes monthly curated lists ("Masters of the Month") often highlighting obscure or forgotten content.

Beyond its similarities with formal archives, the underlying structure of Karagarga is strongly suited to address the difficulties of digital preservation and effectively archives both digital content and the metadata that shows a social dynamic around that content. The distributed model of torrent trackers means that files are not stored on a central server but rather broken up and spread between a broad user-base. Such a model offers a potential solution to the dangers inherent in a centralized archive in which material failure could result in analog and digital loss. By decentralizing the archive, Karagarga not only offers a means of solving the problems of digitally maintained content but, furthermore, outsources the burden of storage space and the process of curation allowing for an expanded archive that includes a broader array of material that might otherwise be deemed unworthy of saving by an archive with limited space and resources.

As a BitTorrent tracker, Karagarga operates in the gray market. Karagarga is a private tracker, meaning its content is only available to invited members of the community rather than the public at large, and yet, the majority of the content being shared through the site's facilitation is in direct violation of copyright laws. As such, tracing a clean history of the tracker is difficult

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- for blu-ray encodes, too high or too low bitrate, or DTS-HD, aka DTS-XLL audio. Stereo DTS audio is allowed but a waste of space -- convert it with qaac -v 109 or AC3 224kbps, for example.

- for WEB-sourced files, if your original file was an MP4, you should remux it to mkv using mkvtoolnix. Categorically do not use Handbrake for this. For youtube-sourced files, make sure to get the h264 and AAC audio streams, not the VP9 video and Opus audio. Those codecs are generally not allowed.

if not impossible and presents an ethical conundrum for this study which is invested in

Karagarga as an archival site. To what extent does revealing the figures behind Karagarga

compromise its ability to function as an archive? This question of course points to the possible

vulnerabilities of Karagarga. Closed elective communities like Karagarga rely on anonymity,

standards of reciprocity, and shared service to operate effectively. The size and scope of

Karagarga's user base allows for its continued operation, but more importantly, its users'

adherence to these shared community standards allows for it to function effectively. As such,

even to participant observers, constructing a cohesive history is if not impossible, ill advised. As

a means of working through this ethical predicament as well as coming to terms with the dearth

of accessible documented history about Karagarga, it is perhaps best to first take Karagarga on

its own terms by way of analyzing the "Karagarga Manifesto" while also taking into

consideration the actual functionality and processes of the site itself.

In the first iteration of the "Karagarga Manifesto " posted directly on the Karagarga

website in 2007, the explicit aim of the site according to its organizer(s) is to "be more than just a

regular BitTorrent tracker for movies. We are an exclusive private file sharing community

focused on creating a comprehensive library of Arthouse, Cult, Classic, Experimental and rare

movies from all over the world."[272] In order to accomplish this aim, the manifesto continues by

laying out particular rules and regulations:

> Do not allow Hollywood/Bollywood mainstream [films to be uploaded] …. Build a
> library by never deleting movie torrents and making reseeds as easy as possible….
> Provide extensive information on each movie torrent…. Emphasize rip quality and
> completeness of extra material…. Promote broadening cinematic knowledge through
> Master of the Month (MoM) program and movie collections…. Allow users to request
> specific movies they have been looking for…. Encourage the custom creation and

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[272] "The Karagarga Manifesto," Karagarga, February 20, 2007,
https://karagarga.in/manifesto.php.

translation of subtitles for rare movies.[273]

Along with these foundational rules and regulations, Karagarga places strict limitations on the amount of material accessible to a given user. Building from more general BitTorrent etiquette, a 1:1 "seed ratio" must be maintained to avoid account cancellation. For every film downloaded (leeched) a user must upload (seed) an equivalent amount of data. This strict ratio ensures that users are not merely leeching content but rather continue to make content available which necessarily ensures the life of the content itself.

While the manifesto and seed ratio regulations might seem strict, the difficulty in maintaining seed ratio in particular is fundamentally what ensures the continued availability of content regardless of its popularity. To better understand this essential feature a brief diversion into the networked infrastructure of BitTorrent in general is necessary. Karagarga, like other BitTorrent trackers, is not a centralized archive housing or hosting the actual films themselves but rather a node in a larger decentralized network. A revised Karagarga Manifesto posted in 2019 expands on site's role as more than just as torrent tracker promoting free access to content. Referencing its operation, the revised manifesto states, "The collection benefits from exchange and circulation. Its digital artifacts do not deteriorate through usage. Rather, through proliferation and dissemination of the material we gain a (modest) measure of data preservation. KG is not the archive, KG is the catalogue. The collection itself is circulating among the peers."[274]

Hosting the .torrent files, Karagarga simply serves as the means of establishing connections between disparate computers in a global network at the moment of a requested download. As the manifesto states, Karagarga is not *the archive*, but rather fosters what the site's moderators conceive of as a circulating "municipal library [...] research library [...] and archive"

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[273] "The KaraGarga Manifesto."
[274] "The Karagarga Manifesto," Karagarga, 2019, https://karagarga.in/manifesto.php.

that resides among peers hosting and sharing content.[275] Accessing the material Karagarga

indexes on its site would include a user downloading a .torrent file for a specific film from

Karagarga. Once this file is opened in a local torrent client on the user's computer, it initiates a

connection to multiple computers all individually hosting the film on private computers or

servers. An ephemeral "swarm" is established, meaning a micro network of disparate computers

all feed a fraction of the film data to the leeching computer leading to a relatively quick

download compared to typical client-server connections. Presumably, the user will in turn

continue to "seed" the newly downloaded film adding their own computational power to future

swarms generated around that particular film. With this framework in mind, the importance of

individual user participation is clear. If, for example, a film has no seeders, then the existence of

a .torrent file is irrelevant, and the film is essentially (at least temporarily) lost.[276]

  To combat the possibility of unpopular films simply disappearing due to the private

network of users deleting or failing to seed them, Karagarga's strict seed ratio is made more

feasible due to the implementation of an ever-changing "featured" section updated by the site's

moderator(s). Serving as a way to build ratio while simultaneously highlighting films that might

likely be overlooked, these temporary "featured" films do not count toward the leech end of the

ratio yet still count as seeded content. Featured content incentivizes users to download and seed

material that might be less appealing to the broader Karagarga base. A similar incentivization

strategy exists through the use of curated "Masters of the Month" lists. Proposed monthly on the

Karagarga forum by moderators and subsequently voted on and curated by users, Masters of the

Month lists include a series of films based on topics ranging from national cinemas (e.g.,

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[275] "The KaraGarga Manifesto."

[276] Karagarga allows users to submit a "reseed request" if a film is not currently being seeded. This request leads to an automated message sent to the most recent seeders of the requested film usually resulting in the reseeding of the content. This system allows users to limit the amount of content they continuously seed so as to reduce bandwidth demands at the user level.

Indigenous and Latin American Female Film Makers) to specific directors (e.g., Jonas Mekas), to abstract topics (e.g., Poets & Poetry in Film). These films temporarily include "seed bonuses" allowing users another means of increasing seed ratio while hosting content that might not immediately appeal to their interests. It should be noted that these incentivization strategies are certainly useful but taking into consideration the user-base itself allows for a better understanding of how seed ratios are maintained and how films remain available through the tracker.

Relying on limited "invites" extended to users who have maintained a high seed ratio for an extended period of time, Karagarga simultaneously functions as a closed community yet allows for a level of user-initiated vetting. Each user (who remains anonymous other than a visible selected username), is linked to the user who sent the invitation resulting in a level of intimate interpersonal and intrapersonal policing and careful selection so as not to damage the reputation of the user offering the invitation. The conjunction of ratio policing and user invites helps maintain a devoted pool of amateur archivists who are, not unproblematically, disciplined in such a way as to feel responsible for the preservation of the content in the archive itself. While popular torrent indexes and trackers like The Pirate Bay remain anonymous and unpoliced, the varying degree of content availability, quality, and retention, not to mention the malware infested torrents that these sites unknowingly host, make them impossible sites for long-term distributed archives. The strategies undertaken by Karagarga's moderators to encourage seeding and preserving content ultimately helps productively filter the content on the site itself and breeds an active community heavily invested in the content it circulates and preserves. One need only scan the user forum or read the comments attached to film pages to gain an understanding of the level

of investment many users feel to cinema and Karagarga more specifically as an archive of often
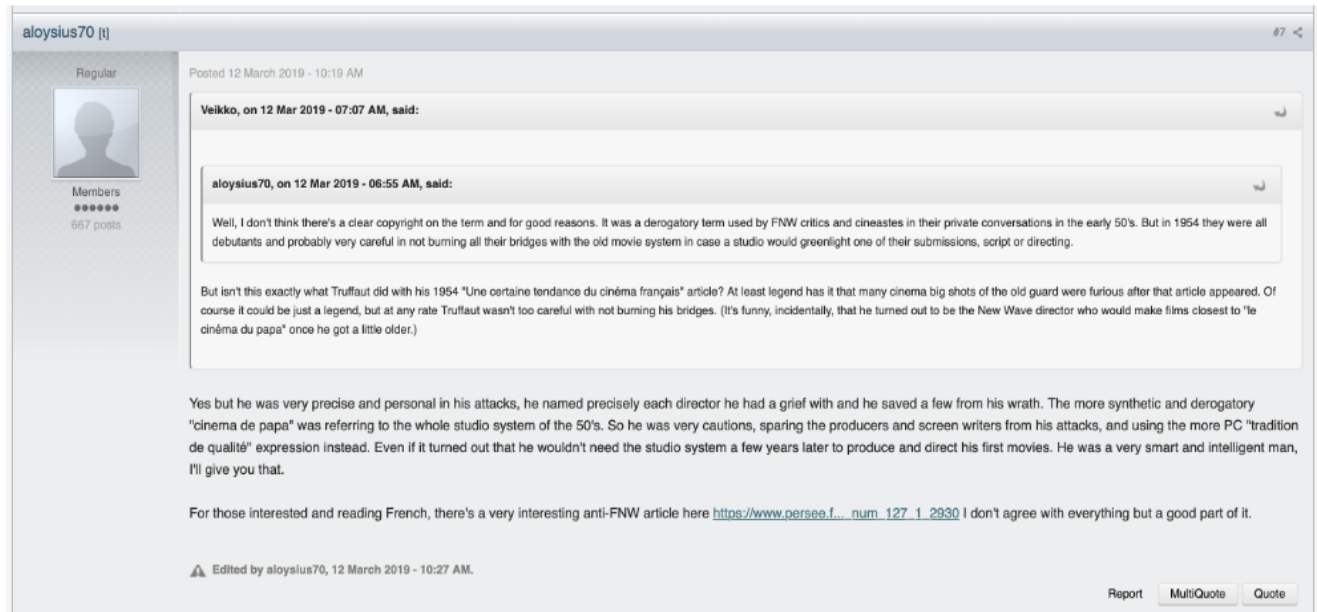
hard to find content [figure 2.3].

Figure 2.3: A small example of the kinds of analysis, debate, and "amateur" knowledge production carried out in the forums on par with academic scholarship around cinema and its history.[277]

Although Karagarga's policies generate a kind of self-policing in order to perpetuate

seeding and preserve content, the archive is not beholden to a larger state or market force. The

modest limitations placed on users of Karagarga still allow for the relatively free circulation of

content spread to a fairly broad user-base with the allowance of further spill beyond the bounds

of the archive itself (as each user becomes the holder of the content in this distributed model), in

contrast to the constraints imposed on physical archives by state actors and market incentives.

Deriding the problematic and limiting nature of certain film archives invested in self-imposed

draconian appraisal and curatorial practices, Frick stresses the importance of *copies* as opposed

to the fetishization of preserving "original carriers" (i.e., the film stock itself). Frick suggests,

"the more copies that are shared, the more likely the film to be used, studied, enjoyed, and even

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[277] "Karagarga Forum," KG Forums, accessed October 16, 2022, https://forum.karagarga.in/index.php?act=idx.

preserved."[278] The importance of copies nicely ties Karagarga's own reliance on copies (and seeding practices) to what Frick argues should be a central goal of archival practice more generally, that is, to make use of the archived content by allowing it to reach the largest audience possible, a goal often impossible to achieve in "legitimate" archives due to funding limitations and copyright challenges.

Arguably more significant than the generation of copies and the slightly more democratized functionality of the archive offered through gray market approaches, Karagarga presents a potential solution to preservation challenges posed to traditional film archives by increasing digital practices. As cinematic production shifts from analog to digital, cinema archives are faced with the necessity of adapting to the demands of the medium it seeks to preserve. This adaptation to larger market and industry forces positions contemporary film archives in a tenuous position with Fossati noting, "In the middle of the technological transition, with a sense of the direction (towards the digital) but with no real sense of direction, we have a unique (and uniquely limited) point of view."[279] A key concern for Fossati and other film archivists is the uncertainty around the stability of digital carriers (i.e., the storage medium itself). While properly maintained celluloid or polyester film (traditional analog carriers) can reasonably be expected to survive for approximately 100 years, digital carriers like hard disks and digital tapes face uncertain futures. Digital carrier stability is dubious on the one hand due to its relative youth compared to a more established medium like celluloid, and, on the other, due to the ever-changing nature of the infrastructure undergirding digital data. Rapidly shifting digitization practices, technology, and platforms leading to changing standards regarding things like compression algorithms, bit depth, and resolution, not only make for a fractured digital

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[278] Frick, "Repatriating American film heritage or heritage hoarding?, 125.
[279] Fossati, *From Grain to Pixel,* 14.

archive but in many ways necessitate continuous data migration practices to keep the archival

material from becoming inaccessible.

This very real threat of digital obsolescence shapes archival practice and eats into the

already limited budgets of film archives. Illustrating the cost prohibitiveness of moving toward

digital preservation, Fossati points to the very expensive material infrastructure necessary to

maintain a functioning digital archive. From the initial expense of an accurate film scan and the

ensuing hard disk and/or Linear Tape Open (LTO) needed to store the resulting "1.5 to 6

terabytes" of data produced per film, the initial cost already precludes the complete digitization

of preexisting film archives.[280] Furthermore, the instability of the carrier and the obsolescence of

hardware, software, and data formats, requires that digitally preserved content be transferred to a

new digital carrier quite regularly. Whereas traditional celluloid or polyester might reasonably be

expected to undergo minimal decay in a century if properly stored, digital data migration must be

undertaken once every two to five years according to Fossati.[281] The data migration process is not

simply a matter of copying and pasting content from one hard drive to another, but requires

"automated monitoring systems to keep track of any loss or degradation of data and some kind of

human supervision."[282] Furthermore, as already discussed, migration equipment must be

frequently replaced and, more importantly, this process is never-ending. Once digitized,

preserved content must undergo data migration regularly thus dramatically increasing archive

operating costs. Fossati notes that according to a study carried out by the Academy of Motion

Picture Arts and Sciences "the long-term cost of storing digital cinema is five to eleven times

higher than the cost of storing the same information on film."[283]

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[280] Fossati, *From Grain to Pixel*, 65.
[281] Fossati, *From Grain to Pixel*, 66.
[282] Fossati, *From Grain to Pixel*, 67.
[283] Fossati, *From Grain to Pixel*, 67.

The difficulties posed by the increase in "born digital" film projects and the inevitable shift toward digitizing archives has led to calls for dramatically refiguring the operation of film archives themselves. In some ways prefiguring the functionality of Karagarga, archivist Jim Lindner's insistence on creating an "immaterial archive," and projects like DISTARNET and LOCKSS ("Lots of Copies Keeps Stuff Safe") mark attempts at moving toward a distributed archive essentially functioning as a peer-to-peer network to reduce overhead and ensure media redundancy. DISTARNET, or the Distributed Storage Archive Network, is a now defunct attempt at creating the infrastructure for a large, distributed archive. Utilizing peer-to-peer technology based on the BitTorrent protocol, DISTARNET began in 2006 at the Imaging and Media Lab at the University of Basel and has been largely inactive since 2012.[284] LOCKSS, or Lots of Copies Keep Stuff Safe, is an operational program based at Stanford Libraries which establishes a network of university and library systems remotely holding and sharing digital copies for redundancy. This networked architecture is similar to the BitTorrent infrastructure but in some ways is less robust due to a smaller nodal chain (limited to specific universities and libraries) and has additional checks and balances to ensure copyright law is being respected.[285] While Lindner's immaterial archive never came to fruition through official channels, Karagarga operates as a perfect embodiment of Lindner's vision. Lindner's "immaterial" archive doubles as a description of Karagarga itself:

> To finally free ourselves from all the problems related to a perishable carrier, instead of transferring content from an analog…to a digital carrier…all doomed to physical decay, data could be kept in a network of hardware terminals, an 'immaterial' medialess medium in which all information (in digital form) can be collected. This could be a redundant

[284] For more on DISTARNET's functionality see: "The Distarnet Approach to Reliable Autonomic Long-Term Digital Preservation," Distarnet, accessed October 16, 2022, https://dbis.dmi.unibas.ch/publications/2011/dasfaa-2011/dasfaa-2011.pdf
[285] For more on LOCKSS see: "About," LOCKSS, accessed October 15, 2022, https://www.lockss.org/about.

system of information in continuous motion, an immaterial (film) archive that entrusts its collection to a huge amount of redundant files that travel within a network. Information could be retrieved on demand.[286]

Karagarga as "medialess medium" currently includes 258,020 torrents linking to media objects of which 175,468 are films—other objects include music and text files [fig. 2.4]. Each .torrent file additionally has a dedicated page with information detailing quality specifications, production history, and member comments often lending further insight into the history of the media object itself [fig. 2.5]. By contrast, a relatively small but successful film archive like Anthology houses approximately 900 works and the more substantial Museum of Modern Art film archive houses 30,000 works.[287] The BitTorrent infrastructure requires redundancy and Karagarga's seed/leech policies and "Masters of the Month" featured lists bolster the sharing and redundancy of these media objects. Unlike traditional film archives, Karagarga encourages its user-base to contribute content so long as they adhere to the strict quality standards set and adjusted by the community base and moderators collectively. Karagarga's 5,620 active users have, according to the site's own statistics, uploaded 17,510.40 terabytes of content collectively.

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[286] Jim Lindner quoted in Fossati, *From Grain to Pixel*, 70.
[287] "Film: Moma," The Museum of Modern Art, accessed October 15, 2022, https://www.moma.org/collection/about/curatorial-departments/film.

Site Statistics [Top Lists]

User Statistics	
Users	16,140
Unconfirmed users	0
New users in past 7 days	8
Users visited today	3,309
Users visited this week	6,910
Users visited this month	10,639

Torrent Statistics	
Torrents	258,020
Torrent/user ratio	15.99
Active (both seeders & leechers)	1626
Live (seeders, no leechers)	181562
Stuck (no seeders, leechers)	3125
Inactive (no seeders, no leechers)	71707
Movie torrents	175,468 (68%)
DVDR torrents	38,405 (14.9%)
HD torrents	55,945 (21.7%)
Music torrents	26,487 (10.3%)
Literature torrents	17,656 (6.8%)
Total snatches	17,435,131
Movie snatches	12,714,245 (72.9%)
DVDR snatches	972,625 (5.6%)
Music snatches	607,778 (3.5%)
Literature snatches	1,409,652 (8.1%)

Peer Statistics	
Peers	813,641
Active users	5,620
Seeders	808,234
Leechers	5,407
Seeder/leecher ratio	149.48

Traffic	
Total traffic	49.178PB
Total upload	35.607PB
Total download	13.571PB
Tracker ratio	2.62
Average upload per user	2.259TB
Average download per user	881.65GB
Total bonus	6.647PB
Average bonus	431.84GB
(Updated 2022-09-05 12:59:41)	

Figure 2.4: Karagarga's site statistics as of 5 September 2022. Many of the "movie torrents" are rare and some are nearly impossible to find through alternative sources.[288]

Figure 2.5: A partial extract of a torrent page on the Karagarga website. Torrent pages include detailed information about the specific film, its production, and the digitization process and

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[288] "KG," Karagarga, accessed October 16, 2022, https://karagarga.in/.

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specifications as well as a comment board where users can add information, ask questions, or simply include their critical reaction to the film.[289]

Karagarga's reliance on its user-base for conservation/preservation of its artifacts leads to an unintended and arguably under-appreciated aspect of more carefully policed distributed archives. Specifically, allowing unrestricted access to the archived material and building a community base as a necessary means of perpetuating the archive opens up space for alternative modes of knowledge production not limited to academic scholarship. While the gatekeeping practices of many traditional archives, in conjunction with curatorial and categorization methods, inform what artifacts are most accessed, the relative freedom of Karagarga invites a broad range of amateur and professional discussion about films, including traditionally overlooked and forgotten material.[290] A quick perusal of the Karagarga forum makes clear the level of engagement by the community as well as the investment in knowledge production which becomes a significant corollary to the preservation component. Beyond the forum, Karagarga actively encourages the creation of subtitles for content that may or may not have received a release outside of its country of origin. Through a process of crowdsourcing through ratio pots, multilingual users are encouraged to translate material and create subtitles and/or closed captioning to allow for films to reach broader audiences. The distributed archive by definition includes a far reaching user-base which furthers the redundancy and invites collaborative knowledge production accelerating the spread of the cinematic artifacts.

While this chapter has hopefully served as a means of elucidating the potential and perhaps pointing toward the larger significance of distributed archives like Karagarga, the kinks and challenges of such systems still deserve more critical examination. What promises and strategies can actually be gleaned or adapted from a gray market enterprise like BitTorrent

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[289] "KG," Karagarga, accessed October 16, 2022, https://karagarga.in/.
[290] For more see Cook, "The Archive(s) is a Foreign Country."

trackers? Is a truly distributed "official" archive modeled after Karagarga a possibility when copyright laws and political and market imperatives weigh heavily on officially sanctioned archives? Is a reliance on a broad user-base that realistically is not beholden to the archive itself beyond potentially ephemeral affective ties a dangerous approach to archival practice? And, more theoretically, what is the ontological basis of cinema and how might a reliance on an immaterial carrier fundamentally alter our engagement with and understanding of the medium itself? As debates, legal battles, and pontification ensues, film deteriorates, data disappears, and significant cultural artifacts vanish. In such an environment, perhaps gray market distributed archives like Karagarga temporarily serve as the best defense in the battle against the unrelenting creep of cinematic decay and loss.

CHAPTER 3: A Raw Deal: Data Compression and the Quality of Digital Cinema

In arguing that digital cinema be defined by its larger ecology, it is necessary to acknowledge that changes within this ecology do not radiate from one central source but rather each element shapes and is shaped by each other. One of the most fundamental causal agents of change however comes from the aggressive marketing of cinema's shifting technologies. The most enduring tactic of marketing cinema and its technologies has been the equation of new cinematic tools with greater degrees of immersion and quality. Quality, a nebulous word at best, has been evoked throughout film's history in varying degrees with shifting ramifications. The latest iteration of this trumpetting of quality achieved through new cinematic technology is linked first and foremost with resolution—the measurement of pixels in a given image—and raw capture—retaining "unmodified" sensor data throughout the production pipeline. Resolution is used as a measurement of quality most marketable to spectators while raw capture represents quality for practitioners. The collision of conflicting and (occasionally) overlapping determinations of quality at given nodes within this ecology have serious ramifications for the often neglected node of film preservation.

The latest marketing of cinema to spectators stresses that the new cinema screen is the television, and the future of television is 8K, at least according to electronics manufacturer LG.[291] LG is not alone in its prediction, the 8K Association tells us that "8K is the future, and it's already here."[292] Extolling the virtues of 8K television, or a screen resolution of 7,680 horizontal and 4,320 vertical pixels, is the raison d'etre of the aptly named 8K Association. For the 8KA, expanding the 8K "ecosystem" is necessary for bringing "the many benefits of 8K technology" to all audiences.[293] What those many benefits are exactly is left to the imagination on the 8KA

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[291] "The Future of TV is 8K," *LG*, https://www.lg.com/us/8k-tvs.
[292] "The Evolution of High Resolution Has Arrived," *8K Association*, https://discover8k.com/.
[293] "About Us-8K Association," *8K Association*, https://8kassociation.com/about-us/

website, but its companion site, discover8K.com suggests that 8K offers the "most immersive" viewing experience.[294]

Throughout the history of visual media, immersion has often functioned as a hype word that both suggests the erasure of a mediating apparatus (canvas, screen, etc.) while also implicitly operating as an evaluative force shaping notions of what media should strive for, namely transparency. For Bazin, cinema was the apotheosis of this model, finally satisfying, "once and for all and in its very essence, our obsession with realism."[295] For Cavell, the automaticity of photography and film overcame the subjective nature of painting which, despite the best attempts at pure representation, were subject to the hand of the artist.[296] Whether Bazin and Cavell invoked realism, transparency, and objectivity in relation to cinema and photography in a good faith attempt at grappling with what amounted to fairly new medium or, instead, embraced the position as a means of elevating cinema's status in high cultural circles (not an impossibility given Bazin's background with *Cahiers du cinema*), both approaches signify the enduring appeal of medium erasure when discussing emerging media.

Film and photography were historically positioned as the perfect media to slot into existing debates on transparent mediation precisely due to their (seemingly) indexical relation to the objects they are representing and the automatic nature of their process of representation. That said, with shifts in the material substrate of film and photography, moving from chemical reactions to algorithmic processes, the cultural hype over transparent mediation has remained a fixture standing on a surface that has shifted dramatically under its feet. For media theorists like Manovich and Rodowick the possibility of digital media to fulfill (or not) the promise of

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[294] "The Evolution of High Resolution Has Arrived," *8K Association*, https://discover8k.com/.
[295] Bazin, *What is Cinema Vol. 1*, 12.
[296] Stanley Cavell, *The World Viewed: Reflections on the Ontology of Film* (Cambridge: Harvard University Press, 1979), 72.

immediacy remains of concern only in so much as its indexical power has undergone a shift with a new layer of mediation, namely computer code, standing between the object and its representation.[297] Unfortunately, lost in the ontological debates about analog versus digital cinema's ability to effectively offer a mode of transparent mediation through increasing "quality" is the reality that the very concept of transparent mediation was, and remains, a rhetorical black box which only serves to hide away the complexity of the mediating apparatus.

In this chapter, I work to deflate the hype of transparent immediacy, of 8K and beyond, of "raw" unprocessed imagery, immersion, and objectivity by examining the processes undergirding digital cinema's perpetual march toward increasing "quality" and how these processes have contradictorily led to a fractious cinematic landscape with a tenuous future. More specifically, I pull back the veil on digital cinema terminology and hype by tracing a history of the rise of "raw" sensor data and increasing video resolution as drivers of professional and consumer grade video cameras and patch these into a larger ecology of digital cinema that includes marketing tactics, economic imperatives, algorithms, patents, and the concerning externalities of the drive for increased image "quality." As I argue throughout this chapter, current definitions of quality in relation to digital cinema are all too often attributed to seemingly objective metrics (that is, technical specifications). This obsession with metrics—a product of data science and algorithmic patents becoming central in cinematic production pipelines—has led to a need for cameras to capture (record) increasing amounts of data regardless of perceptual benefits. Increased data does not necessarily correspond with perceived quality nor do increases in perceptual quality necessarily reveal why in terms of raw numbers.

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[297] Manovich, *The Language of New Media*;
Rodowick, *The Virtual Life of Film*.

The Future is RED

In 2012, director Peter Jackson made a stir by releasing *The Hobbit: An Unexpected Journey* which he elected to film at a shooting speed of 48 frames per second in 5K resolution using the RED Epic digital cinema camera.[298] This film was controversial not for its content but rather due to the choice of filming frame rate. Forced to standardize frame rates in order for proper sound synchronization and fidelity, film has been shot at 24 frames per second (more commonly 23.976 since the role of televisual rebroadcasting of films) in the United States since the 1920s. Jackson's move, therefore, represented a radical challenge to traditional cinematic practice in a way that resonated far beyond the novelty of technologies like 3D, Smell-O-Vision, or Percepto. Whereas, for example, 3D technology *is* the spectacle, the use of 48 frames per second as a shooting speed is a subtle shift away from technological norms not necessarily intended to attract a general audience unfamiliar with the specifics of the cinematic medium. 3D technology is, above all, the product, the film is often secondary to the spectacle of the 3D experience for the average audience member. Frame rate, in contrast, is a seemingly minor change that, although certainly featured in the marketing for the film, is ultimately less of a selling point.

For Jackson, 24 frames per second "is jarring" and the end result of 24 frames per second filmmaking is a "primitive" look.[299] For some critics, however, *The Hobbit*'s 48 frames per second frame rate was "kitsch and alienating" and gave the film "a sickly sheen of fakeness."[300] The mixed reactions toward Jackson's film illustrate two central tenets of cinema: The first, cinema is deeply traditional. Until recently, its technological base has remained superficially stable (celluloid), its standards fixed. The second, cinema is fundamentally fluid and embedded

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[298] *The Hobbit: An Unexpected Journey*, directed by Peter Jackson (2012).
[299] Emma Saunders, "The Hobbit Director Peter Jackson Defends Fast Frame Rate" *BBC* (11 Dec. 2012),
https://www.bbc.com/news/entertainment-arts-20676605.
[300] Saunders, "The Hobbit Director Peter Jackson Defends Fast Frame Rate."

within the market's insatiable need for "newness." This contradiction is often resolved around the notion of quality. That is, throughout its history, popular cinema has been framed as a medium truer to its referent than any other medium. Quality hinged on the attainment of transparency through medium erasure. As I have already argued, this marketing of medium erasure/transparency was particularly pronounced with the introduction of DVD, but it has served as a driving force to varying degrees throughout film history.

Cinematic quality is often deployed in one of two ways. Quality as cultural capital, that is, quality as a paean to high culture usually as a differentiator between two artistic media. Discussions of quality in this regard are most pronounced when one medium adapts content of another. This registers most clearly in the highly "moralistic" language used to deride film adaptations of literary sources, "infidelity, betrayal, deformation, violation, vulgarization, and desecration" being terms typically included in these attacks as noted by Robert Stam.[301] This type of quality cuts both ways as the film industry itself has championed the quality of cinematic content as a differentiation between film and television before becoming firmly entangled with the "idiot box" in its more recent years. Ultimately, quality in this scenario is understood as being largely culturally situated. In other words, subjective.

The other notion of quality often touted with regards to cinema refers to its technology. More specifically, technological quality of this kind is primarily concerned with truthfulness to the referent. Technological advances in cinema are typically framed as achieving "unparalleled quality" of image and sound which is fundamentally linked to transparency and verisimilitude but also carries with it an air of objectivity. Even seemingly gimmicky technologies like Aromarama and Smell-O-Vision are still in service to the myth of verisimilitude to the extent

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[301] Robert Stam, "Beyond Fidelity: The Dialogics of Adaptation," *Film Adaptation,* ed. James Naremore (New Brunswick: Rutgers, 2000), 54.

that they increase our sensual access to the content on screen by encouraging the "immersion" of another of our senses into the diegesis. Even the wafting of canned floral scents into the auditorium to accompany the image of flowers represents a kind of striving toward transparent immediacy—even if the resulting effect is quite the opposite. Frequently, this technological flavor of quality is supported by data, controlled studies, and "scientific rigor" but more often than not remains nearly as subjective and contextual as the quality associated with taste cultures. Perceptual quality is, unfortunately, not reducible to raw data.

While carriers like VHS serve as an aberration in this regard (highlighting access over quality) the battle between VHS and Betamax no doubt illustrates that quality remained a central concern. VHS, as a perceptually lower quality carrier in terms of sheer resolution and noise, eventually overtook Betamax due to a number of market and economical factors but this has been an exception in the history of cinema. In terms of digital cinema, quality is unabashedly at the center of most debates. As a filmmaker/technology apostle, Jackson, for example, has argued that the quality introduced by digital cinema cameras is "like the back of the cinema has had a hole cut out of it where the screen is, and you are actually looking into the real world."[302] As Sterne reminds us, "definition" (or resolution) and verisimilitude are not necessarily coterminous despite claims to the contrary. Instead, "aesthetic pleasure, attention, contemplation, immersion, and high definition" are terms that "can exist in many different possible configurations."[303] A high-definition digital video can reject immersion just as a lower resolution video can immerse us completely.[304]

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[302] Peter Jackson qtd. In Lee Gomes, "Red: The Camera That Changed Hollywood," *MIT Technology Review* (19 Dec. 2011).
[303] Sterne, *MP3*, 5.
[304] The best scan of *Mothlight* (Stan Brakhage, 1963) for example, still refuses immersion while an SD rip of *Apocalypse Now* (Francis Ford Copolla, 1979) is still a sumptuous immersive feast owing to its beautiful lighting, compelling sound design, and powerful performances.

The flattening of quality as a term essentially meaning transparency in relation to film can be traced back to the earliest days of cinema. The introduction of incandescent lighting as a replacement for classic arcs led "experts" to note that the "qualities of incandescent light, particularly when used with panchromatic film, make it possible to photograph the skin with the greatest fidelity to nature yet achieved."[305] This linkage to quality spans the entire life of the cinematic medium. With each new technology we have a new promise of fidelity, transparency, medium erasure, and undiluted access to the content depicted.

Jackson's decision to work in 48 frames per second marks only one of his forays into embracing technical changes as a means of advancing cinematic "quality." Prior to his 2012 decision regarding shifts in frame rate, Jackson invited Oakley Sunglass founder and then cinema hobbyist Jim Jannard to bring his new digital camera prototypes out to New Zealand for a test shoot. The result was the short war film *Crossing the Line* (Jackson, 2008) as well as the emergence of the RED One digital cinema camera, a precursor to the RED Epic Jackson would go on to use in the filming of *The Hobbit*.[306] The RED One was arguably the first truly viable digital contender to traditional analog cinema. Shot on March 30th and 31st of 2007 on Jannard's "Boris" and "Natasha" cameras (RED One prototypes), Jackson filmed his 12-minute short in 4K resolution with the ultimate goal being 4K projection of the finished product at the 2007 National Association of Broadcasters (NAB) show.

According to NAB 2007 reports, *Crossing the Line* was projected in 4K to an enthusiastic audience that stretched around the Las Vegas Convention Center's South Hall.[307] Commenting on the promise of the RED One after seeing its performance at NAB, cinematographer David Stump

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[305] "New Lighting for Movies." *The New York Times* (12 Feb. 1928).
[306] *Crossing the Line*, directed by Peter Jackson (2008).
[307] "'Crossing the Line' With the Big Red One," *TVTechnology* (12 June 2007), https://www.tvtechnology.com/news/crossing-the-line-with-the-big-red-one.

stated, "They are leading us down a path that everyone knows we want to go[…]the high end always drives the market."[308] Stump's comment unintentionally illustrates the contradictions inherent in notions of cinematic quality from a technological perspective. On the one hand, he suggests that cameras like the RED One are leading us down a path that "everyone wants to go" implying a kind of natural progression toward something. On the other hand, he suggests that the "high end always drives the market" which implies that the vague signification of "high end" shapes taste cultures around specific products. Where "everyone wants to go" is largely a product of what is understood as "high end" at a given moment and that determination is often manufactured rather than organically emergent.

Despite claims of objective quality, every test is "a form of technological performance" and the testing environment itself functions as a kind of theater.[309] For RED, Jackson's film and subsequent NAB screening marked the first public "tests"—quite literally in a theater—and no doubt fueled the excitement around the camera and its association with "high end" technology. In regards to technological tests, "proper aesthetic judgment requires a context that transcends context" or more straightforwardly, impartial testing is an impossibility.[310] Regardless of how controlled the environment, each and every testing condition shapes and contributes to how the content is perceived, both in a wholly physiological way while also phenomenologically. The setting, lighting, screen, and projector are all contributing factors as to how a film is perceived but the paratext also fundamentally shapes audience perception. While Sterne's examination of the development of MP3 technology highlights an industry that, at the very least, attempted to control test variables to determine if the compression algorithm is significantly "transparent,"

[308] David Stump qtd. in "NAB2007: Red Noses Apple as Star Turn," *TVB Europe* (26 April 2007), https://www.tvbeurope.com/production-post/nab2007-red-noses-apple-as-star-turn.
[309] Sterne, *MP3,* 150.
[310] Sterne, *MP3,* 152.

RED's NAB premiere marked a highly publicized event complete with the massive directorial star power of Peter Jackson coming at the tail end of a year's worth of hype and RED Camera preorders. It also followed over a decade of film industry shifts "from the inside out" toward digital production (beginning with editing, visual effects, and sound, followed by projection and finally capture).[311]

This is not to say that NAB was intended to be a carefully calibrated testing environment, nor am I suggesting that the performance of the RED One did not mark a significant improvement in the capture of digital images. After all, the nature of NAB shows is first and foremost marketing. Stories about NAB often center around what new technologies will be shaping the future state of the industry or revolutionizing this or that area of production. What is significant here is the way in which RED, through its public display at NAB in conjunction with the high-profile stature of both Jackson and RED/Oakley founder and "bad boy" Jim Jannard, managed to position itself as revolutionary—a distinction that could only be made on account of the camera's ability to capture 4K "raw" content with relatively manageable file sizes. In this case, "raw" refers quite literally to the copying of raw sensor data from the sensor to a storage medium. Raw as a powerful signifying term in and of itself will be further addressed below.

Beyond these details (resolution coupled with manageable raw capture), the RED One's super 35mm size CMOS sensor, raw shooting capabilities, and all digital workflow were already well-established through cameras like the 4K capable Dalsa Origin, Panavision Genesis, Arriflex D-20 and D-21, and Sony F35. Resolution and the raw shooting format would become fundamentally linked with the "future" of high-end cinema from a market perspective. If Red was able to achieve higher resolution capture in a data rich format like raw, with *relatively*

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[311] Walter Murch, "A Digital Cinema of the Mind? Could Be," *The New York Times* (2 May 1999).

manageable file sizes, and the result was a market frenzy, then the future of digital cinema was clear. Increased data capture (through resolution and the raw format) would become the modus operandi of digital cinema manufacturers moving forward. Inverting Stump's comment, as it turns out, high end would not come to drive the market, but rather hype would drive the high end. Expanding on the RED formula, increasing resolution and incorporating raw capture became a central goal of nearly all respected camera manufacturers. A decision that would reverberate throughout the industry and beyond.

Unfortunately, what is lost in the resolution hype around RED One's premiere is the underlying technology which allowed for its capture of 4K raw footage, namely the REDCode Raw compression algorithm. A patented, heavily-guarded, technology without which the sheer scale of the data captured would be overwhelming for most RED camera users. The drive for greater amounts of data capture through increasing video resolution while relying on raw sensor data continues to shape the industry. Red's role as the "high-end" technology leading the market in these early days of digital cinema has ultimately led to a digital cinema ecology skewed toward increasing "data" throughput at the expense of industry/preservational sustainability.

The Virtual Life of (Raw) Data

"Raw" is not a new word in film production but now carries two distinct meanings with the introduction of digital cinema. On the one hand, "raw footage" is commonly used to demarcate unedited and unprocessed recorded content both in the analog and digital realm. Captured footage that has not yet been edited is often considered raw footage. On the other hand, raw is a mode of capturing images that saves "unprocessed" sensor data. While most digital cameras extract numerical sensor data and process it in camera using one of many possible algorithms to produce a legible image saved to a storage medium, raw capture saves pure numerical data

effectively offloading the algorithmic processing to a later stage of the pipeline. Practically, this means that one can choose what algorithm(s) are to be applied to that raw data to create the legible image and this can be done nondestructively so long as the original raw data remains on the storage medium. The power of the word "raw" in both instances is its virtuality.

Despite the colloquial tendency to reduce the "virtual" to a wholly imagined realm or a computational reproduction of the "real," etymologically the word has its roots in the Latin *virtus* meaning goodness, worth, and value. It is precisely this notion of the word which motivates scholars like Massumi, Deleuze, Bergson, Levy, and King to reclaim the power of virtuality as more than "the opposite of the real."[312] For Massumi, the virtual is "that which is maximally abstract yet real, whose reality is that of potential—pure relationality, the interval of change, the in-itself of transformation."[313] Preceding Massumi, Bergson locates virtuality as a collision point between "mirror-images" of the past and "pantomime" projections into the future all growing from the actuality of the present.[314] Building on these definitions, King locates virtuality in "memory images that belong to the past, potential images that are thrown toward the future, fringe images that surround us in the present moment, and, most important, the cushion of interval of duration that invites these images in."[315] Each of these definitions positions virtuality as the myriad paths of possibility stemming from a position of the present. Harkening back to its etymological roots and with these theoretical interpretations in mind, we might read the virtual as latent potential.

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[312] Pierre Levy, *Becoming Virtual: Reality in the Digital Age* (New York: Plenum Trade, 1998) 16.

[313] Brian Massumi, *Parables for the Virtual: Movement, Affect, Sensation* (Durham: Duke University Press, 2002) 58.

[314] Henri Bergson, "Memory of the Present and False Recognition," *Mind-Energy: Lectures and Essays* (Westport: Greenwood Press, 1975), 165.

[315] Homay King, *Virtual Memory: Time-Based Art and the Dream of Digitality* (Durham: Duke University Press, 2015) 102.

The usage of the term "raw" in film production signifies both past, present, and future and that signification positions it as perhaps the most powerful elucidation of the virtual and is central to its position in artistic practice. On the one hand, "raw" is a useful term simply for describing a state of media on a practical level. Informing a client, director, producer, etc. that what they are viewing is "raw footage" is a succinct way of justifying a certain degree of inconsistency, incoherence, or aesthetic unpleasantness while also pointing toward what is ultimately a document of the past. Unprocessed and unedited, raw footage is often meant as a term signifying that the content is merely for review and initial feedback. A chance to glimpse at what once was, frozen, mediated, and reproduced on demand; the past frozen. On the other hand, more than anything, "raw" is pregnant with the future. Raw is a term that promises something better. It is a term that suggests change above all else. Even in telling a client, director, or producer that the footage they are reviewing is raw, you are promising improvement. "Raw" holds in its three letters a world of possibility. The finished product will consist of this "raw" content, but it will be radically changed, polished, and coherent. Like Bergson's notion of the virtual being at once memory and futurity, raw footage exists as an open window between past and future.

"Raw" is also incredibly misleading. While raw footage points back to a past captured and mediated through various technical means, it also implies a degree of purity that belies the process of capture itself. While the "rawness" of media/data typically "corresponds to ever-increasing expectations from audiovisual resolution" precisely because it represents the promise of change through processing, artistic manipulation, and editing, it also problematically implies a kind of purity of mediation.[316] If "raw" suggests an unmanipulated state with the

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[316] Peter Krapp, *Noise Channels: Glitch and Error in Digital Culture* (Minneapolis: University of Minnesota Press, 2011) 57.

promise of value through processing, then it simultaneously veils, or at the very least dilutes the layers of technical mediation and processing already at play in the procedure of capturing reality. This occlusion is only exacerbated through the processing and polishing of raw media into "finished" products. Of course, there are deviations from this teleology of raw media from capture to editing to exhibition but, by and large, raw is conceived of as a rough stone waiting to be polished into a diamond.[317]

Significantly, when dealing with digital media, rawness also refers directly to data. Reviewing raw digital images for all intents and purposes still operates on the same level virtually, as a promise for future improvement, but the distinction at the point of capture is important. As Manovich notes, what differentiates digital from analog is numerical representation.[318] Through numerical representation, media are turned into computer data making them programmable. The implications of this shift are often discussed in relation to increased manipulability of images, the generation of wholly computer-generated photorealistic representations, duplicability, and myriad other concerns and praise for the different affordances of the digital. What is often lost in these discussions are the underlying processes that content undergoes to become numerically represented in the first place, to become "raw" media. The logic of "raw," as rough content lying in wait for improvement through processing permeates academic discourse around shifts toward digital mediation just as it does in the post-production client room. In popular media studies trends, media are digital (whatever that means) and from there are discussed as numerical representations with myriad implications of easy duplication, manipulation, and true/false representation. All processing before the fact is tied to later claims of truth to a "real" referent. What is lost in these discussions is arguably one half of the media

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[317] See Krapp, *Noise Channels.*
[318] Manovich, *The Language of New Media*, 68.

industry and artistry. Specifically, what happens before media are numerically represented, before they become raw? Of course many works are attentive to the process of production and pre-production broadly speaking but what about the most important of moments between reality and numerical representation?

Since digital media are numerically represented, media studies as a discipline is also necessarily a kind of informatics. Cinema, new media, raw footage and raw data are now fundamentally linked concepts, and the logic of information science becomes increasingly useful for studying "raw" footage in film production in particular. Drawing on Geoffrey Bowker's claim that "raw data is both an oxymoron and a bad idea,"[319] Lisa Gitelman and Virginia Jackson note that raw data is fundamentally a misunderstood concept:

> At first glance data are apparently before the fact: they are the starting point for what we know, who we are, and how we communicate. This shared sense of starting with data often leads to an unnoticed assumption that data are transparent, that information is self-evident, the fundamental stuff of truth itself.[320]

Gitelman and Jackson trace this assumption of unmanipulated "raw" mediation back to a longer history noting that mechanical objectivity emerged in the sciences along with the development of photography with observers "struck by the apparent displacement of human agency in the production of life-like images."[321] Years of critical popular and academic texts have of course disproven the ideological neutrality and objectivity of mechanical representation, but the discourse around "big data" has imbued digital reproduction in popular and academic circles with similar assumptions about its objective power. Chris Anderson of Wired magazine marks one extreme example as he defends big data as a tool that speaks for itself, thus putting an end to

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[319] Geoffrey C. Bowker, *Memory Practices in the Sciences* (Cambridge: The MIT Press, 2005), 184.
[320] Lisa Gitelman & Virginia Jackson, "Introduction," *"Raw Data" Is an Oxymoron,* eds. Lisa Gitelman & Virginia Jackson (Cambridge: The MIT Press, 2013), 2.
[321] Gitelman & Jackson, "Introduction," 5.

subjectively crafted theories about human behavior:

> This is a world where massive amounts of data and applied mathematics replace every other tool that might be brought to bear. Out with every theory of human behavior, from linguistics to sociology. Forget taxonomy, ontology, and psychology. Who knows why people do what they do? The point is they do it, and we can track and measure it with unprecedented fidelity. With enough data, the numbers speak for themselves.[322]

In Anderson's account, data is necessarily raw as it ultimately amounts to "numbers" that can "speak for themselves." Anderson's trumpeting of the objective power of data to reveal truths about human behavior relies on the notion that data are fundamentally "the stuff of truth," transparent and self-evident. Of course, as Bowker's dictum holds, data can never truly be "raw." Data do not exist in the world but are themselves mediations as Steve Anderson reminds us:

> Before data can be considered data, it exists as phenomena in the world—often the results of human activities that are registered by server logs and information sensors. Before data can be captured, it must be desired, identified, and described; correctly sized and formatted repositories must be created that are suited to its capture, storage, and processing. In this way, each stage in the treatment of data implies others in the circuit.[323]

Data can never be raw since the very nature of its becoming data requires mediation built on technology researched, crafted, assembled, optimized, and deployed for a precise mode of data capture. To turn natural phenomena into data means developing and creating the tools to do so which, in and of itself, necessitates a kind of intentionality that refuses any easy claims of objectivity.

Despite the impossibility of capturing truly raw data, the virtual potentiality of the term has nonetheless driven digital image capture toward what are superficially ever more transparent tools of mediation. Unlike the process of capturing an image to analog film, which at least superficially only requires exposing a sensitized film strip to light, the process of converting

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[322] Chris Anderson, "The End of Theory: The Data Deluge Makes the Scientific Method Obsolete," *Wired* (23 June 2008).

[323] Steve F. Anderson, *Technologies of Vision: The War Between Data and Images* (Cambridge: The MIT Press, 2017) 7.

natural phenomena (in this case photons of light) into numerical values requires a different type and degree of technological mediation and different series of problems to overcome in a quest for "transparency."[324] To start, a digital sensor must contain light sensitive components on a very small scale in great quantity effectively mirroring the silver-halide crystals present on a strip of analog film. Whereas analog film consists of silver-halide coated on a flexible gelatin base thus creating a unique dispersion of miniscule light-sensitive silver salt crystals on each frame, a digital sensor is a static silicon-based square with a series of photosites dispersed in a grid. This grid pattern as opposed to the natural variance of analogue silver halide crystals means the possibility for more fixed noise patterns as opposed to the random nature of film grain which often owes to the latter's association with a kind of warmth and pleasantness. Analog film feels alive because of its randomization of noise (grain) whereas digital capture can produce unnatural, fixed noise patterns even if those patterns are only subtly registered by the viewer.

Beyond digital noise patterns, the larger issue is quite simply: how can we take a silicon wafer sensitive to light and convert that light into 0's and 1's and, furthermore, reinterpret those as color imagery? Photosites, or the extraordinarily small cavities on a sensor which trap photons of light and feed them to light sensing diodes, are by nature colorblind. They are sensitive to fluctuations in luminance (light intensity) but cannot differentiate one frequency of light from another. Color analog film went through various iterations before settling primarily on the integral tripack color capture process reliant on chemicals called couplers which operate on three

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[324] Of course, analog capture is far more complex than simply exposing a sensitized film strip to light. Ultimately it begins with the complex ecology needed to create that sensitized film strip to begin with. Although the complexities of the underlying chemistry that goes into myriad technologies at the core of analog photography are beyond the scope of this dissertation, suffice it to say that the huge variety of analog filmstock disproves the lazy assumption that analog film is necessarily more transparent or simple than digital. Both mediating technologies still require the hand of dedicated craftspeople, a long history of research and development, and copious material resources. No mediating technology emerges pre-formed and unmolested no matter how "natural" it may seem in comparison to the abstractness of numerical representation.

overlapping layers each sensitive to a different frequency of the visible spectrum.[325] Ultimately, what is produced via analog capture is a layered image but still one that is resolutely analog. The random dispersion of the silver-halide and their overlapping interconnectedness is quite different from the discrete grid of a digital sensor which transfers fluctuating intensities of light into distinct numerical values. By contrast, while the quantization of luminance by light sensitive diodes arguably shares a closer relationship to analog film (to some extent) in that photons register luminance and respond—in analog film, silver-halide responds by breaking down to metallic silver based on intensity while photons generate electronic signals based on those values—the ability to register color requires additional intentional processing at the moment of capture.

Contemporary digital photography has responded to this challenge by incorporating Bayer Arrays coupled with a form of image processing known as demosaicing.[326] In order for digital sensors to "see" color, the photosites are layered with a repeating pattern of color filters known as a Bayer Array [fig. 3.1]. A pattern consisting of a row of green, red, green filters followed by a row of blue, green, blue filters repeated throughout the sensor allows each photosite in the array to register one specific color frequency. Of course, this process means that what results are numerical values of light intensity based on a patchwork of distinct colors. For example, the first photosite on the array will give us only a value for green, while the next photosite will register a value for red, et cetera. In order for a legible image to be extracted from this checkerboard of information, a degree of processing is required. Demosaicing (sometimes referred to as debayering) relies on a process of algorithmic sampling and guesswork. Without

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[325] Leo Enticknap, *Moving Image Technology: From Zoetrope to Digital* (London: Wallflower Press, 2005) 90.
[326] K. Chung and Y. Chan, "Color Demosaicing Using Variance of Color Differences," in *IEEE Transactions on Image Processing*, vol. 15, no. 10, pp. 2944-2955, Oct. 2006.

veering too heavily into the realm of engineering, it is enough to say that algorithms designed to

sample the values of each photosite and attempt to recreate missing red, green, and blue values at

each photosite are utilized to build a whole image from what is ultimately a representation shot
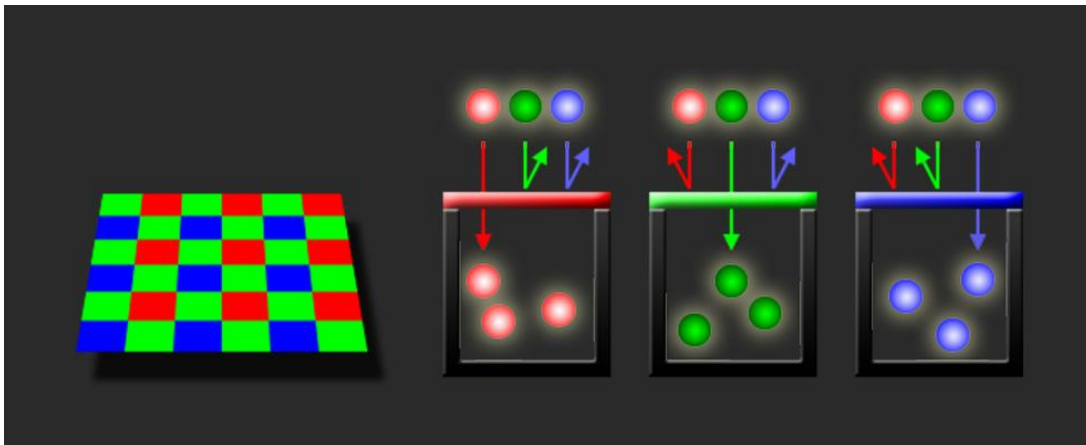
through with holes.

Figure 3.1: The Bayer Array.[327]

Raw footage in the digital realm is therefore illegible without a degree of processing and

even prior to its capture it necessitates intentional decisions about what values are most useful

and what values can merely be interpolated/interpreted. All sensors—camera sensors

included—"gather certain kinds of information while neglecting others" and this truth is already

registered in the logic of the Bayer Array itself.[328] While the concept of "raw" data grows from a

longer history of mechanical objectivity resting on a morally elevated notion of

"nonintervention" into the reproduction of natural phenomena, each of the Bayer Array's

millions of photosites pokes a hole in the legitimacy of that claim of objectivity through

technological mediation.[329] From the start, the array is built to exploit the limitations of human

[327] "The Bayer Sensor Strategy," Red Digital Cinema, accessed October 16, 2022, https://www.red.com/red-101/bayer-sensor-strategy.
[328] Anderson, *Technologies of Vision*, 7.
[329] Lorraine Daston & Peter Galison, "The Image of Objectivity," *Representations* No. 40 (Autumn, 1992) 119.

optics and is merely one of many possible approaches (each with their own affordances) to digitally interpreting natural phenomena. A careful reader may have noted that the Bayer Array has twice as many green photosites as red or blue. Human vision is more sensitive to luminance levels which register more strongly in the green channel thus the Bayer Array is formatted to essentially discard red and blue color information in order to retain a greater degree of green samples.[330] In essence, red and blue information is discarded and requires increased algorithmic interpolation during the debayering process.

Despite alternative approaches to digital image capture like the incorporation of distinct red, green, and blue sensors (as was common in the "three CCD" arrays of early digital cinema), the embrace of the Bayer Array on a single sensor (typically a CMOS sensor) marks an economical decision more so than a choice based on absolute fidelity to the image. The Bayer Array is merely one possible mode of digital mediation and representation based on very particular and intentional processing algorithms. As Sean Cubitt notes, often these decisions to exploit the limitations of human vision are inversely about conforming human vision to the limitations of mediating technology. Like a Bayer Array discarding blue and red information, representing color content on digital screens undergoes a degree of color gamut remapping that discards, at best, 50 percent of the visible spectrum in most consumer displays.[331] Rather than an ideal approach, this offers a workaround to reduce energy consumption, heat, and noise as representing the entire spectrum would require a much greater degree of illumination to be perceptible since human vision is weak at the extremes of long and short wavelengths.[332]

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[330] Robinson, S. J. and Schmidt, J. T., Fluorescent Penetrant Sensitivity and Removability: What the Eye Can See, a Fluorometer Can Measure, *Materials Evaluation* Vol. 42, No. 8, (July 1984), 1029-1034.

[331] Sean Cubitt, *The Practice of Light: A Genealogy of Visual Technologies from Prints to Pixels* (The MIT Press, 2014), 148.

[332] Cubitt, *The Practice of Light*, 148.

Regardless of the fact that raw (sensor) data is inherently processed, limited, and never truly objective or transparent, extracting "raw" data from a camera's sensor has fueled the field of digital photography for still and moving image production alike. A driving factor behind this embrace of raw media owes itself precisely to the lingering connotations of the word itself. The virtual life of raw, the promise of improvement, of polish. Raw digital photography means, above all else, a degree of flexibility in post-production. Just as "raw data" is fetishized as a kind of clean slate of possibility, unmolested by subjective mediation and interpretation, raw digital photography is popularly understood as offering the same degree of "unprocessed" data. In truth, the difference between raw and processed data is merely one of degree.

Prior to raw photography's larger adoption with the introduction of Adobe's DNG (Digital Negative) format in 2004, sensor data was generally processed more aggressively in camera to output smaller image files.[333] As an alternative to raw, the JPEG (Joint Photographic Experts Group) file format results in sensor data being debayered and compressed in camera resulting in small file sizes on output to memory devices. JPEG's lossy compression offers another layer of interpretation after debayering in order to remove more data but, as a result, can increase the likelihood of artifacts like aliasing, moire, and noise, as well as decrease the smoothness of the gradient between colors (also known as posterization) [fig. 3.2]. In contrast, raw photography exports sensor data such that the processing required to make that data visually legible takes place on a computer rather than in camera. What this means on a practical level, is that working with raw digital files allows for changes in processing techniques prior to outputting a visually decoded image. Whereas JPEG compression algorithms interpret sensor data and remove varying amounts of data deemed unnecessary to create a "good-enough" image,

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[333] "Adobe Unifies Raw Photo Formats with Introduction of Digital Negative Specification," *Adobe Systems Incorporated* (27 Sept. 2004).

raw image files retain (in theory) all of the numerical data captured by the sensor, meaning that different degrees of processing can be (and must be) applied not in camera but in a post environment.
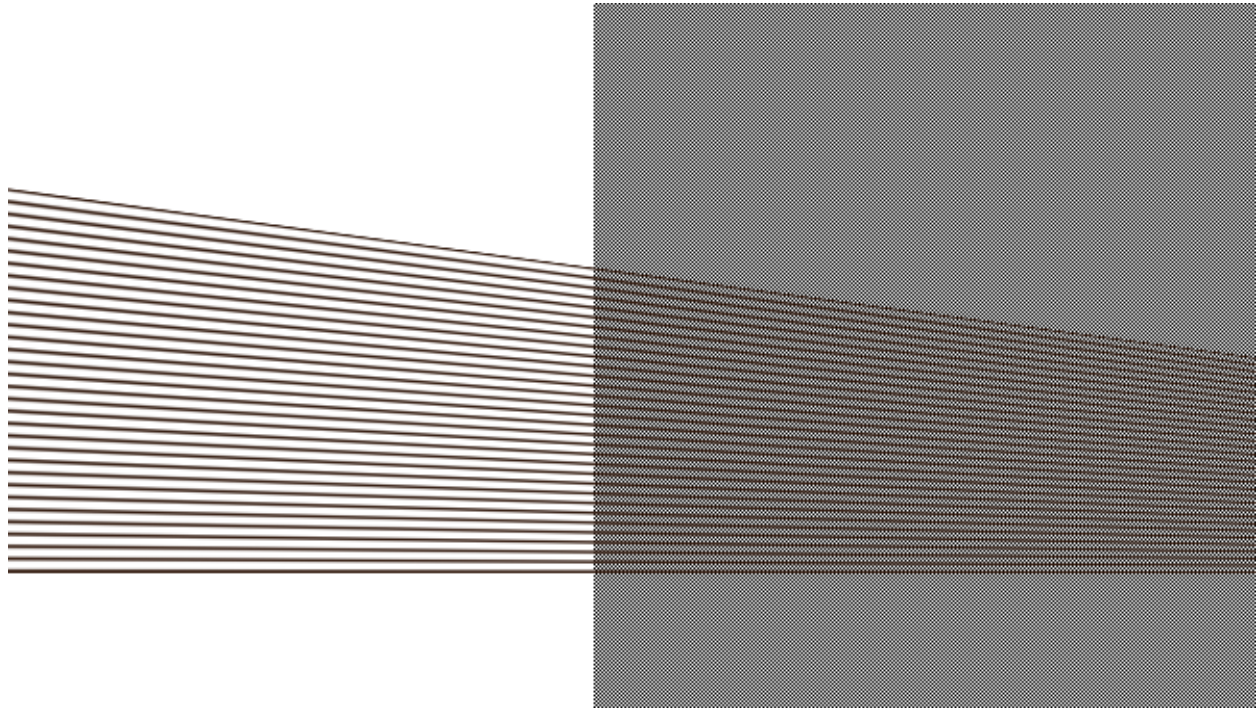

Figure 3.2: Moire (image right), a common example of artifacting in digital photography that presents itself as a strange pattern of stripes.[334]

The benefits of raw are obvious in this regard. Lossy-compression creates a smaller file size by removing what is algorithmically determined to be redundant data, but it concretizes the digital image such that post-processing is circumscribed by the remaining data not discarded through in-camera processing. Adjusting the exposure on a raw image, for example, is a non-destructive process to the extent that you are merely telling software to interpret sensor data in a different way. Changing the exposure on a JPEG image however means working with predetermined pixel values based on a prior, aggressive, method of interpolation of color and

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[334] Phil Rhodes, "What Really Causes Moiré in Cameras?," RedShark News - Video technology news and analysis, accessed October 16, 2022, https://www.redsharknews.com/production/item/5209-what-really-causes-moire-in-cameras.

luminance extracted from photosites. Raw images provide a degree of non-destructive experimentation in post. But this increased flexibility should not be misinterpreted as anything more than the externalization of one component of a larger proprietary chain of processing embedded in digital image capture from hardware through software.

On Networks, Processing, and Protocol

The temptation to imagine raw digital images as a direct link between a seemingly neutral sensor on one side and an equally indifferent screen on the other is obviously troubled by the fact that intentional decisions regarding hardware (from Bayer Arrays to the limited light output of digital screens) drastically intervene in the process of digital mediation. Beyond hardware, however, it is important to keep in mind that "every network is a network because it is constituted by protocol."[335] Whether that network is large and "decentralized" like the World Wide Web, or more seemingly closed-off like what we experience when working with raw camera data. Discussing raw camera data as necessarily "networked" might seem counterintuitive. After all, we often think of networks as a spider-web like meshwork of nodes whereas a camera raw "workflow" gives the impression of a processual wave beginning at one point and crashing at the other. From sensor to storage media to computer for processing and visualization. Of course, the reality is that raw image data is bound up in a much larger ecology.

In an attempt to undo the reification of "source code"—or the executable commands written in low-level programming languages that undergird software—, Chun argues that, despite its name, source code is undergirded by a larger network that allows it to function as a "source" to begin with:

> Source code is more accurately a *re-source*, rather than a source. Source code becomes the source of an action only after it—or more precisely its executable

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[335] Alexander R. Galloway, *Protocol: How Control Exists After Decentralization* (Cambridge: The MIT Press, 2004), xviii.

substitute—expands to include software libraries, after its executable version merges with code burned into silicon chips; and after all these signals are carefully monitored, timed, and rectified.[336]

For Chun, the tendency in popular culture, the tech industry, and academia alike is to valorize "source code" as a kind of foundational element of software and computer operations despite its networked reality. Source code is nothing but text if removed from its larger ecology which includes further layers of translation to machine executable binary through compilers, an array of hardware manufactured to respond to executable code, and internally referenced code libraries containing more lines of code. In an apt comparison to raw imagery (and raw data more broadly for that matter), source code is often mistakenly understood in a one-to-one framework. Code is written by a programmer, code is executed by the computer; a photo is taken, the data is exported to a memory device.

Like source code, raw image data is bound up into a much larger ecology. An ecology that becomes clear, in a truly Latourian way, during moments of disruption.[337] However, Chun's broadening of the "networks" of source code fails to expand to an even broader and arguably more significant collection of nodes in this larger meshwork. Gillespie notes that with the expansion of digital media—and in this definition of media we might include software—commercial industries and the technology they produce which allow for digital mediation, often take an outsized role in regulating what media circulate and how. Gillespie considers Digital Rights Management—like the Content Scramble System discussed in chapter 2—as an example given that, among other things, it delimits the possibilities of fair use as legally defined.[338] In the case of source code, we might include Oracle Corporation's Supreme Court

[336] Wendy Hui Kyong Chung, *Programmed Visions: Software and Memory* (Cambridge: The MIT Press, 2011), 25.
[337] Latour, *An Inquiry into Modes of Existence*, 32.
[338] Tarleton Gillespie, *Wired Shut: Copyright and the Shape of Digital Culture* (Cambridge: The MIT Press, 2007), 280.

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argument against Google that its Java programming language's API (application programming interface which essentially defines how different types of code communicate) is copyrightable, a claim which would necessitate the imposition of increased incompatibility standards to enforce.[339] While the court ruled that Google's incorporation of Java APIs amounted to fair use, it also granted that "the entire Sun Java API falls within the definition of that which can be copyrighted."[340] Justice Breyer's comment in the majority opinion marked a win for Google but left the door open for the implementation of proprietary technology to enforce copyright outside of the courts. A significant node in the "network" of source code.

Invoking Heidegger's claim that technology is most visible at the point of failure, Latour reminds us that "under the word 'network,' we must be careful not to confuse what circulates *once everything is in place* with the *setups* involving the heterogeneous set of elements that allow circulation to occur."[341] During moments of "network interruption," these two distinctions— "network" as what circulates and "network" as the conditions of that circulation—collapse.[342] Disruption allows for the contours of the larger network to become visible. In the case of raw photography, network disruption often comes in the form of incompatibility. Before raw digital photography made its way into the moving image market, it caused a stir in the still photography world. Although most high-end still cameras had raw capabilities by 2005, the market lacked a fixed standard. To the shock of Nikon users in particular, the camera company announced that its NEF files (Nikon's proprietary raw file

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[339] Joe Mullin, "Second *Oracle* v. *Google* trial could lead to huge headaches for developers," *arsTechnica* (8 May 2016).

[340] Justice Steven Breyer quoted in Timothy B. Lee, "How the Supreme Court saved the software industry from API copyrights, *arsTechnica* (6 April 2021).

[341] Ruth Irwin, "Heidegger and Stiegler on Failure and Technology," *Educational Philosophy and Theory*, 52:4 (2020), 362;
Latour, *An Inquiry into Modes of Existence*, 32.

[342] Latour, *An Inquiry into Modes of Existence*, 32.

format) would be encrypted to only operate with full flexibility by purchasing Nikon's own raw editing software. In support of the new restrictions on NEF use, a Nikon representative argued, "We built certain levels of protection into those files to protect proprietary intellectual property about how our cameras work."[343]

Like DRM software or the looming possibility of the intentional incompatibility of APIs, Nikon's decision resulted in a short-lived fracturing of the seamlessness of raw as a mode of digital image capture. No longer was this process one between sensor, memory card, and personal computer. Instead, the realities of the network revealed themselves. One angry user in particular is quoted as saying, "Nikon apparently thinks that my work belongs to THEM, not me! If they someday decide to change the format, they can hold my photos hostage forever!"[344] This demystifying of the contours of the network through disruption reminds users of digital devices that "every network is a network because it is constituted by a protocol."[345] Despite raw data signifying a kind of untouched and unprocessed information, the very foundation of its existence relies on a set of predefined, often proprietary procedures, rules, and material infrastructure which dictate how raw data is captured, accessed, and modified.

In response to the growing fractious landscape of raw digital photography, Adobe developed its Digital Negative (DNG) format. While patented, DNG is freely licensable. However, even though Adobe DNG has simplified the raw landscape, its development is no doubt central to the growth of Adobe's collection of paid and proprietary photo editing tools like Lightroom and Photoshop. Threatened by patented raw formats from camera manufacturers like Nikon, whose NEF would not work properly in Photoshop, Adobe relied on a "royalty-free" approach to ensure its post-production software remained dominant in the industry.

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[343] David Pogue, "Pixels and Protocol," *The New York Times* (5 May 2005).
[344] Pogue, "Pixels and Protocol."
[345] Galloway, *Protocol*, XVIII.

Moving Raw to the Moving Image

The myth of raw data is even more complex when discussing its role in digital cinema. Adobe DNG's open license approach in the world of digital photography effectively ironed out the seams of the network allowing for the illusory flow of "raw" data to continue. However, moving images posed a different set of problems requiring a new suite of proprietary solutions. Raw digital photography using a CMOS sensor operates by first reading the static voltage at each photodiode, enabling light to hit the sensor (through the opening and closing of a shutter or turning on and off each photodiode), storing electrons at each photodiode, converting those electrons into voltages, comparing the voltage against the static voltage as a means of removing noise at each photosite, converting those voltages into digital signals via analog/digital converters, and finally outputting that digital data to a memory card. For still photography, this process results in a data file measured in megabytes (MB), generally about two times the size of the megapixel (photodiode) count of the sensor depending on bit depth. As an example, 24-megapixel sensor would output a raw file of about 48 megabytes (at a high bit depth).

For a mode of digital capture that is relatively slow like still photography, a data stream of 48 megabytes per exposure can be handled easily based on the architecture of CMOS sensors and the read/write speed of most compact flash and secure digital (SD) storage solutions. Moving image media poses a different set of challenges however, owing to the fact that for each one second of video, the camera would need to carry out the process of capture and data transfer a minimum of 23.976 times (the standard cinema frame rate). This effectively means that, following raw specifications for still photography, 1,152 megabytes (or 1.152 gigabytes) would need to be written to a digital storage medium every second for video. While those data rates are already impossibly high to manage for consumer grade storage media like those used for digital

photography, those numbers compounded would mean that one minute of raw video footage would result in approximately 70 gigabytes of data. A 120-minute feature film production shot at a rate of 5:1 (five times as much unused captured footage as the final film contains) would amass approximately 42 terabytes worth of data—a significant amount even at the time of this writing when hard drive space per dollar has seen rapid improvement.

The Dalsa Origin—which premiered in 2003 and saw its first use in the field in 2006—captured "uncompressed" raw images with a resolution of 4096 pixels by 2048 pixels (better known as 4K) but recorded to a proprietary storage device created in partnership with Codex Digital. Connected to the Codex Digital recorder by a quarter inch 4-braided-band fiber optic cable, the Dalsa Origin could output raw files at the data rates necessary for digital cinema and at equivalent resolution to analog filmstock (estimated at 4K). That said, the Codex Digital recorder consisted of 10 hard drives split between two RAID array decks totaling about 2 terabytes of space and, given the Origin's data rates, could hold only about 54 minutes of footage.[346] The Dalsa Origin represented a step toward raw digital video but was not viable for anything other than large-scale productions due to its massive files. More often than not, those larger productions were just as happy shooting on the tried-and-true medium of celluloid that promised equal (if not better) image quality and a network of industry professionals knowledgeable in the ins-and-outs of analog film production.

Alongside the Origin, professional digital video capture by cameras like Sony's HDW-F900 relied on HDCAM and HDCAM SR ("superior resolution") storage media to record high definition (1920 pixels by 1080 pixels) of compressed content maxing out at 440 megabytes

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[346] Jay Holben, "Catching Up with the Dalsa Origin, *American Cinematographer* (January 2007), 108.

per second.[347] Unlike the Origin, HDCAM SR fell far below the data rates needed for raw image capture at 4K resolution or even at the then industry standard 2K (2048 x 1080) resolution used in most digital post-production environments and for nascent digital theatrical delivery. Although its file sizes were noticeably smaller than the Origin's, the cost of operation, HDCAM SR tapes, untried workflow, and lack of manipulability of the captured footage due to overly aggressive in-camera compression, limited the use of HDCAM SR and cameras utilizing the storage medium like the HDW-F900 to those with an agenda focused on pushing digital cinema adoption. The most famous of these digital apostles being George Lucas, who essentially contracted Sony and Panavision to create HDCAM SR and the F900 in order for him to stay within an entirely digital workflow for *Star Wars Episode II: Attack of the Clones* (2002).[348]

Other digital video cameras like the Arriflex D-20 which launched in 2005, utilized both the techniques of the Dalsa Origin and the Sony HDW-F900. With the option to record in either "Data Mode" or "HD Mode," the D-20 could output "uncompressed" 2K raw data to costly S.2 digital field recorders in Data Mode, or compressed 1920 x 1080 (HD) images to an HDCAM SR recorder in HD Mode. Despite the Arri D-20's incorporation of a single Super 35MM size CMOS sensor which set the standard for future digital video capture, the D-20 workflow was complicated, the file sizes were massive, and the picture quality (particularly in HD mode) was lacking in comparison to analog film.[349] Mateer notes that even Arriflex's own publicity for the D-20 admitted that the camera was not meant as a replacement for analog film, but rather another

[347] "Sony HDCAM SR FAQ," *Sony* (Dec. 2007), *Wayback Machine*, http://www.sonybiz.net/biz/view/ShowContent.action?site=biz_en_GB&contentId=1164903089736&parentFlexibleHub=1169220709744.
[348] John Mateer, "Digital Cinematography: Evolution of Craft or Revolution in Production," *Journal of Film and Video* 66.2 (Summer 2014), 5.
[349] The Dalsa Origin used a single CCD (Charged Couple Device) sensor and the Sony HDW-F900 used three, smaller CCD chips to capture red, green, and blue information respectively. CCDs are notoriously power hungry and slower in their data transfer speeds owing to their less efficient circuitry.

tool useful only in the right context. Mateer quotes Arri digital camera project manager Bill Lovell as saying, "Film will continue to be the preferred acquisition format when its benefits are paramount, but if digital is the tool for the job, then we have a camera here for you to do it."[350]

The quest for affordable raw video capture at 4K resolution without the need for costly external storage devices would ultimately come to shape the discourse around Red Cameras. Popular press coverage of the Red One camera focuses primarily on its ability to capture 4K imagery but, as we have seen, cameras like the Dalsa Origin had already achieved that distinction years before Red's arrival. Similarly, raw video capture was also well established including in 4K (again, by the Dalso Origin). The RED One was considerably lower in price than its competitors but making the $17,500 "brain" (essentially a computer with an image sensor) operable as a video camera required thousands of dollars in additional proprietary add-ons greatly reducing the cost savings associated with the camera. Contradictorily, what makes the RED One such a unique camera is its offering of a compressed raw format. Adding an additional layer of processing to the "raw" data of the sensor, the RED One could output compressed raw sensor data in their proprietary R3D files. Raw data is an oxymoron, and in RED's case a new layer of mediation was positioned between sensor and debayering, namely REDCODE RAW further highlighting the intentional layer of mediation data undergoes before it can be declared "raw data."

REDCODE RAW

Discussions about the RED One—RED's first camera offering—generally center around its 4K capture, price point, sensor, and ability to record data to its relatively small (proprietary) compact flash drives. This is true of both marketing material and more in-depth examinations of the

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[350] Bill Lovell quoted in John Mateer, "Digital Cinematography: Evolution of Craft or Revolution in Production," *Journal of Film and Video* 66.2 (Summer 2014), 7.

camera:

> Although technologically it was not radically different from the Arri D20, a number of
> key differences did represent a shift from conventional film and HD systems. The CMOS
> chip developed by Red, Mysterium, had a full resolution of over 4K, which was
> significantly larger than Arri's and was the largest commonly available image format
> made (similar to Super 35mm film). Likewise, the chip had extended latitude and
> sensitivity similar to mid-level film stocks. Rather than using tape recorders or bespoke
> data cartridges, the Red One could record to commonly available CompactFlash cards
> and portable hard drives. This reliance on established data technologies ensured that
> production and postproduction support could be accomplished through time-tested IT
> methods. A very low price point for the camera body itself ($17,500 on release) meant
> that the overall cost for a Red system was significantly less than HD systems and a
> fraction of the cost of a film system.[351]

What is missed is the fact that the majority of these new affordances were previously operative in

other cameras as already discussed. In this hype, there is a tendency to ignore compression as the

fundamental fixture of media and that is just as true when discussing RED Cameras as when

discussing the broader state of digital media more generally. In Sterne's study of MP3

technology, he reminds us that compression—or in the case of digital media, the removal of

information to decrease file size—is not a new technology emerging alongside digital media but

rather central to media history.[352] The circularity of vinyl records, tape machines, and film reels;

the spinning hands of clocks; the split and stacked vellum of a codex; the carefully calculated

efficiency of dots and dashes of Morse code; even the gestural media of the human body, carry

ever greater amounts of information from source to source as efficiently (both in terms of energy

expenditure and space) as possible. RED's contribution to—and contradictorily as I will detail,

its diminution of—digital cinema was its use of compression.

REDCODE RAW is a compression algorithm that discards a particular ratio of raw

sensor data prior to the debayering process. Unlike typical video compression which removes

various amounts of data after the image undergoes debayering leaving the final image with a

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[351] Mateer, "Digital Cinematography," 8.
[352] Sterne, *MP3*, 6.

fixed amount of visual information that, depending on data levels, can withstand only limited post-production processing before artifacts are introduced, REDCODE RAW compresses the sensor data and offloads all debayering to an external device. REDCODE RAW represents a relatively lossless mode of compression that still allows the filmmaker the benefits of raw in post (non-destructive control over exposure, white balance, sharpening, etc.).

More importantly, REDCODE RAW allows for the careful control of data rates meaning that 4K content can be captured in raw to relatively inexpensive and less obtrusive storage devices. REDCODE 36 (REDCODE RAW's highest data rate for the RED One) offered data rates of approximately 36MB per second or, on average, 1.8 GB per minute.[353] RED's current REDCODE RAW offerings range in data rates from 259MB per second at REDCODE 5:1 ratio film in 8K resolution (7,680 pixels by 4,320 pixels) down to 59 MB per second for the same 8K raw footage at a 22:1 compression ratio.[354] The variability and built in compression of REDCODE RAW has effectively ushered in an era which might best be called the race for resolution. Increasing resolution of the digital image is rapidly becoming the primary means of marketing cameras, displays, phones, and more. Despite the RED One's marketing as introducing raw 4K imagery at relatively low data rates, cinematographer Christopher Probst questions the viability of these claims. On the one hand, Probst notes that owing to the mechanics of Bayer arrays and their use of subsampling as discussed above, a 4K sensor would only truly be 4K when shooting in black and white given that each photodiode would be used completely rather than the averaging and algorithmic estimating of color values in the checkerboard array. Probst has similar reservations regarding RED's use of the word "raw." Probst states, "Given that significant amount of compression, coupled with the Bayer-pattern

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[353] Christopher Probst, "Working With the Red," *American Cinematographer* (February 2010), 66.

[354] "Red Recording Time," *Red* (2022), https://www.red.com/recording-time.

sensor's color/resolution considerations, I have a hard time calling the RED's .r3d files true RAW data."[355]

Probst's critique of RED is less about the functionality of the cameras the company manufactures and more about its marketing of those cameras. For Probst, marketing the RED One as true 4K raw is misleading due to the techniques the algorithms utilize to limit the data stream which is necessary for "4K raw" to actually be captured. This critique of course raises questions as to what degree of manipulation is acceptable when it comes to "raw" sensor data? Regardless of how we might answer this more esoteric question, the result of RED's incorporation of two fundamental keywords of "quality" in digital video, namely "raw" and "4K" meant, for many, that digital video had finally arrived. Early adopters like Steven Soderbergh praised the RED One as offering the first truly "filmic" digital images and the industry was quick to respond with praise, concern, and competition.[356]

The existing histories of digital cinema tend to focus on the arrival of the RED One as the first nail in the coffin of analog cinema, a claim that holds some water. 2021 saw approximately 30 movies shot on 35mm film out of about 403 total theatrical releases in the United States and Canada, a number that represents an almost 100 percent inversion of format since 2008 when the RED One became more widely available.[357] Despite cinematographers like Probst questioning the claims of RED's marketing hype, RED's creation of REDCODE RAW effectively propelled an increasing drive for resolution and "raw" capability into both industry practice and, by extension, popular culture. The ability to film in "4K raw" to less cumbersome storage ushered in a new era. And yet, these very same technologies, hyped through clever marketing and shrewd

[355] Probst, "Working With the Red," 66.
[356] Michael Behar, "Analog Meets Its Match in Red Digital Cinema's Ultra High-Res Camera," *Wired* (18 Aug. 2008).
[357] Vadim Rizov, "The (Approximately) 30 Movies of 2021 Shot on 35mm," *Filmmaker Magazine* (18 Jan. 2022).

business tactics, have excelled at the expense of long-term sustainability cinematic artifacts.

The Codec Wars

As the primary technology allowing for RED's impact on the film industry, REDCODE RAW

remains a heavily protected one. Loosely detailed in an original patent filing on April 11, 2008,

the details of REDCODE RAW are incredibly general and overly vague. In US patent 8,174,560,

RECODE RAW is briefly mentioned alongside the rest of RED's camera system. In the patent

abstract—which offers about as many specifics as are detailed in the patent overall—the system

is described as follows:

> A video camera can be configured to highly compress video data in a visually lossless manner. The camera can be configured to transform blue and red image data in a manner that enhances the compressibility of the data. The data can then be compressed and stored in this form. This allows a user to reconstruct the red and blue data to obtain the original raw data for a modified version of the original raw data that is visually lossless when demosaiced. Additionally, the data can be processed in a manner in which the green image elements are demosaiced first and then the red and blue elements are reconstructed based on values of the demosaiced green image elements.[358]

What is novel about this patent is the possibility of compressing video data prior to demosaicing.

Overall, the patent describes a fairly prosaic camera system utilizing a single sensor overlaid

with a Bayer Array, lens system, and internal or external storage but differs in its ability to

compress raw data and reconstruct it prior to demosaicing/debayering.

Although this might seem fairly insignificant, the patenting of REDCODE RAW in such

general terms has fundamentally shaped film production and has reverberated into all areas of the

film industry. While discussions about the "black boxing" of technology and implications of

screening-off the functionality of technology through easy-to-understand interfaces is significant,

perhaps more important is the roping-off of these same technologies through overly aggressive

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[358] United States Patent US 8,174,560 B2 (8 May 2012).

patent law.[359] In the case of REDCODE RAW, multiple lawsuits filed on behalf of RED (and

against RED) illustrate the extent to which RED has effectively blocked other manufacturers

from developing efficient "compressed" raw systems regardless of understanding the underlying

technology. In two lawsuits involving Sony and Apple, RED defended its patent and charged its

competitors with infringement on the grounds that they adopted "compressed raw" into their

workflows.

In the case of Sony, RED filed its complaint for patent infringement with the United

States District Court of the Southern District of California on February 13, 2013. RED charged

Sony Corporation of America and Sony Electronics Inc. with infringing on U.S. Patent No.

8,174,560 "duly and lawfully issued on May 8, 2012, describing and claiming the invention

entitled 'Video Camera.'"[360] As previously discussed, "Video Camera" in the case of this patent

is defined quite broadly and this particular infringement claim ultimately revolved around Sony's

incorporation of "compressed raw" into their newly released F65, F5, and F55 cameras, a

technology which comes to define "Video Camera" in RED's original and subsequent patents.

Compression algorithms are frequently at the center of patent infringement cases

regardless of the actual functioning of the algorithms themselves. In perhaps the most famous

early case, information technology company Unisys threatened legal action against NASA Ames

Research Center employee James A. Woods in 1987 for his development of image compression

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[359] For more on the effects of "black boxing" see: Vilém Flusser, *Towards a Philosophy of Photography* (London: Reaktion Books, 1984);
Wendy Hui Kyong Chun, "On 'Sourcery,' or Code as Fetish," *Configurations* 16, (2008);
Timo Kaerlein, "Playing with Personal Media: On an Epistemology of Ignorance," *Culture Unbound* Vol. 5 (2013), 651-670;
Boris Groys, *Under Suspicion: A Phenomenology of Media* (New York: Columbia University Press, 2012).
[360] United States District Court Southern District of California, Red.com., dba Red Digital Cinema vs. Sony Corporation of America and Sony Electronics Inc., Case Number 13CV0334MMABGS, 3.

software "Compress." Unisys argued that Woods's compression software infringed on its Lempel-Ziv-Welch (LZW) algorithm due to the end result rather than the actual specific underlying code of the algorithm which differed markedly from LZW.[361] Ultimately settled out of court, the role of LZW (a compression algorithm central to GIFs) none-the-less has become a solid example of what is known as a "standard essential patent," or a patent that stands in the way of engaging with an industry standard. The LZW algorithm, regardless of its specific underlying code, stood in for image compression more broadly and served to lock out competing algorithms that achieved similar ends. Recognizing its monopoly, Unisys became particularly litigious, publicly announcing its intent to "sue all commercial developers who did not secure the appropriate licensing rights."[362] Unisys even went so far as to threaten amateur homebrew programmers stating, "[people] writing their own stuff using C code" should have a proper license because "we have a patent on [the] technology and we mean to protect it."[363]

Almost 30 years later, the messiness of algorithm patents has only worsened, a situation which Red founder Jim Jannard has embraced to his advantage responding broadly to potential infringement in a way not dissimilar to Unisys's protection of the LZW compression algorithm. In response to the release of the Sony F5, F55, and F65 cameras in 2012, Jannard's lawsuit against Sony not only called for an injunction to stop all sales of these cameras and issue an award for damages, but also requested that Sony" deliver up and destroy all infringing cameras" due to their incorporation of compressed raw.[364] Jannard, not one to shy away from making brash public statements, commented on the lawsuit posting a lengthy screed on RED's user forum

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[361] Gerardo Con Diaz, *Software Rights: How Patent Law Transformed Software Development in America* (New Haven: Yale University Press, 2019), 232.

[362] Con Diaz, *Software Rights*, 238.

[363] Con Diaz, *Software Rights*, 238.

[364] Red.com, Inc., dba Red Digital Cinema v Sony Corporation of America & Sony Electronics Inc., Case No: 13CV0334MMABGS (12 February 2013), 7.

REDUser.net:

> We have taken a bit of flak for filing a lawsuit against Sony Electronics.
> #1. Sony stepped up and finally supported 4K from cameras to displays. That is helping to cement 4K as the real cinema standard. Good. We actually have a Sony 4K 84" display and Sony 4K projector at RSH for reference. But…
>
> #2. We are heavily invested in concepts, inventions, designs, development and manufacturing of RED cameras, REDRAY and the RED Projector. Each is unique and has motivated the industry to get better, for the benefit of all. We don't mind others joining the 4K revolution… quite the contrary, we embrace it. What we don't accept is others just borrowing our technology, intentionally or unintentionally. We admire invention and happily pay for and license great technology from other companies when it is useful to our program.
>
> #3. We have created many jobs in the US leveraging our vision and technology and we will aggressively protect our employees. Every single job matters. It is a magic trick to build a camera in the US, especially at the highest level. This cannot be done if others are allowed to just take what we have done and use our work as their own.
>
> #4. Our customers have invested in our technology. They need to be protected and their investment needs to be protected. We have an obligation to our customers so they will not have their investment diluted by a proliferation of the proprietary technology they invested in.
>
> We don't tend to be heavy handed. We saw 4K as the future standard in 2005. We have endured comments that "RED was a scam." "1080P was good enough." "What does a sunglass guy know about cameras?" … as well as others I would never publish. Patents are here for a reason. They protect IP. Receiving a patent now means that you have an obligation to protect it…or they have absolutely no value whatsoever.
>
> We are anxious to resolve this and have everyone move along. But in the end…our ideas, employees and customers matter. We will tenaciously protect all of them.[365]

Regardless of whether the lawsuit represented a good faith attempt by Jannard to advocate for

the best interests of his employees and customers, or simply functioned as a means to lock out

RED's competition, it has nonetheless had a chilling effect on the continued development of

compressed raw formats. Ultimately settled out of court after Sony countersued RED for patent

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[365] Jim Jannard quoted in Steve Dent, "Red sues Sony over patents, wants disputed F-series cameras 'destroyed'," *Engadget* (14 February 2013), https://www.engadget.com/2013-02-14-red-sues-sony-over-patents-wants-offending-f-series-cameras-de.html?guccounter=1.

infringement alleging that RED's entire product line infringed on seven of Sony's patents, the

broad patent on raw compression has shaped how camera manufacturers incorporate raw

workflows into their product lines.[366]

Following on the heels of Sony, technology behemoth Apple Inc. filed a petition to

institute an *inter partes* review of RED's REDCODE RAW patent in May of 2019 arguing that

RED's iteration of compressed raw imagery was unpatentable and merely represented an

"obvious" approach to media capture based on two preexisting patents (US 9,565,419 B2 and US

7,656,561 B2). In a ruling entered on November 8, 2019, Patent Judges Brian J. McNamara, J.

John Lee, and Jason M. Repko denied Apple's petition arguing, "petitioner has not shown a

reasonable likelihood that it would prevail in establishing that any of the challenged claims 1-30

are unpatentable."[367]

The ruling is worth examining precisely because it represents the broad reach of RED's

patent. At its core, the decision made by the three patent judges hinges on linguistic play more so

than any technological novelty of REDCODE RAW itself. Apple's argument points to the

likeness of hardware configuration and overall process defined by US patent 9,565,419 to RED's

patent and also to the description of algorithmic processes defined by US patent 7,656,561 which

illustrates how to achieve (effectively) lossless compression of mosaiced data from a Bayer

array. For Apple, RED's patent merely takes these two prior ideas and combines them as the

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[366] Sean Buckley, "Sony responds to Red lawsuit with its own patent claims, seeks damages, injunction," *Engadget* (07 April 2013), https://www.engadget.com/2013-04-08-sony-responds-to-red-lawsuit-with-its-own-patent-claims .html.
Sony's filing essentially mirrored Jannard's comments on the REDuser forum arguing, "Sony is seeking both money damages and an injunction to stop the continued sale of Red's infringing products. Sony makes significant investments into the research and development of technology related to the cinema camera industry and intends to protect those investments against companies that infringe our patents."
[367] Apple Inc., v. Red.com LLC, Decision Denying Institution of *Inter Partes* Review (8 November 2019), 18.

basis for its own patent. For the Judges, although both prior patents taken together lay out a

digital camera system making use of "lossless" compression on data from a Bayer array, the

patents do not discuss how one defines "substantially visually lossless," a central component of

RED's patent. The Judges assert, "Petitioner does not explain how Presler's decompressed and

demosaiced image is 'substantially visually lossless'. *Id.* For instance, Petitioner does not discuss

(1) a side-by-side comparison with original (never compressed) image data on the same display

device or (2) why one of ordinary skill in the art would not be able to determine which image is

the original with a reasonable degree of accuracy."[368] The failure of the prior patents to

adequately define "substantially visually lossless" (or what we might think of as perceived

quality) in material terms precludes the possibility of claiming the "obviousness rationale" as a

means of voiding RED's patent.

In response to the ruling, Chinese camera manufacturer Kinefinity removed compressed

raw codecs from its camera offerings stating, "Starting from March 1, 2021, Kinefinity removes

CinemaDNG codec from MAVO LF, MAVO 6K, and TERRA 4K on the current camera line,

also drops the planned KRW2.0 codec, for the well-known reason in the industry."[369] The

"well-known reason" is, of course, RED's patent and its subsequent upholding through multiple

challenges. Effectively, the REDCODE RAW patent has operated as a means of restricting

compressed raw functionality to RED's own offerings, a savvy business tactic given the industry

desire for "raw" sensor data and its connection to "quality cinema" and flexibility in post. While

competing manufacturers continue to include the option to shoot "raw," these offerings are either

uncompressed and result in massive files as previously discussed, or utilize a work around like

Blackmagic's BRaw which partially debayers/demosaics the image prior to its being written to a

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[368] Apple Inc., v. Red.com LLC, 13.
[369] Jakub Han, "Kinefinity Removes CinemaDNG and Other Raw Codecs from Its Cameras," *CineD.com* (2 March 2021).

storage device, a technique that offers some of the same benefits of REDCODE RAW but due to partial demosaicing in camera, limits some of the level of flexibility that comes with "raw" sensor data.

Archiving Loss

The stakes of these legal battles that superficially play out as merely a company protecting its hard earned assets, reverberate beyond the film set. RED's hold on compressed raw codecs shapes the industry in one specifically profound way: RED's ability to compress raw sensor data before debayering allows for larger and larger data streams to be output to storage media. This, of course, gives RED the edge in the independent production market given that REDCODE allows for high resolution raw capture but only requires a fraction of the storage needs resulting in a much smaller total data output overall. Less data, means fewer hard drives, and fewer hard drives means a substantially lower total bill for feature film shoots in particular. More significantly however, decreasing the size of the data stream contradictorily opens the door to increasing the data stream to take advantage of the max bandwidth available. While data compression is often considered a means of fitting data streams into existing infrastructural limitations, RED illustrates that compression algorithms often are far more agential in shaping that overall infrastructure. For example, RED has taken advantage of their compressed raw algorithm to allow for increased resolution image capture. The RED One's 4K Mysterium sensor was soon eclipsed by its 5K Mysterium, 6K Dragon, and most recently, its V-Raptor sensor which allows for 8K raw capture at up to 120 frames per second.[370] Increasingly, REDCODE RAW has forced the adoption of higher resolution image capture regardless of need. Higher resolution image capture has not been a requirement awaiting a compression algorithm for

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[370] "V-Raptor: All New Multi-Format Sensor | Up to 120 FPS at 8K," *RED*, https://www.red.com/v-raptor.

implementation, but rather compression algorithms have driven the desire to increase resolution to largely unnecessary levels. Compression algorithms, in this instance, are inseparable from infrastructure as both allow for and prompt the adoption of 8K capture and beyond.

With RED's hold on compressed raw, other competing manufacturers have gone in one of two directions: Either they have spurned compression altogether—as is the case with high-end camera manufacturer Arri whose ArriRaw is touted as being "uncompressed, unencrypted and uncompromised sensor data"— or they have implemented workarounds while fighting at the level of resolution.[371] BlackMagic Design has taken the latter approach, introducing a 12K camera capturing footage in the compromised BRaw format as previously discussed.[372] Ultimately, both of these approaches result in exceptionally large files which only continue to grow larger in response to RED's increasing push for higher resolution as it takes advantage of its heavily protected REDCODE Raw algorithm.

It is important to note that the film industry overall grows unevenly from a technological perspective and changes are not always uniformly necessary or desired. In the case of resolution, for instance, it is debatable whether or not an increase from 4K to 8K registers for the average viewer in the average home viewing conditions. The standard limit of optical acuity is defined as one arcminute or "the minimum separable angle for 20/20 vision," or the smallest distance between two objects detectable by most human eyes.[373] The point at which one pixel is equivalent to one arcminute is approximately 2,700 pixels on a 65 inch screen at a distance of

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[371] "File Formats & Data Handling," ARRI, accessed October 16, 2022, https://www.arri.com/en/learn-help/learn-help-camera-system/pre-postproduction/file-formats-data-handling.

[372] "Blackmagic Ursa Mini Pro 12K," *Blackmagic Design*, https://www.blackmagicdesign.com/products/blackmagicursaminipro.

[373] Kenichiro Masaoka, Takahiro Niida, Miya Murakami, Kenji Suzuki, Masayuki Sugawara, Yuji Nojiri, "Perceptual limit to display resolution of images as per visual acuity," *Human Vision and Electronic Imaging XIII* (14 February 2008).

about 6.6 feet.[374] Regardless of the limitations of human vision, 8K television and viewing

environments are being heavily marketed and sold as the next evolution in moving picture

viewing. Despite scant empirical evidence that home viewers would benefit from 8K televisions,

this resolution increase is the logical next step particularly as 8K productions are increasingly the

norm.

From a production perspective, shooting 8K makes sense primarily because of the

reframing possibilities particularly when finishing at a more commonly accepted standard like

4K or even 2K. Filming in a higher resolution allows for a certain degree of enlarging the frame

before noticeable pixelation occurs when working on a lower resolution timeline. However, as

8K productions increase in number, the appeal of watching content in its native resolution

becomes a stronger and stronger marketing tool. Following this line then, production resolution

will continue to increase to take advantage of reframing possibilities while home viewing

technology plays catch up in a largely unnecessary race to "transparency" which, if consortiums

like the 8K alliance are to be believed, hinges solely on resolution.[375]

As production and exhibition technology pushes on in the never ending race toward

ever-higher resolution, preservation—arguably the most neglected component of the film

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[374] Jeff Hecht, "Television Goes 8K: Can You See the Difference?," *Optics and Photonics News* (May 2020), 45.

[375] Perhaps most comical about the linkage of resolution and "reality" is that regardless of resolution, the fundamental differentiating factor between human visual experience and filmic reproduction hinges on the artificiality of temporal fragmentation discussed in regards to cinema as far back as Henri Bergson's linkage of cinema and Zeno's Paradox. No matter how pristine a digital moving image might look, the fluidity of reality is always lost in the interstices between frames, a shortcoming that arguably can never be rectified and will always limit the possibility of true "transparent immediacy." Oddly enough, this is precisely what gives cinema its "cinematic quality." The unique motion blur attributable to 24 frames per second capture gives cinema its dream-like quality as opposed to the hypereal "soap opera" effect of higher frame rates. A quality that Peter Jackson attempted to usurp and why many critics found his Hobbit films oddly discomfiting.
Henri Bergson, *Creative Evolution* (New York: Henry Holt and Company, 1911), 308.

industry—is further buried under the growing mound of data. Despite some growth in preservation technology, the archival industry is still largely reliant on the same material substrate in use for the past 50 years. Magnetic tape (Linear Tape Open), spinning disk platters (hard drives), and transistors (solid state drives) make up nearly the entirety of the underlying media which house the data of countless digital productions albeit often offering more storage for less costs with each new generation of hardware.[376] Even with increased storage capacity the sheer volume of data generated, particularly when filming in high resolution raw formats, makes long term preservation increasingly difficult to facilitate [fig. 3.3].

Format	Nominal Bitrate (Mbps)	Nominal Bitrate (MBps)	Frame Rate (fps)	Frame Size (MB)	One Hour of Content (GB)
SD	50	6	30	0.2	22
HD	100	13	30	0.4	44
Uncompressed SD	270	34	30	1.1	119
XAVC 4k	330	41	24	1.7	145
ProRes422 HQ 4k	754	94	24	3.9	331
ProRes4444 4k	1100	138	24	5.7	483
BlackMagic 4k	1400	175	24	7.3	615
Uncompressed HD	1500	188	24	7.8	659
Sony F65 RAW (3:1) 4k	2000	250	24	10.4	879
ProRes4444 XQ 5k	2100	263	24	10.9	923
Canon RAW 12bit 4k	2300	288	24	12.0	1,011
Uncompressed 4k	12000	1,500	24	62.5	5,273

Figure 3.3: "Data Scale in Media and Entertainment," *The Media Workflow Puzzle*.[377]

Often, in order to cope with this increasing growth of digital content, entertainment industry archives typically adopt an approach known as Hierarchical Storage Management (HSM) allocating faster, more expensive storage media for content more recently created or accessed while relegating less accessed material to slower media. A typical tiered approach will include a mix of solid state hard drives, spinning disk drives, and data tape with Linear Tape Open representing the lowest, slowest, and most cost effective tier [fig 3.4]. As I have already

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[376] *The Media Workflow Puzzle: How it All Fits Together,* eds. Chris Lennon and Clyde Smith (New York: Routledge, 2021), 190.
[377] *The Media Workflow Puzzle*, 190.

explained in chapter two, Linear Tape Open, while certainly a much more cost effective and secure storage medium than hard drives, is prone to forced obsolescence with limited backwards read/write compatibility and an increasingly limited supply of manufacturers.[378] Furthermore, the need to migrate content between LTO cartridges to stave off obsolescence and to ensure longevity of storage is not only excessively expensive—as already discussed in chapter two—, but incredibly time consuming as "each read, write, and unmount cycle can take several hours" meaning that it takes even relatively small archives "months or even years" to appropriately migrate their content.[379]

Storage Tier	Digital Archive Lifecycle	On Premise Technology	Cloud Technology	Relative Performance	Relative Cost	Relative Scale
Tier 0	Creation	Solid State, SAN	Cloud Workloads Only	★★★★★	$$$$$	
	Creation	Performance NAS, SAN	Performance	★★★★	$$$$	
Tier 2	Dissemination	Scale Out NAS, Object Storage	Reduced SLA	★★★	$$$	
	Archive	Object Storage, Data Tape	Archive	★★	$$	
Tier 4	Archive	Data Tape Shelves	Cold Archive	★	$	Near Infinite

Figure 3.4: "Storage Tiers Comparison," *The Media Workflow Puzzle.*[380]

Of key concern here is the definition of quality as defined by the production, exhibition, and archival industries as differentiated components of a larger film ecology. The flexibility offered by raw and higher resolutions in the production realm mark "quality" as a kind of promise of improvement and change (as mentioned previously regarding the virtuality of raw). Quality as defined in production environments is often linked to bitrate, bit depth, chroma subsampling and overall possibility of control over the image in a post-production environment (precisely the reason why raw video is so appealing). Beyond simplistic accounts of resolution alone, each of these other components shape the perceived quality and manipulability of digital

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[378] As of this writing, only two companies manufacture LTO (Fujifilm and Sony) although Hewlett Packard Enterprises, IBM, and Quantum are all approved as "compliance verified manufacturers" able to manufacture and sell LTO Ultrium branded data tapes. The number of compliance verified manufacturers is down 50% from 2018.
"LTO Technology Participants," *Ultrium LTO*, https://www.lto.org/lto-participants/.
[379] *The Media Workflow Puzzle*, 193.
[380] *The Media Workflow Puzzle*, 200.

content in their own way and limit the potentially negative effects of post-production adjustments like color correction.

Bitrate refers to the amount of data written to a storage medium usually measured in bits per second. In a recent study regarding the minimum bitrate at which 8K video isn't perceptibly negatively affected, researchers concluded that a minimum bitrate of 85-120 Mbps (Megabits per second) was required when encoding using the widely adopted HEVC/H.265 codec.[381] A higher bitrate creates larger file sizes but the higher the resolution of the captured image, the more necessary higher bitrates become to ensure a perceptibly cleaner looking image. While bitrate quite literally tells us about the amount of data recorded per second during image capture, chroma subsampling refers to how luminance and color is interpreted when sensor data is interpolated and compressed. 4:2:2 chroma subsampling for example, represents the capture of two chroma (color) values for every four luminance (brightness) values. 4:4:4 represents no chroma subsampling. Like the Bayer Array, this essentially strips out color information which is either algorithmically interpolated once decompression occurs or, more often than not, permanently removed. Both of these approaches have practical implications often including more visible artifacting in captured imagery and less possible manipulability of the image before introducing unwanted noise and artifacts.

From an exhibition perspective, the bandwidth limitations of home media, from optical discs to streaming services, disallows the exceedingly high bitrates and lack of chroma subsampling needed for "quality" imagery as defined by production standards. Instead, the most easily adopted marker of quality is resolution which has no real bearing on perceived quality

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[381] Sugito, Yasuko, Shinya Iwasaki, Kazuhiro Chida, Kazuhisa Iguchi, Kikufumi Kanda, Xuying Lei, Hidenobu Miyoshi, and Kimihiko Kazui. "Video Bit-Rate Requirements for 8K 120-Hz HEVC/H.265 Temporal Scalable Coding: Experimental Study Based on 8K Subjective Evaluations." *APSIPA Transactions on Signal and Information Processing* 9 (2020).

when considering other factors such as bitrate, bit depth, and chroma subsampling specifications as discussed. An 8K image with a low bit rate and 4:2:0 chroma subsampling would look far worse than a 1080 image with high bitrate and 4:4:4 chroma subsampling on a similar monitor. Despite this, streaming providers like Netflix focus on maintaining resolution at the cost of bitrate with Netflix recently slashing their 4K datastreams in half—a move met with considerable annoyance by its customers.[382] At the end of the day, resolution is a much more marketable and (superficially) easily understood concept than bitrate and chroma subsampling.

While production and exhibition/distribution outlets continue to define quality by post flexibility and resolution, archives have maintained a staunch dedication to the notion of "originals" perhaps to their detriment. Of course, different archives have different best practices, but nearly all archives preserving digital content adhere to a similar set of goals most clearly articulated in the International Association of Sound and Audiovisual Archives "Guidelines for the Preservation of Video Recordings."[383] IASA lists its goals as, "1. Sustain authentic and complete copies of the original recordings; 2. Sustain very high levels of quality in terms of reproduction of picture and sound; 3. Sustain features and elements that support access by future users."[384] There is no uniform way to achieve these goals particularly given the variation in originating digital formats, but these three underlying principles shape how various archives, whether production archives, state archives, or smaller independent archives, operate.

Considering the growing adoption of raw capture along with increasing resolution, myriad archives are forced to evaluate how they define these three primary goals. For smaller

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[382] Barry Collins, "Netflix Viewers Upset with 4K Picture Quality," *Forbes* (4 September 2020), https://www.forbes.com/sites/barrycollins/2020/09/04/netflix-viewers-upset-with-4k-picture-quality/?sh=1de3afbb745e.

[383] "Guidelines for the Preservation of Video Recordings," *International Association of Sound and Audiovisual Archives* (2019), https://www.iasa-web.org/tc06/guidelines-preservation-video-recordings.

[384] "Guidelines for the Preservation of Video Recordings."

cash-strapped archives and some larger archives intent only on preserving the final output for posterity's sake, authentic and complete copies of original recordings might be limited to the "complete final production/release version of motion picture work in the original production resolution, aspect ratio and frame rate."[385] Although "camera negatives" are often accepted, the desire to retain the finished product takes precedence over a complete catalog of raw footage and additional assets.[386]

Among archivists, however, there is debate about whether or not such a limited approach to preservation is true preservation particularly in light of the rapid changes in perceived quality of born-digital media from year to year. Steve Anastasi, former Vice President of Global Media Archives and Preservation Services for Warner Brothers, notes, "One of the main responsibilities of the archive and archivists today is to make sure we're keeping the best surviving assets."[387] Anastasi, Paramount Pictures/SVP Archives/head of Academy Motion Academy of Motion Picture Arts and Sciences Digital Preservation Initiative Andrea Kalas, and Studio Archive and Asset Management Executive Schawn Belson argue that "the best assets" are not, in fact, final production releases which, "are not good enough."[388] Instead, Anastasi, Kalas, and Belson agree that the "ungraded DI"—along with all unused footage in its original raw format in Kalas's case—must be maintained primarily as a means of true preservation.[389] This argument stems precisely from the fact that a majority of productions shoot at higher resolutions in raw (as

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[385] "Recommended Formats Statement," *Library of Congress*, https://www.loc.gov/preservation/resources/rfs/moving.html.

[386] In the case of digital cinema, raw capture is often deemed as the camera negative.

[387] "Archivists Talk: How to Select Digital Assets for Preservation," *Digital Preservation Forum*, https://academydigitalpreservationforum.org/2021/11/19/example-post-5/.

[388] "Archivists Talk."

[389] Ungraded means prior to color correction, a post-process which occurs as the final step before a finish is created. Color correction is carried out on the unprocessed (in most cases raw) captured imagery. In essence, the unprocessed raw imagery stands in as the "best assets" in the case of production archives.

previously mentioned) yet industry standard deliverables remain at 2K and 4K. The "original" raw footage retains additional data lost in the final output. To truly meet the stated goals of IASA, for example, retaining the original raw footage is essential even if that raw footage results in an untenable amount of data to be stored and migrated over the years.

Regardless of how "originals" come to be defined in an archival context (as final exhibition deliverables or the raw, ungraded DI), there is a fundamental divide between the production, distribution/exhibition, and archival wings of the film industry in how to best determine "quality" at a moment when digital formats continue to proliferate and the inclusion of more and more data into each image becomes the norm. As camera manufacturers like RED rely on aggressive legal action to restrict more feasible raw image capture while simultaneously driving the market for increased resolution and 8K exhibition becomes the norm as a response to production standards, the growth of largely uncompressed raw capture at 8K and above only further inundates archives with an untenable amount of data to preserve. Without clearly defined "quality" standards across the industry not based solely on marketing hype and hyperbole, the first decades of digital cinema preservation may end up looking much like the first years of analog film preservation. A scattershot of films saved, pirated, circulated, lost, and some of the lucky ones, preserved for future generations.

CHAPTER 4: Over the Moon: Digital Ghosts/Future Phantoms

Since the introduction of DVD, the change in relationship between film and film viewer has gradually become one in which the carrier is far less of a concern than in the days of analog cinema. Accessing a film has become superficially a seamless process despite the larger network of material infrastructure, government policy, legal tangles, and long term precarity that define the contours of digital cinema as a medium as this dissertation has addressed. Besides being considered one indicator of cinema's many deaths, the new relationship around cinema marks a kind of liminal point between endings and beginnings, life, death, and afterlife. On the one hand, as I have discussed, the shift from analog carriers to digital has ushered in an era when the possibility of cinematic loss is exacerbated despite the ease of access promised by the immaterial seamlessness of digital technology. Whether it be due to the impossibility of keeping up with storage demands as a push for "quality" produces greater and greater amounts of data, a dip in collecting by cinephiles and amateur archivists due to the ease of access promised by streaming services, or legal snags owing to draconian copyright laws, digital cinema is precarious cinema. On the other hand, the affordances of digital technology have allowed for striking examples of resurrecting the past and bringing back to life artifacts long since lost as I will explore in this chapter.

While "loss" is often thought of as a backwards looking phenomenon, in the context of digital cinema it is also a future concern. Digital technology and longevity are predicated on future shifts. Accessing born-digital content necessitates tapping into a much larger infrastructure of both material and immaterial technology than analog film. As such, while the growth of digital technology is unpredictable, attempting to preordain trends and shifts in both cultural demands and technological possibilities becomes essential to ensure that all films and digital

media of the present can be securely accessed in the future. How future technology is designed and embraced, and whether that technology is thoughtfully built as a bridge from the past or instead as a radical leap into the future will ultimately come to determine the survival and longevity of our contemporary cinematic artifacts. Digital technology contradictorily offers the audacious possibility of bringing back lost artifacts while simultaneously producing artifacts with short and precarious lifespans.

Two projects make this double-edged sword of digital cinema quite clear: The first, the controversial restoration of the color edition of *A Trip to the Moon* (Georges Melies, 1902), once thought lost and painstakingly restored by Lobster Films and released in 2011, highlights the power of digital technology to effectively resurrect a ghost of cinema's past. This project could not have been completed without the power of digital technology but it also raises significant questions about the role of loss in relation to cinema and shines a light on the questionable trend of digital "resurrection" more broadly. The second, Guy Madden's 2016 web-based *Seances* offers a fundamentally different relationship between digital technology and ghosts. Algorithmically generating unique and ephemeral short films inspired by a growing history of cinematic artifacts forever lost to time, *Seances* meditates on the role of analog film loss in cinema while also drawing attention to the ephemerality of digital media.

Seances dwells on digital ephemerality and change and reflects larger industry trends and concerns even beyond the walls of the archives I have already mentioned. For example, post-production-based initiatives like ACES color workflow are designed around the possibility of future loss and future potentiality. In an attempt to secure digital cinema of the present, the ACES color workflow places digital cinematic content into a currently unrepresentable color space in the hopes of keeping contemporary content relevant in a future of more advanced

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technology. Both the restoration of *A Trip to the Moon* and *Seances* illustrate the tension between

digital technology as a powerful tool in the fight against artifactual loss while also highlighting

digital media's own ephemerality in the face of continued obsolescence and change.

Digital Precarity

Digital cinema relies on movement to exist and survive. Whether that movement is registered in

light flashes over fiber optic cable, electrical current changing transistor states as compression

algorithms strip away data to make file sizes more manageable, migration between different

generations of Linear Tape Open in an archive, or sharing a file using the BitTorrent protocol.

The "store and ignore" approach to analog film preservation is a non-starter in the age of digital

capture, distribution, and exhibition. In this way, the fate of born-digital cinema is intertwined

with that of digital media more broadly. Digital media is inherently ephemeral media built

around this movement and migration.

Although I have discussed the importance of recognizing the different ecologies of digital

media in an effort to avoid a complete flattening of all-things-digital into an interchangeable stew

of 0's and 1's, the fact remains that digital cinema and its future remain tightly woven to the fate

of a rapidly expanding collection of digital content and that fate is tenuous. Take, for example,

the case of the Internet Archive, the foremost digital library archiving billions of digital assets

including millions of videos and films. On June 24th, 2019 a single 1.25mm strand of fiber optic

cable broke at a data center in Richmond, California.[390] This tiny glass thread was one of a fiber

pair carrying all the information stored in the data centers of the Internet Archive. 625 billion

web pages, 38 million books & texts, 14 million audio recordings, 7 million videos, 4 million

images, and 790,000 software programs all stored on over 30,000 spinning disks and 200 solid

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[390] Rob Lanphier, "Two Thin Strands of Glass," *Internet Archive Blogs* (29 June 2019),
https://blog.archive.org/2019/06/29/two-thin-strands-of-glass/.

state drives, were simultaneously made inaccessible to a global network for a period of 15 hours. The Internet Archive's 55 petabytes of unique storage is no small number, in fact, it effectively dwarfs the estimated 50 petabytes of content that would result if one could combine everything ever written in all languages throughout human history.[391]

This temporary disruption of service might be better imagined as the blinking off of eons of information. Of course, this technological mishap marks only one minor potential for failure that the Internet Archive—and all archives working with digital content—must grapple with. Only two months prior to the 15 hour archive blackout prompted by a temperamental glass conduit of data-rich light, the Internet Archive faced another operational challenge, this time at the hands of the French Internet Referral Unit and the French government's L'Office Central de Lutte contra la Criminalité liée aux Technologies de l'Information et de la Communication (OCLCTIC). Claiming that the Internet Archive was hosting "terrorist propaganda" on hundreds of URLs, French authorities sent over 550 takedown notices targeting content ranging from whole collections like "American Libraries," and "Live Music Archive," to very specific scholarly texts like Yuan Yuan He and Subhrakanti Dey's, "Spectrum Sharing in Cognitive Radio with Quantized Channel Information."[392]

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[391] John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago: University of Chicago Press, 2015), 326.
Any attempt to quantify all the written output of human history is, of course, an estimate at best. That said, 55 petabytes can hold approximately 357,500,000,000 document pages—or 893,750,000 400-page books—as PDFs. A petabyte is one million gigabytes and a terabyte is 1000 gigabytes. By way of comparison, a consumer desktop computer in 2020 generally ships with around 512 gigabytes to 2 terabytes of available data storage via spinning disk and/or solid-state drives.
[392] Chris Buttler, "Official EU Agencies Falsely Report More Than 550 archive.org URLs as Terrorist Content," *Internet Archive Blog*, http://blog.archive.org/2019/04/10/official-eu-agencies-falsely-report-more-than-550-archive-org-urls-as-terrorist-content/, 10 April 2019.

That the functionality of the Internet Archive is subject to the whims of often conflicting

national and international policies and laws, as well as the universal laws of thermodynamics is

not a unique feature of the archive itself but rather speaks to the ephemerality and precariousness

of digital data and any long term efforts at its preservation whether strictly digital cinema or

digital media more generally. The dilemma of digital preservation is ubiquitous and a common

point of discussion among myriad archives housing born-digital content.[393] At its core, digital

content, regardless of its representation on a screen, is nothing more than the temporary states of

transistors strung into a series of logic gates constantly shifting with variances in electrical

currents. In effect, storing what is intrinsically ephemeral is no small task. As previously

discussed, analog film existing on cellulose nitrate and cellulose acetate stock can last for more

than 100 years in a relatively stable climate, digital content is prone to more rapid "data decay"

as its highly ordered state makes it more vulnerable to entropy.[394] As a result, digital content must

undergo a fairly consistent regime of "migration" moving from one storage carrier to another

which poses its own challenges for institutional archives, many of which are struggling with

limited funds.

The vast amount of human (or expensive mechanical) labor involved in such a process

multiplied by the sheer volume of digital content requiring preservation makes this perpetual

migration an untenable practice as the volume of digital content being created and preserved

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[393] See Fossati, *From Grain to Pixel*;
Usai, *The Death of Cinema*;
Tanya Clement, "Toward a Notion of the Archive of the Future: Impressions of Practice by Librarians, Archivists, and Digital Humanities Scholars," *The Library Quarterly: Information, Community, Policy* 83.2 (April 2013).
[394] "Data decay" or "data rot" refers to the breakdown of digital information on storage devices like solid state drives. As opposed to analogue media, this digital "decay" is exacerbated by digital storage media's reliance on complex and highly ordered systems which ultimately make them more vulnerable to entropy. For more see Fairbanks & Garfinkel, "Factors Affecting Data Decay," *Journal of Digital Forensics, Security and Law*, Vol. 7 (2012), 2;
Fossati, *From Grain to Pixel*, 62.

swells to absurd proportions.[395] In addition to the difficulties posed by data decay, the larger

question of technological obsolescence raises further issues. To analyze the contents of an analog

film, albeit superficially, one needs only light and the film strip being investigated. By contrast,

accessing the contents of an 8 inch floppy disk necessitates a much larger technological

infrastructure itself prone to the whims of society's adoption and shedding of such technologies.

As we collectively produce upwards of 2.5 quintillion bytes of digital data per day, both

intentionally (e.g., social media posts, video uploads, etc.) and unintentionally (e.g., geospatial

data, logfiles, cookies, etc.), and rely increasingly on digital technology on a micro and macro

level, the pendulum begins to swing from digitality as a technological aid in the service of

humanity toward a new human subject position, specifically, humans as stewards of the digital.[396]

In a kind of Faustian bargain, digital technology has granted us immediate access to an

unimaginably vast pool of human knowledge and culture and yet, its role as convenient

mnemotechnical "extension" belies its transience threatening a future in which vast swaths of

human history blink out of existence like the Internet Archives' own short disappearance on what

was otherwise just another Monday in June. Outlining the contours of this new relationship to

information storage, Peters notes that the range of linguistic understanding for intercivilizational

communication is approximately 5000 years—e.g. specialists' can understand Sumerian texts

still in existence after falling out of human use for millennia—whereas the necessary assemblage

of "hardware, software, organizational intelligence, and cultural will" required to access digital

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[395] YouTube alone boasted that its users uploaded an average of 720,000 hours of new content per day in 2019. For more see, James Hale, "More than 500 Hours of Content are Now Being Uploaded to YouTube Every Minute," *Tubefilter*, 7 May, 2019, https://www.tubefilter.com/2019/05/07/number-hours-video-uploaded-to-youtube-per-minute/.
[396] See "Data Never Sleeps," *DOMO*, https://www.domo.com/learn/data-never-sleeps-6.

content results in a span of intercomputer communication of only a few decades.[397] Just as the microstructural relations of a computer rely on constant writing and rewriting, so too do the larger infrastructural frameworks—in which digital content is circulated—rely on a continued attentiveness and participation to remain in existence. While an invisible yet ever-present electricity powers the microstructure of digital networks, a new kind of invisible yet ever-present human labor is called into existence through digital technology, effectively undergirding the larger infrastructure.

If at its core archival work centers on curation, restoration, and conservation of largely at-risk content, then the structural instability of digital artifacts coupled with the explosive growth of their creation inherently positions them as at-risk. For digital objects, restoration is recall and circulation. This is true ontologically, even if somewhat abstract operationally, as digital content itself is literally restored from an illegible state of machine code with each method of access. Formal representation aside, accessing any and all digital content, whether raw source code or an H.264 video in an MP4 wrapper, restores to a level of accessibility otherwise unintelligible content, not unlike restoring so many indecipherable frames of a film suffering badly from vinegar syndrome. Moving from the abstract to the practical, circulation also plays a key role in restoration as each new copy not only increases redundancy but also the likelihood of being transcoded. While I have outlined the contradictory issue of redundancy in more public facing file sharing networks, redundancy through transcoding remains a significant tool against digital loss on a micro level. A key issue plaguing digital content is inaccessibility due to obsolescence (of both hardware and software), with that in mind, every move from one format to another, even when not specifically for restorative purposes, leads to a greater likelihood of

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[397] John Durham Peters, "Proliferation and Obsolescence of the Historical Record in the Digital Era," *Cultures of Obsolescence: History, Materiality, and the Digital Age* (New York: Palgrave Macmillan, 2015), 83.

perpetuation and, often, functions as a means of restoring inaccessible content to a level of greater accessibility. Whether sharing a Word Doc as a PDF, transcoding a ProRes4444 file to an H.264 for posting on YouTube, or an AIFF to WAV, transcoding as a more ubiquitous practice often doubles as a restorative and conservationist one.

It is precisely the transitory nature of digital content, its temporary states with no permanent indexical inscription on a particular medium, that make it both incredibly precarious and surprisingly malleable. These two characteristics of the digital raise interesting questions about its preservation and restoration, particularly in cases where circulating and preserving a cultural artifact means relying on digital malleability to alter what might be construed as its ontological base. Transcoding, circulating copies, and using digital tools to "improve" older media objects (whether analog or digital artifacts) ensure survivability yet throw into relief the impermanence of digital media in the process. The ease with which we can copy and modify digital objects also mirrors the ease with which those objects can be manipulated and lost.

A Trip to the Moon on Theseus's Ship

Premiering (again for the first time) at the 2011 Cannes Film Festival, George Méliès's hand painted early cinematic masterpiece *A Trip to the Moon,* "rescued" from permanent loss by Lobster Films, points to the complex relationship between a backwards looking nostalgia built around preservation and completeness and a global economy built on the promise of the new. In a project taking approximately 12 years and €500,000 to complete, Lobster Films, in partnership with The Technicolor Foundation for Cinematic Heritage, and Foundation Groupama Gan pour le Cinéma, resurrected Méliès's classic after a painstaking process involving individually photographing each frame and reconstructing much of the film through digital tools. Receiving a badly deteriorated nitrate print of the film that was essentially decomposed into a solid mass,

Serge Bromberg and Eric Lange of Lobster Films utilized a chemical compound to soften the print enough to separate individual frames for photographing. However, this act of restoration simultaneously necessitated the complete destruction of the print itself. Lange notes of the two year chemical bath/photography project, "Every time a few images were recovered, we'd photograph them before they turned to dust, which is a consequence of using the chemicals. Basically there are only a few days to photograph the stills, which can be considered the 'scan' of the original source."[398]

In *Flickers of Film: Nostalgia in the Time of Digital Cinema*, Sperb draws on this paradoxical process of preservation through destruction as a means of foregrounding the problematic tendency to assume that digital technology exists beyond the reach of loss. Through a nostalgia for the lost object, in this case *A Trip to the Moon,* a careful process of preservation through "creative destruction" is undertaken and yet, such a process "saved" the decaying *film* while privileging *digital* furthering the false assumption that the move toward digital cinema is inherently a move toward a more robust medium and a necessary step toward regaining a lost past and resisting future loss. Although this argument could quite easily devolve into nostalgia for celluloid itself, Sperb instead highlights the flaws in both media but appropriately highlights the danger in assuming digital as a superior medium simply based on its malleability. Suggesting that the Lobster restoration serves as part of a larger industry move toward selling "digital as a cure-all to film's troubles," Sperb warns, "The key issue is both planned and unintended obsolescence, where the computer technology and the software programs needed to store and access such digital copies of movies are constantly going out of date as a result of capitalism's demands, which consistently insists on a new platform to perpetuate the market."[399] Both media

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[398] Robert S. Birchard, "Restoring Melies's Marvel," *American Cinematography* (October, 2011), 70.

[399] Sperb, *Flickers of Film*, 84-85.

come with particular preservation challenges. Sperb continues, "What the medium of celluloid lacks in terms of interactivity or malleability that digital cinema offers, it makes up for with a material stability, which can last a hundred years, with relatively minimal maintenance."[400]

The rapid shifts and planned and "natural" obsolescence of digital technology is apparent even within the Lobster restoration process itself. Speaking to the variety of digital image formats received from Lobster as technology improved over the years of photographing the print, Tom Burton, Technicolor's executive director of restoration services, notes, "What we received from Lobster Films were digital files in various formats and in several different resolutions. Much of the image data represented broken frames and shattered pieces of frames, and there are even several versions of some shots, with the files differing greatly in color, density, size, sharpness and position. It was not possible to play back a continuous image stream."[401]

Important to note here is that the terrible condition of the print itself, "broken frames and shattered pieces," is positioned alongside the variation in naming and file conventions, color, density, size, sharpness, and position which is part of the changing characteristics of the digital capture process itself. Shifts in codecs, sensor size/type, pixel count, color space, and bit depth (amongst other things) not only drastically alter the digital image but additionally raise the possibility of requiring transcoding to simply make digital files compatible with shifts in software. The promise of digital as inherently more stable belies the fact that its very stability is perhaps more fleeting than celluloid itself. The difference, however, lies in the speed of its obsolescence. While celluloid is prone to slow visible decay from the start, the apparatus which makes the digital archive possible functions simultaneously to hide its material infrastructure. Celluloid's slow decay based on its materiality, impossible to halt, butts up against a cinema of

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[400] Sperb, *Flickers of Film,* 85.
[401] Birchard, "Restoring Melies's Marvel," 71.

eternal life in "the cloud" that promises endless permutations and generations by erasing the

material and immaterial infrastructure enabling its existence and perpetuation. A process that

began, as I have already recounted, with the introduction of DVD. Whether through

ever-changing software, power demands and storage limitations, or even the accidental erasure

of a hard drive through a static discharge, the loss of digital material is rapid, unseen, and

ignored due to its own promise of restoration through new digital tools.

Lobster Film's restoration and Sperb's account of the power (and paradoxes) of nostalgia

as a catalyst for preservation hints at grander questions regarding the ontological foundations of

cinema itself. To what extent is decay and loss built into the very heart of cinema? How might

the promise of ephemerality and material decay be just as central to cinematic engagement as the

content being projected? Materially, cinema's early reliance on nitrocellulose as a necessary

component of filmstock meant not only the dangerous possibility of fire (responsible both for the

destruction of film itself and the loss of human life as well) but the promise of rapid decay and

dissolution of the medium. Furthermore, early cinema's utilization of highly unstable nitrate film

stock coated in silver halide positioned it as a repository waiting to be mined for its chemical

content, a resource which proved invaluable to governments worldwide particularly during

moments of global crisis.[402] Loss is inherently built into the medium. This moves beyond

questions of materiality and seeps into cinema's own paradoxical promise to embalm time while

simultaneously destroying duration and contingency. Equating cinema with Zeno's Paradox,

Henri Bergson argues that cinema's approximation of motion through the dissection of time into

static images means, in actuality, that "the [captured] movement slips through the interval

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[402] Interestingly, Méliès's own films fell victim to this approach as, according to Elizabeth Ezra, approximately 400 of Méliès's films were melted down during WWI to harvest a chemical used in the creation of boot heels.
Elizabeth Ezra, *George Méliès* (Manchester: Manchester University Press, 2000), 19.

[between frames], because every attempt to reconstitute change out of states implies the absurd proposition, that movement is made of immobilities."[403] The fluidity of movement and the continuity of time are frozen and dissected into impossible fragments that approximate time but lose time's true inextricability.

While celluloid paradoxically promised to "capture" time while simultaneously sentencing it to death through the loss of contingency and inevitable material decay, digital cinema (problematically) promises a permanence that expands beyond discrete moments to history itself. The resurrection of *A Trip to the Moon* was truly made possible not through regenerating the unstable nitrate film of the original print but rather through a virtual reconstruction and approximation of the film perfectly in line with a larger tendency to rely on the power of digital technology to model, simulate, and reconstitute past, present, and future. Discussing the restoration process, Burton details the extent that digital interpretation of missing material played in the regeneration of *A Trip to the Moon.* After ingesting and organizing the existing and incomplete scans and running the images through a stabilization and de-flicker process, "We used Resolve's color-correction platform to do a 'pre-timing' to bring the widely diverse colors and densities of the various capture sources into reasonable proximity with one another."[404]

This initial process merely brought the existing imagery into close approximation with an imagined original print. Following this, Burton details, "Then the serious image reconstruction began…. We used a palette of visual-effects specific digital platforms [to rebuild] shattered frames into new, full-frame recreations of their original state. Black and white material was then digitally painted to replicate the original color frames where the original colors had not

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[403] Henri Bergson, *Creative Evolution* (New York: Henry Holt and Company, 1911), 308.
[404] Birchard, "Restoring Melies's Marvel," 72.

survived."[405] This in depth restoration process as "Ship of Theseus" undertaking points to the radical promise of digitality. Like Theseus's ship, being remade plank by plank over time prompting one to ask whether such a ship remains the same ship at all, *A Trip to the Moon*'s restoration relies on new technology and material to perpetuate the old. If, as is the case with *A Trip to the Moon*, a "lost" original can be reconstructed via digital mediation and interpretation, has the archive finally become total or at the very least offered the possibility of totality through reconstruction, or are we merely laying new planks until the object ceases to exist altogether?

Playing on the concept of the total archive as imagined by Jorge Luis Borges in his classic short text *The Library of Babel*, which tells of a Library containing books in which every possible combination of 410 pages worth of letters exists, the web based Babel Image Archives project allows for the algorithmic generation of every possible combination of 4096 colors in a 416 x 640 pixel grid.[406] Exploring this image archive statistically means encountering endless images of noise. With so many pixel variations, the likelihood of seeing any recognizable imagery is astronomically low. But like Borges's library, the sheer scale of the library means that every possible image is represented therein. Theoretically, you could stumble across a photorealistic image of your birth, your death, or the building of the pyramids [Fig. 4.1].

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[405] Birchard, "Restoring Melies's Marvel," 72.

[406] Jorge Luis Borges, "The Library of Babel," *Fictions* (New York: Penguin Books, 1999), 112; Jonathan Basile, "Babel Image Archives," Babel Image Archives, accessed October 15, 2022, https://babelia.libraryofbabel.info/.
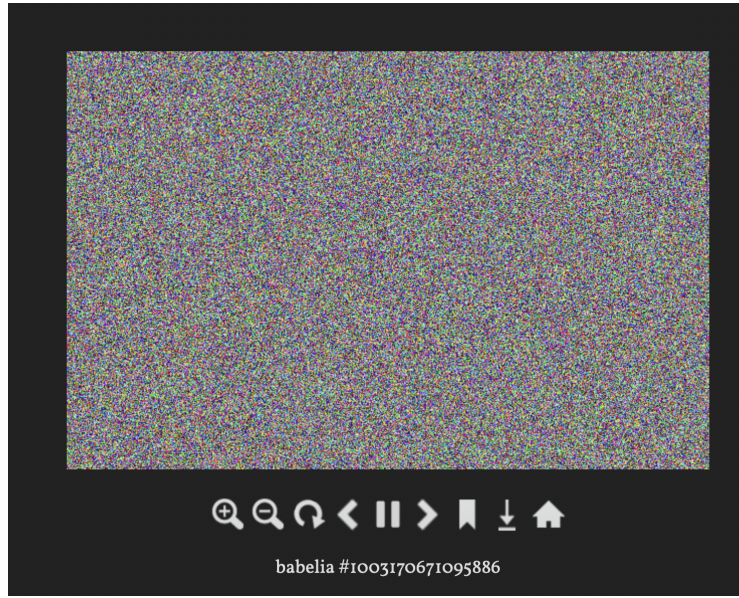
Figure 4.1: "Browsing" The Babel Image Archives.[407]

The site itself relies on an algorithm to generate random images on demand but it is written in such a way that every image generated is linked via formula to a specific call number. Essentially an archive of all images (if not a practical archive), The Babel Image Archives is a reminder of the power of digital technology to generate imagery on demand.[408] A meditation on the power of digital technology, The Babel Image Archives no doubt serves as an interesting parallel to the reconstruction of Melies's masterpiece. Resurrection through digital tools (so common now in cinematic practice), however belies the precarity of the underlying technology. The exciting affordances of digital technology as tools ushering in a pseudo "total archive" make the larger ecology of digital media easy to ignore. But, while Borges's library was celestial in nature, physical in existence, and accessible by its "librarians," The Babel Image Archives are algorithmically generated, ephemeral, accessible due to a complex web of cables, servers, and

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[407] Basile, "Babel Image Archives."

[408] DALL-E, and now DALL-E 2, is another powerful algorithmic tool for the generation of photorealistic (or not) imagery on demand. Simply typing in the description of an image leads to the program generating a visual representation of the description provided.
OpenAI, "Dall·E 2," OpenAI (OpenAI, April 14, 2022), https://openai.com/dall-e-2/.

cultures all subject to change and obsolescence. Digital imagery can be resurrected but physical

infrastructure and cultural pasts are much harder to bring back to life.

Seances

Guy Madden's *Seances* relies on its own assemblage of algorithms and digital content to

meditate on the loss of cinematic artifacts. Unlike The Babel Image Archive that reflects on the

affordances of the digital to (re)create imagery, *Seances* embraces the radical potential of

absence and contingency as a move away from fixed futures through a database approach built

around ephemerality, potentiality, reflexivity, and chance. For Madden, digital technology can

only ever fleetingly represent (or summon) lost cinematic works but it can never truly recapture

what is lost, nor should it truly seek to. According to the description provided on Maddin's

website, *Seances* is a project explicitly about the ghosts of the archive:

> Shot in public over 18 days at the Centre Pompidou in Paris and over another 13 days at
> the Phi Centre in Montreal, Seances mystically conjured long-long-forgotten stories of
> lost films from periods such as Hollywood's silent era. Haunted by the notion of lost
> films, Guy Maddin invited the sad spirits of lost films to possess his assembled actors and
> compel them to act out the old stories, while the spirit-photographer/director captured the
> precious narratives with his camera."[409]

This description which upon first read seems fundamentally tied to filling in gaps in the archive

and recreating/resurrecting lost films, belies the experience of the project itself. While at its core,

Seances, sponsored by the National Film Board of Canada, was conceived of as a project in

which Maddin would recreate lost films on a title-by-title basis, Maddin notes, however, that as

the project went on, "the spirit of many other lost movies, and the spirit of loss in general,

haunted our sets and demanded to be represented in front of our cameras."[410] This representation

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[409] "About." Seances | By Guy Maddin, Evan Johnson, Galen Johnson, and the NFB. Accessed 01
August 2022. http://seances.nfb.ca/.
[410] Jonathan Ball, "Guy Maddin on the Forbidden Room and Writing Melodrama," Jonathan Ball,
PhD, May 2, 2019,
https://www.jonathanball.com/guy-maddin-on-the-forbidden-room-and-writing-melodrama/.

of loss is not built upon a nostalgia for the lost object but rather a generative loss that uses absence to produce the new rather than the new affordances of digital technology to produce the absent object. *Seances* represents a reversal of the nostalgic drive fundamentally linked with popular culture and a challenge to the significance of the total archive as a means of producing progress through knowing the past.

Understanding the ways in which *Seances* challenges the promise of the new to give us access to the past necessitates an analysis of both the aesthetic dimensions of the project as well as the mechanics of its presentation. Part database cinema, part interactive online artwork, *Seances,* which began as an installation work, is accessible on the Internet and, upon navigating to its website, users are greeted with text that reads, "Touch and hold to conjure. Then sit back and relax. It's your one chance to see *this* film."[411] Like a phantom, the text evaporates before being replaced by new content marked by what appears to be various types of celluloid artifacting and aberration. From a subtle grain pattern to a more exaggerated gate weave and ghost like blotches of film decay, the analog film effects are blended with digital chromatic aberration and interlacing while text and imagery shake and move as if the computer monitor itself were possessed. Adding to this, the viewer is confronted by a seemingly random string of text with words that haphazardly fall into and out of order. One might, for example, see "The Power of the Scorned Urge" slowly give way to "Revenge of the Smooth Urge" as words drift into and out of place and fade in and out. This constant reconfiguration is only understood through its relationship to a smaller string of text on the bottom of the screen that is also subject to recombination but, unlike the main string, retains a syntagmatic coherence. While the main string seems to be an endless recombinatory chain with no particular structure, the lower chain always describes an object of a particular duration. One might, for example, see "A 17 minute

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[411] "About." *Seances*.

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transhumanist post-phenomenological kinderspiel" transform into "A 20 minute transhumanist sub-petrarchan tractatus eroticus."

Taken together, these two strings of recombinatory text, signify on a quasi-denotative level, that the primary string is the title of the film you are "conjuring" while the secondary string details the duration and loose, absurdist, synopsis. Considering the mechanics more abstractly, however, the recombinatory character of the strings points to both contingency and ephemerality as powerful generative forces. More than just a randomized string of possibilities, a roulette wheel of films, each title that comes into being is also a lost future. Failing to "click" and "conjure" in time means that the previous title(s) are lost and with them a unique experience. For a project reflecting on gaps in the archive, this is of course precisely the point. For every film, image trace, object, in the archive, there are countless other objects that are permanently lost to time. And yet, rather than simply dwell in that nostalgic space of absence or desperately attempt to fill in the gaps using digital technology, Maddin embraces the generative power of loss for each title that flickers out of existence and simultaneously generates a virtual trace. "What if I had?" This short statement can be problematically backwards facing or, rather, directed at the future. "What might have been if I had" prompts us to imagine alternative futures outside of our own historical narratives and, if cultivated properly, can incite rather than hinder change. This change is not built upon smooth progress but rather radical breaks, not a promise of the new but instead a promise of the *different*—alternatives outside the constructed causality of history.

From its home screen, Maddin's film experience already invites this productive speculation, but it isn't until we actually engage with the work that a clear vision of generative loss comes to the fore. The "about" page of the official website details the underlying thrust of the project, "Driven by the desire to reincarnate this vanished history [of lost films from the

silent era], an abundance of these films have been reimagined by Maddin and brothers Evan and

Galen Johnson, with the express goal of combining and recombining them to create infinite

narrative permutations."[412] This description, which, prima facie, seems to suggest that the project

is built around a regressive turn toward the past, is undercut by the claim of recombination and

reimagining. It is precisely the fact that these films are lost that the possibility of a clean remake

becomes impossible. As such, Maddin does not dwell in the loss but allows the loss to open

avenues of alternative exploration. "Conjuring" a film within the project by clicking and holding

reveals these alternatives which anachronistically combine analog material traces (scratches,

decay, gate weave, etc.) with digital artifacting (compression artifacts, interlacing, etc.), silent

exaggerated performances with color effects that could only be achieved through careful digital

manipulation, and silent era intertitles with digital era, nondiegetic, YouTube content that

periodically breaks through the film image. The result, typically, is a rather absurdist and

incoherent chain of imagery and title cards that sometimes congeal into an interpretable scenario

but often unfold with a kind of dream logic. Causality is lost, time is out of whack, contingency

reigns.

Contingency and loss here must be understood not simply as a fun means of exploring the

possible as novelty within this project itself but as a virus transmitted to the viewer. Considering

the structuring mechanics of *Seances* we must account for the fact that the disjointed film we are

witnessing will never be screened again. The website notes, "Each [film] exists only in the

moment, with no pausing, scrubbing or sharing permitted, offering the audience one chance to

see this film before it disappears."[413] More than just a comment on ephemerality, what this

"limitation" and forced loss achieves is a transference of the productive power of loss to the

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[412] "About." *Seances*.
[413] "About." *Seances*.

spectator. For example, after viewing the film, its "ghost" exists only within the memory of the viewer. The disjointed, dream-like narration, anachronistic mise-en-scene, and overall form of the project cannot be easily parsed and as such, the "film" becomes largely an impossible memory resulting in, essentially, a trace of an absence. The project achieves Eco's impossible *ars oblivionalis* in that its incongruity allows for traces to remain but the experience in its entirety becomes difficult to recount due to the layers of discontinuity (spatial, aesthetic, temporal, etc.).[414] *Seances* isn't simply about loss but, additionally, actively participates in the creation of forgetting—a generative loss—that is, specifically its own loss. We remember the trace but recounting the experience to another becomes a practice of creative reimagining not unlike *Seances* itself. In *Twilight Memories: Marking Time in a Culture of Amnesia*, Huyssen argues, "The past is not simply there in memory, but it must be articulated to become memory. The fissure that opens up between experiencing an event and remembering it in representation is unavoidable. Rather than lamenting or ignoring it, this split should be understood as a powerful stimulant for cultural and artistic creativity."[415] While Huyssen succinctly notes that memory itself is necessarily a creative act, *Seances* foregrounds this essential creativity in a way that illustrates the generative possibility of gaps in historical consciousness. It makes us hyper aware of absence as a productive presence not just within the confines of personal or collective memory but reaching to larger questions of historical consciousness and possible futures.

Seances' focus on potentiality through loss, also foregrounds the fundamental flaw in conceptions of the "total archive" made possible through new modes of mediation. Specifically, digital technology conceivably allows for the retention of more material but the promise of filling in gaps in the archive through the new ignores the ways in which new technology reshapes

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[414] Umberto Eco, "An Ars Oblivionalis? Forget it!" *PMLA* 103.3 (1988): 254-261.

[415] Andreas Huyssen, *Twilight Memories: Marking Time in a Culture of Amnesia* (New York: Routledge, 1995), 3.

the very character of historical consciousness itself. Ignoring the obvious fact that digital technology is still subject to loss through the ever-expanding and always fluctuating digital field (software, file formats and codecs, etc.), the promise of the "new" as a means of retaining the old points towards the ways in which the new itself always changes the fragment it archives along with our understanding of it. Kittler's claim that, "Philosophical astonishment has never challenged its own preconditions: the techniques of questioning, the books and the institutions, which are philosophy too" can just as easily be applied to archival practice itself.[416] Historical consciousness and even historiography proper, is subject to change not simply based on the incorporation of "new" archival material but also in how that material is cataloged, retained, presented, etc., and how these new modes of access lead to new relationships and understandings of loss and possibility. This observation can be taken on a strictly material level, for example, the preservation of decaying celluloid film by way of a telecine transfer, by its very nature privileges imagery at the expense of the medium by which it is originally recorded. Such a distinction ignores the fact that the imagery is necessarily bound to its material trace. An effort to preserve film by transcoding from celluloid to digital changes the terms of spectatorial engagement. This is not to privilege celluloid but merely to suggest that there is indeed a difference, quality notwithstanding, between celluloid and digital capture systems, if only in the affective registers of the spectator, and, that affective change can, arguably, be linked precisely to the ephemeral quality of an analog media.

Seances addresses this dislocation of analogue materiality by digital mediation through the inclusion of digital artifacting that frequently destroys the cinematic image replacing it with what appear to be amateur DIY videos one might find on a video streaming service like

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[416] Friedrich Kittler, Carolyn Wellbery, & David Wellbery, "Forgetting," *Discourse* vol. 3 (Spring, 1981), 90.

YouTube. We can read this disruption on two levels: one, as a reminder of the change that does occur by transference from a material to an "immaterial" medium as previously discussed, and two, as a reminder that digital's promise of complete archivability belies the fact that the very newness of its approach conversely covers over the old—and digital technology's own ephemerality—even as it promises to save it. The sheer volume of material promised to be saved by the digital archive is never entirely accessible but filtered by new algorithms and careful limiting approaches. This limitation, however, is often itself occluded due to the promise of totality. *Seances* reminds us that the new we come to embrace as we look back toward the old is a newness that *displaces* the missing aspects of the archive which we have relied on to *replace* all while prompting us to accept or strive for totality. This focus on regenerating or saving the past through the promise of the new chains us to a historical path pre-charted and cleared by the peddlers of the new. New technology to fill the gaps in the past; new technology to save the very artifacts it forces into obsolescence.

The (Color)Spaces of Tomorrow's Seances

The promise of new technology as a means of resurrecting the past comes through more practically in the world of post production. Often ignored in academic analysis of the film industry and its practices, one striking element of the current digital cinematic landscape is its focus on predicting the future of image capture and playback technologies. While this focus should be on ensuring longevity in the face of digital obsolescence, the majority of these efforts center around resurrecting a dated looking image in a "higher quality" digital environment. More specifically, colorspace management tools like ACES and Davinci Resolve's Wide Gamut Workflow function as a means of "future proofing" contemporary images to ensure they can be improved to match the possibilities of future displays. Not unlike Seances' resurrection through

interpretation, these future proofing technologies seek to solidify practices to resurrect (algorithmically reinterpret) digital artifacts lost to obsolescence spurred on by shifting quality standards and expectations.

Key to understanding this trend are color space and gamut. Color space is a term which refers to the spectrum of colors available in a specific color model. Standards like Rec. 709 and DCI-P3 offer very different possibilities when it comes to the limits of representable colors as is clear when looking at the two color spaces on a CIE chromaticity diagram that represents the limits of the visible color spectrum for the human eye [fig. 4.2]. Both Rec. 709 and DCI-P3 are standards in the world of digital cinema, however Rec. 709 has a far more limited range of representable colors and is a common color space for web-based moving image content given the limits of most consumer grade monitors which are primarily designed based on the sRGB standard (essentially a copy of Rec. 709 specifications). DCI-P3, in contrast, is a deliverables standard for cinematic projection first established by the Digital Cinema Initiative, a consortium of Hollywood Studios concerned by the rapid emergence of digital imaging technology.[417] In its July 2005 "Digital Cinema Specifications" document, the DCI outline the DCI-P3 color space, one element of a larger effort to define "quality levels, system specifications, and the engineering standards necessary for implementing a comprehensive Digital Cinema system."[418] Color spaces like Rec. 709 and DCI-P3 represent standard color models that post production facilities can utilize to ensure their final deliverables are accurately reproduced in the target exhibition environments.

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[417] The 2005 consortium consisted of representatives from Disney, Fox, Metro-Goldwyn-Mayer, Paramount Pictures, Sony Pictures Entertainment, Universal Studios, and Warner Brothers Studios.
"Digital Cinema System Specification V1.0," *Digital Cinema Initiatives, LLC* (20 July 2005), 1.
[418] "Digital Cinema System Specification V1.0," 68;
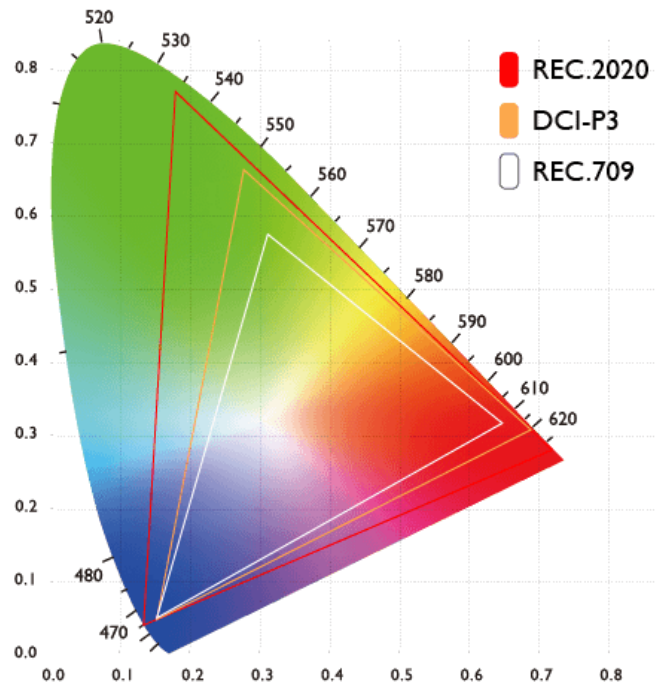"Digital Cinema System Specification V1.0," 1.

Figure 4.2: Chromaticity Diagram.[419]

Alternatively, color gamut refers to hardware limitations when it comes to representing

colors. For example, brand A's computer monitor might have a color gamut that covers 98

percent of a given color space, while brand B's monitor may cover 100 percent of the same color

space. If DCI-P3 represents only a small portion of the visible spectrum, a monitor that only

displays 80 percent of the DCI-P3 color space has a color gamut even further from the limits of

human perception. While the DCI's initial decision to craft a standardized color space for digital

finishing and projection ultimately was an effort to tame the quickly growing herd of proprietary

color specifications owing to a rapidly growing body of camera manufacturers and digital

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[419] "Color Gamut: Understanding Rec.709, DCI-P3, and Rec.2020," benq.com (BenQ), accessed October 15, 2022, https://www.benq.com/en-us/business/resource/trends/understanding-color-gamut.html.

displays, today's approach to color management is just as much a kind of prognostication as it is standardization.

Recent developments in contemporary post workflows have expanded their focus beyond standardization to ensure uniformity across exhibition devices, to also ensuring that gamut limitations of current display technology does not limit future potential of contemporary cinematic artifacts. The Academy Color Encoding System (ACES) developed by the Academy of Motion Picture Arts and Sciences, stresses that the ACES 1.2 color space ensures that "digital assets can be repurposed to take advantage of future high-dynamic range, wide-color-gamut display devices."[420] Similarly, DaVinci Wide Gamut color space, introduced shortly after ACES, expands beyond the bounds of the visible spectrum and into color extents that are well outside what even the best contemporary digital capture devices and display technologies can produce [Fig. 4.3]. Both ACES and DaVinci Wide Gamut address the initial concerns of the DCI. By creating a color space that is wide enough to encompass the color range of all current cameras and displays, a uniform workflow can be achieved by ensuring that all footage is moved into a common color space.

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[420] "ACES Academy Color Encoding System," *Academy of Motion Picture Arts and Sciences*, https://www.oscars.org/science-technology/sci-tech-projects/aces.
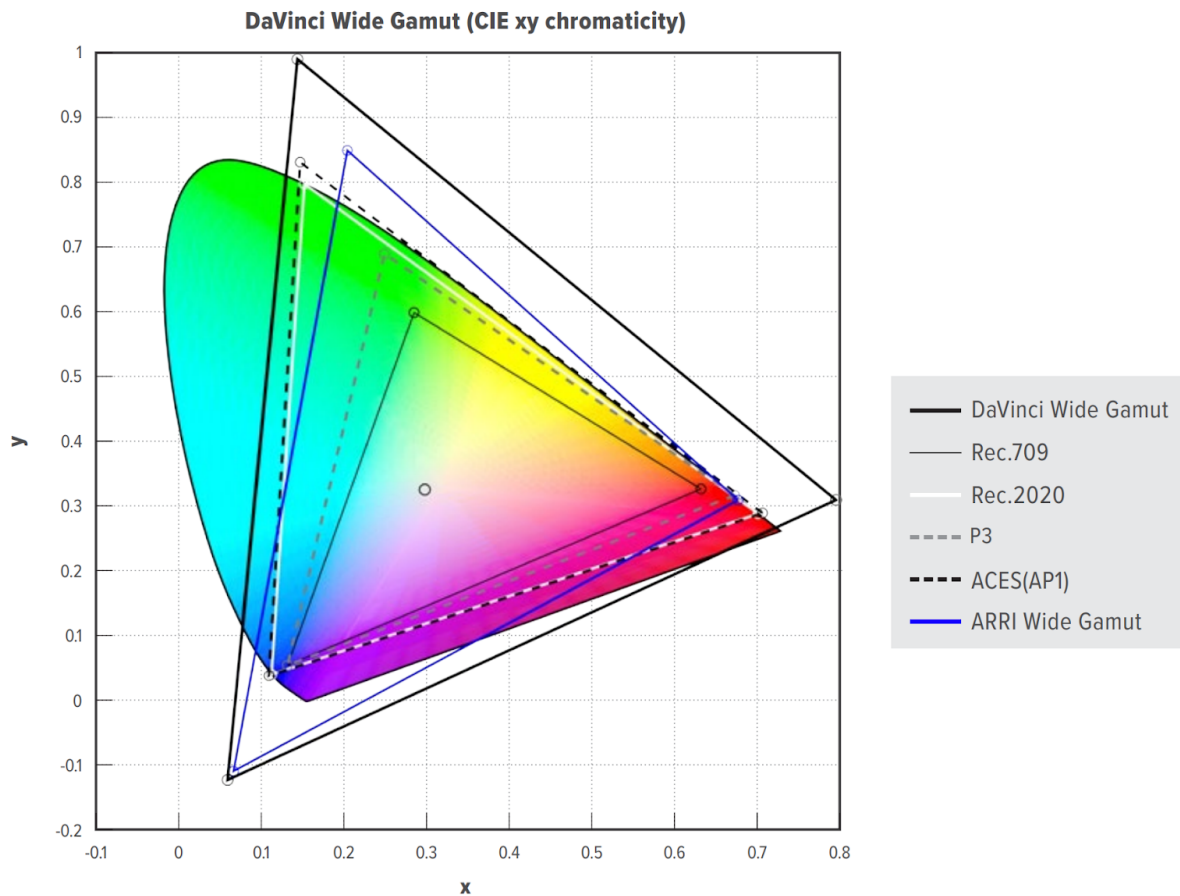
Figure 4.3: CIE Chromaticity Chart Displaying DaVinci Wide Gamut.[421]

What this means practically is that delivering finished films for various distribution platforms is far more of a streamlined process even on projects involving multiple different cameras all shooting with different proprietary color science (and color spaces). By bringing all digital assets into one shared color space, changing output targets for digital projection, streaming, broadcast, etc. is a much simpler and reliable task. One output color space transform can ensure your imagery looks the same whether it is output in the DCI-P3 color space or Rec. 709. But, implicitly, what these workflows promise is a kind of afterlife in the face of continued change and "newness." These workflows are premised on the notion that cultural understandings

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[421] "Wide Gamut Intermediate," (Blackmagic Design, August 2021), 3.

of quality will shift and that what might now be considered high quality will be subpar in the future. Buried within these new post production workflows that do little to entice pop cultural hype, there is a kind of magic premised on resurrection and a promise of incessant change. But it is the very promise of change, movement, shifting standards, increasing quality, that simultaneously poses the gravest threat to contemporary digital objects. Above all, digital cinema is perpetual change: on a microstructural level that change registers as shifting transistor states or temporary magnetic polarities. On a cultural level, change manifests as a series of deaths and rebirths: the spaces and places of cinema, conceptions of quality, and shifting tastes and practices incite fear that the century-long tradition of the seventh art is disappearing while inspiring hope that new audiences have access to a growing catalog of cinema at its finest. And on a macrostructural level, change is hard fought in courtrooms, mapped out in research and development departments, and its concomitant entropy and obsolescence is being fought off with limited means in archives, both amateur and professional, the world over.

CONCLUSION

Hidden within this larger ecology of computational film, of protocol, algorithms, patents, piracy, carriers, and collections, are humans. An essential part of this ecology, people ultimately make up those experiencing, making, marketing, and circumscribing cinema in the age of algorithms. Throughout this dissertation, I have dealt with key elements of cinema's larger ecology and its technological base, but beyond just impacting our ability to preserve cinema in archives, exploring the shifts in the ecology of cinema helps to reveal motivations and practices bound to all-too-human actors. While each of these chapters focuses in one way or another on how definitions of quality are linked to shifts in the technologies of cinema and how those shifts impact preservation and circulation, they just as easily could have revealed a contradictory tendency about the people behind these shifts. Despite less seemly motivations, these human actors each betray a degree of investment in saving cinema as a unique medium even if their actions may contradictorily impact the ability to materially save cinematic artifacts in archives.

Each of the overarching questions explored in this dissertation through the lens of media ecology links back to networks of individuals invested, in one way or another, in answering such questions and, more significantly, invested in cinema as an artistic medium. What is cinema? How do we define perceptual quality? What cinematic artifacts should we/can we preserve? Invoking Gitelman, Newman reminds us that a medium must be "understood not only as a technological form but also a set of supporting protocols" or usage norms which Newman identifies as defining a medium's "cultural status."[422] These norms are never stable but always evolving and shifting as different nodes of a medium's ecology change and respond to each other and to larger shifts in adjacent media's cultural statuses. Computational cinema's "cultural

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[422] Michael Z. Newman, *Video Revolutions: On the History of a Medium* (New York: Columbia University Press, 2014), 100-101.

status" has always been up for debate, just as analog cinema's was before it. The stakes around defining computational cinema's cultural status are as varied as the individuals directly and indirectly working out this definition, yet to fully understand what cinema is, we need to keep in mind that the ecology of cinema, its network of connections at scales both micro and macro, is also related to a much larger media landscape. Saving cinema in this dissertation focuses on saving its artifacts, but it also opens doors to investigating the ways in which saving cinema as a popular cultural form is deeply bound to each (re)definition of quality and the technologies that continue to drive these claims.

The Many Faces of Quality Cinema or: Saving Cinema as Artistic Medium

While the human actors in each chapter of this dissertation may represent, at times, overlapping nodes in this ecology, each chapter nonetheless serves as a window into a set of motivations both unique and shared. Unique motivations may vary from monetary gain to cultural status but what is shared in each of these chapters, regardless of actors, is a fight to reassert the importance of cinema as an artform in the wake of cultural change. Whether we are talking about the introduction of a new carrier, the sharing of a digital cinematic artifact, the creation of a new codec, or the introduction of a post-production workflow, each new technology of cinema is created as an investment in the perpetuation of cinema as a significant artistic medium.

We might look toward DVD marketing and its invocation of "quality" as a simple tactic to further move a product. Afterall, as I have already argued, linking technological shifts to increasing quality has been a core technique of cinematic marketing since the medium began. We might just as easily note that DVD's quality (far from equal to 35mm prints in terms of clarity of image and color rendition), was invoked primarily as a means of moving spectators from VHS to the far more policed medium of DVD. VHS, a medium marketed around accessibility to the

dismay of the film industry more broadly, was an aberration in need of correcting from the perspective of Lieberfarb and other industry heavy hitters as noted in chapter one. In the case of DVD, quality, more than anything, meant control. CSS algorithms, more technically difficult approaches to duplication and bootlegging, all reinforced by the DMCA's anti-circumvention provisions, meant DVD was a medium far less prone to seamless copyright infringement (in theory). Quality renditions of films on DVD was a means of the film industry to reassert its power in the wake of an embarrassing defeat in court and to tap into the full revenue possibilities offered by the growing modes of distribution beyond the theater walls.

And yet, DVD also prompted a new focus on cinematic objects as fundamentally distinct from television and worthy of careful technological oversight when it came to readying them for home entertainment. Whereas films released on VHS were often debauched by pan and scan techniques to fit the widescreen imagery into a 4:3 box, and additionally interrupted by commercials and edited for time in many television broadcasts, DVD began the process of retaining correct aspect ratios and respecting editing decisions, even releasing myriad "director's cuts," in an attempt (for marketing purposes or not) to stay "true" to the cinematic artifact's aesthetics. Overblown claims of quality may have contradictorily contributed to a future culture invested in easy and seamless access as previously discussed, but it simultaneously ignited a broader recognition of cinema as a medium worthy of accessing as close to its "intended" aesthetic as possible. Furthermore, special features like director's commentary, "making of" featurettes, and alternate endings reinforced the mythos of the film industry as a magical dream factory, whose techniques and tools, artists and technicians, could produce captivating cultural artifacts capable of whisking audiences away unlike any other artistic medium.

If DVD quality meant control *and* served to reiterate the significance of cinema in a changing media climate, Karagarga's definition of quality, while equally based on the promise of a kind of visual and aural clarity, betrays another mode of agency and control. As the film industry has shifted from selling "theater quality" DVDs to promising unlimited access of content via streaming services (another tactic of control if ever there was one), we might understand users of Karagarga's embrace of quality specifications as a means of reasserting the importance of cinema as a medium in an altogether different way. At a historical moment when films are easily accessible via OTT platforms like Netflix, Disney+, Paramount+, and Hulu, and are indifferently featured alongside television shows, sports broadcasts, music, and news (amongst other things) within those platforms, stressing the importance of "quality" is essentially an act of care that reinforces the importance of cinema.

It is easy to dismiss Karagarga's invite-only policies and its broader user base as elitist. A closed-off network of cinephiles refusing to engage with popular blockbuster cinema seems *prima facie* to be merely conservative nostalgics looking back on "the good ol' days" of cinema's history. But, such a dismissal ignores the clear motivations behind its policies particularly when understood in the larger context of ephemeral access. At a moment when a user can just as easily subscribe to a streaming service as access a poorly ripped copy of a film on YouTube, Karagarga's gatekeeping and enforcement of specific technical quality standards remind us that cinema is not a throwaway product. Beyond Karagarga's potential to intervene in the preservation of cinematic artifacts, the torrent tracker's policies reinforce the fact that cinema is an artform that requires our time and attention. To fully understand and deeply experience a cinematic artifact requires a degree of temporary devotion that the seamless era of digital distribution and web-based video services seem to disallow.

We are not rewarded for our enduring attention in the era of computational media and neither are the platforms circulating that media. Rather, distraction, clicks, and the trance-like, short-term "engagement" reinforced through algorithmic rabbit holes asks us to keep moving forward, to keep clicking, to keep surfing. In many ways, Karagarga insists on slowness in its refusal to allow more contemporary Hollywood films (known for their rapid editing and spectacle), its stress on quality standards that delimit the potential for more seamless ephemeral access, and in its policies around downloading cinematic artifacts (e.g., a degree of investment through seeding is required before you can download the films you want). In essence, quality functions as a means of control for Karagarga users, but more importantly it serves as a means of reinforcing the joys that the attentive cinematic spectator can reap if they would just slow down to experience it.

We find a similar devotion to cinema as an artform when considering RED and the REDCODE Raw codec. While RED founder Jim Jannard is certainly well-known for his overly-aggressive enforcement of patents as a means of locking down the market, it is also true that Jannard's own love of cinema inspired his foray into camera manufacturing. As the founder and owner of the sunglass empire Oakley, Jannard was not a struggling engineer working to revolutionize the industry, but rather a wealthy businessman whose love of the cinematic medium spurned his obsession with the technologies of digital cinema. Regardless of Jannard's shortcomings and the negative impact on archives his camera company has unintentionally exacerbated, the embrace of "quality" as connected to raw file formats and increasing resolution by Jannard and RED might be understood as a means of differentiating cinema from alternative modes of content production. At a historical moment when anyone can shoot impressive looking content on an iPhone and quite effortlessly post it to YouTube, raw capture is a technology that

requires intensive production and post-production resources and processing before a completed product can reach an audience. In essence, through a degree of technological complexity and the careful marketing of those characteristics as quality, Jannard's RED—as well as myriad other camera manufacturers—is reasserting cinematic practice as a rarefied artform that exists at the professional level well-beyond the reaches of the "prosumer" public.

There is of course a kind of technophilic gatekeeping at play. Despite the early chorus of digital evangelists arguing that the computational age would mean the dissolution of the walls between professionals and amateurs, producers and consumers, the reality is quite different. The line between professional and amateur, although sometimes breached, remains largely reinforced through technological barriers. RED cameras might be relatively inexpensive from a professional standpoint for a low-end camera package in their RED line, but RED's price points coupled with the complexity of the workflow required for their operation restricts the entry of your average "content creator" into the realm of professional cinema. A problematic truth of cinema has always been that as a medium of the masses, it remains an impossibly difficult artistic industry to truly "succeed" in. Technology is fundamentally implicated in this axiom of the medium. At the same time however, this problematic gatekeeping reinforces cinema as an artform existing beyond mere content. TikTok is not cinema. Twitch is not cinema. A truth reinforced just as much through technology as aesthetics. The technological barriers to entry could just as easily be attributed to a drive for market control as to a means of reinforcing cinema as a rarefied artistic medium, for better or worse. In most cases, we would be right to assume that both of these intentions are true.

This personal, professional, and market investment in defining and redefining quality at various nodes in cinema's ecology as a means of differentiating cinema from other closely

related media is also directly linked to the temporal liminality of color workflows as discussed in chapter four. After all, what are ACES and Davinci Wide Gamut color workflows if not promises that cinema as a popular artform will hold onto its "cultural status" as an important and unique medium? As technologies that put video files into color workspaces that contemporary displays cannot yet reproduce, these workflows are future oriented. They are algorithmic messages of hope that cinematic artifacts of the past will still be valuable in a future when the tools of computational media have advanced well beyond their present limitations. They imagine a cinematic ecology of the future whose nodes and interconnections might look different, but whose significance as a popular cultural form retains the power to move audiences just like it did in that Paris Cafe in 1895.

Exploring the nodes of the ecology of computational film can reveal myriad traits of the medium as it currently exists. One network of connections examined throughout this dissertation— those linking technological shifts to claims of perceptual quality—reveals one aspect of a medium intent on moving forward while failing to adequately ensure that its past remains secure and safe. Following other connective threads, as this conclusion briefly examines, reveals a network of human actors invested in saving cinema's position as a popular and unique artistic medium in the wake of cultural change. While the overall constitution of cinema in the age of computational film remains nebulous, following more threads, more connections, and more relational shifts in this larger cinematic ecology might function as its own small contribution towards saving cinema in the wake of cultural change, even if only by reasserting its importance as an object of academic study.

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