

Cinema in the Digital Age: A Rebuttal to Lev Manovich

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I. Introduction

Philosophy of film has been in upheaval since the early days of digital post-production effects and manipulation in the 1980s. Although shot and released on celluloid, many feature films of the 1990s were transferred to video in a process known as telecine. Telecine effectively turned the film image into an analog video image which could then be digitized and ingested into a computer for post-production editing and visual effects. Concurrent rapid innovations in non-linear editing software and hardware dramatically accelerated the post-production editing process, while decreasing costs and increasing profits for film studios. End-to-end digital filmmaking gained industry credibility when George Lucas embraced digital for his 1999 release of *Star Wars Episode I: The Phantom Menace*. The film was partially recorded on digital cameras, edited and composited on computers and distributed digitally to select movie theaters.¹

As technologies continued to mature and cinema became increasingly digital, film philosophy entered a crisis. Classical film theories that depend upon the acknowledged indexical relationship of an analog photo to its referent in reality were unable to accommodate the move to digital. This quandary has renewed interest in these classical theories, returning them to the forefront of film philosophy.

Lev Manovich, a preeminent digital media philosopher, has posited that cinema has been fundamentally changed by cinema's digital revolution. In *The Language of New Media*, Manovich claims the index is an ontological condition of cinema. Quoting a 1975 article by French film theorist Christian Metz, Manovich agrees "most films shot

¹ It is only recently that significant numbers of movie theaters have made the costly conversion to digital projection, allowing for a complete end-to-end digital filmmaking process. Digital projection is expected to reach 90% of world-wide theaters by the end of 2013 (Hancock).

today, good or bad, original or not, 'commercial' or not, have a common characteristic that they tell a story; in this measure they all belong to one and the same genre, which is, rather, a sort of 'super-genre' ['sur-genre']" (300). Manovich then goes on to proclaim "in identifying fictional film as a 'super-genre' of twentieth-century cinema, Metz did not bother to mention another characteristic of this genre because at the time it was too obvious: Fictional films are *live-action* films; that is they largely consist of unmodified photographic recordings of real events that took place in real, physical space" (294). By restricting this super-genre to *unmodified photographic recordings*, Manovich aims to elevate the index of photochemical film a requirement for all cinema. For Manovich, the transition to digital "represents a return to the pro-cinematic practices of the nineteenth century, when images were hand-painted and hand-animated" (295). He believes digital cinema's "inherent mutability erases the difference between a photograph and a painting" (304), thereby eliminating the indexical relationship with reality. Because he understands the index is a condition for cinema, he must conclude "computer media redefine the very identity of cinema" (293).

This paper offers a refutation of Manovich's assertion of the devolution of cinema to mere animation, and the resulting redefinition of cinema. Arguments will show that digital cinema can be indexical, but that indexicality is not an ontological condition for cinema. Consequently, cinema has not fundamentally changed and requires no redefinition.

II. Cinema Terminology

The self-explanatory terms *motion picture*, *moving picture*, *movie*, *flick* and *film* have been used interchangeably for decades. *Moving picture* and *motion picture* were the earliest terms used to describe the finished output of a myriad of motion arts technologies that rose to popularity in the late nineteenth century. The earliest photographic moving pictures were called *photoplays*; these terms now sound quaint, but the derived term *movie* is common vernacular.

These terms evolved from different origins. *Moving picture* and *motion picture* derived from the spectator experience of viewing the finished work, in which the content of the images is perceived to move within the frame. *Flick* described the perceptible flicker experienced by audiences watching early motion pictures, which were often displayed at around 16 frames per second. *Film* derives from the celluloid substrate that initially records an image captured by the camera, and from the final strip of celluloid that holds the finished piece; the term originally evolved to differentiate film motion pictures from earlier animated motion pictures.

Cinema, derives from the French *cinématographe*, one of many early names for both the projector that displayed photographic motion pictures and the camera that recorded them. Originally from Greek, meaning *writing in movement*, the term is now used to refer to the entire motion picture industry, as well as the individual theaters where films are displayed.

Throughout this paper I will use the term *cinema* to refer to both the motion picture industry, and the collective output of that industry. I will use the term *film* to refer

to an individual motion picture generated by that industry. Additional terms, defined below, will be referenced throughout this paper.

Traditional Cinema / Film: Film(s) recorded onto celluloid film stock with a mechanical camera, using only analog production and post-production techniques.

Digital Cinema / Film: Film(s) using digital production or post-production techniques for any part of their creation. This may include films digitized after recording on film stock in a traditional manner.

Production: Also known as *principal photography*. Work performed on set while the movie is filmed or recorded with cameras, crew and actors.

Post-production: Work performed after principal photography footage is available. Includes manipulating the digital or traditional principal photography footage, including editing, color correction, color grading, sound design, visual effects, compositing and much more.

Distribution: The distribution phase includes duplication and release of finished film through various channels. May be released to movie theaters for projected exhibition, or directly to consumers through digital download or consumer media such as Blu-Ray. This phase also includes marketing and promotion of the film.

Film Stock / Film Strip / Celluloid: Originally made of cellulose nitrate, film stock now consists of a transparent polyester base with layers of light-sensitive emulsion applied to one side. The emulsion consists of silver-halide crystals suspended in a gelatin colloid. These terms will be used interchangeably through the paper.

CGI / CG / Visual Effects / Visualization: Various names for digital effects and animations created on a computer during post-production.

Special Effects / Practical Effects: An effect produced physically on set, without post-production techniques.

Sync Sound: Sound recorded during principal photography, intended to stay in sync with the footage recorded at the same time.

III. The Art of the Index

Classical film theories emerged from early philosophies of photography. In 1843, David Brewster published the first writings on the indexical nature of photography in an Edinburgh Review article. Brewster hypothesized that the photographic image is directly linked to an object by its reflected light, saying “the image is connected with its prototype by sensibilities peculiarly touching. It was the very light which radiated from his brow ... that pencilled the cherished image, and fixed [itself] for ever there” (Lenman 621). Over fifty years later, in an 1894 discourse on semiotics and logic, Charles Sanders Peirce developed this concept further, stating “the index is physically connected with its object; they make an organic pair” (Hartshorne and Weiss 301). Peirce clarified that, not only were the index and its referent connected, but that their relationship is causal; “The *index*, ... like a footprint or a shadow, denotes an object by being physically caused by that object” (Lenman 621). This causal indexical relationship was accepted as a unique artifact of the mechanical and chemical nature of photographic production.

These same mechanical and photochemical characteristics were initially used to reject the very possibility of an art of photography; the purely physical photographic processes left no room for artistic intent. In response, early justifications for

photographic art embraced the index as part of the essential and unique nature of photography, quintessential to its aesthetic value. It was the physical production of photography that gave it artistic merit.

When the burgeoning moving picture industry adopted the photographic filmstrip, criticisms and theories of photography were extended to moving pictures, because “one of the earliest proposals for defining cinema was the idea that cinema is essentially nothing but moving photography, a process of sheer mechanical recording” (Carroll 55). Consequently, the index and the mechanical and photochemical nature of motion pictures became central to philosophical debates about the artistic merits of cinema. Defenders “argued that the art of film depended fundamentally on its photographic element. ... However, they did not — like the early detractors of cinema — believe that film forfeited its claim to art status because it was photographic. Rather, they asserted that photography made possible a new kind of art — an art of the real — of which film was in the vital forefront” (Carroll and Choi 52). Consequently, the indexical nature of film was essential to classical film philosophies.

Even though “the pressure to prove that moving pictures can be an art is, by now, far behind us” (Carroll 54), the index has returned to the forefront of film philosophy debate. Digital technologies have altered methods of capturing and editing film and have renewed interest in the indexical nature of photography and cinema.

IV. Manovich on Digital Cinema

Echoing Peirce, Manovich states “cinema is the art of index; it is an attempt to make art out of a footprint” (295). Manovich believes the index is an ontological

condition for cinema. He claims “no matter how complex its stylistic innovations, the cinema has found its base in these deposits of reality, these samples obtained through a methodical and prosaic process” (294). Manovich asserts that digital cinema cannot be indexical because it is merely a form of animation, and therefore digital cinema redefines the conditions of cinema. This argument contains several significant problems, which will be individually addressed.

Traditional fictional film is indexical. Manovich declares fictional cinema’s super-genre to be *live-action*; he asserts live-action films “largely consist of unmodified photographic recordings of real events that took place in real, physical space.” Since unmodified photography is indexical, and by extension, cinematography is indexical, Manovich surmises all fiction film must be indexical.

Manovich excludes animated films from “cinema’s indexical identity” (295), as they are not recordings of real events. Gunning acknowledges the weakness of this position, asking:

[I]s it not somewhat strange that photographic theories of the cinema have had such a hold on film theory that much of film theory must immediately add the caveat that they do not apply to animated film? Given that as a technical innovation cinema was first understood as “animated pictures” ... shouldn’t this lacuna disturb us? (34)

Some theorists have attempted to remedy this problem by suggesting that traditional animated films are superficially indexical because they consist of photographs of objects in the real world, albeit hand drawn image cels. Manovich does not address this

counterargument. He simply excludes animation as an artifice left behind by cinema:

Once the cinema was established as a technology, it cut all references to its origins in artifice. Everything that characterized moving pictures before the twentieth century — the manual construction of images, loop actions, the discrete nature of space and movement — was delegated to the cinema's bastard relative, its supplement and shadow — animation.

Twentieth-century animation became the depository for nineteenth-century techniques left behind by cinema. (298)

Manovich ignores the sophisticated cel animation film production techniques that emerged in pace with photographic film technologies. Hand drawn animation was recorded to film in 1900 for sequences of *Enchanted Drawing*; the first fully animated film, *Humorous Phases of Funny Faces*, followed in 1906; the hugely popular film *Gertie the Dinosaur* mixed live-action and cel animated footage in 1914. Animated films were shown in theaters alongside live-action films. Why then should animated films be excluded from cinema's super-genre and be simply rejected as "cinema's bastard relative"? Simply put, Manovich must exclude animated films to support his claim that all fictional films are live-action photographic recordings.

Accepting Manovich's exclusion of animated films from cinema's super-genre, it is initially not obvious what he means when he states that live-action films are *largely unmodified*; is he asserting that the content of individual films is largely unmodified, or that the majority of fictional films are unmodified? Manovich must be referring to the majority of fictional films as a whole, as he goes on to exclude all partially modified films from his super-genre definition.

Manovich states “one of the major impulses in all avant-garde filmmaking ... was to combine the cinematic, the painterly, and the graphic — by using live-action footage in a variety of ways, or by juxtaposing printed texts and filmed images” (306). He excludes avant-garde films from the fiction super-genre:

When the avant-garde filmmakers collaged multiple images within a single frame, or painted and scratched film, or revolted against the indexical identity of cinema in other ways, they were working against the “normal” filmmaking procedures and the intended uses of film technology. ... Thus they operated on the periphery of commercial cinema not only aesthetically but also technically. (306)

Manovich justifies excluding avant-garde films because they exist outside of the filmmaking norms, but, as with animated films, it is unclear why this relegates these films to a realm of non-cinema.

Manovich uses the same argument for his exclusion of special effects by stating:

Rear-projection and blue-screen photography, matte paintings and glass shots, mirrors and miniatures, push development, optical effects and other techniques that allowed filmmakers to construct and alter moving images, and thus could reveal that cinema was not really different from animation, were pushed to cinema’s periphery by its practitioners, historians and critics. (299)

In the case of special effects cinematography, Manovich does attempt to offer support for his position. Manovich references:

- *Cinema*, a 1974 book containing history of the cinema industry, including details about actors, filmmakers and outstanding films. It includes a section of short stories about the making of specific films: “The heroes of these stories are actors, director and producers; special effects artists are mentioned only once” (299).
- *Film Art: An Introduction*,² an introduction to film aesthetics.
- *Aesthetics of Film*, first published in French in 1983, which defines the parameters of international film criticism.
- The ratio of books on the specific subject of *special effects cinematography* and very general subject of *motion pictures* in the UC San Diego library.

These sources do not support his claim.

First, the books Manovich references are written for non-technical film enthusiasts, and scholars of film aesthetics and criticism. Specifically, *Cinema* is a history book focusing on the adventures of famous *above the line*³ personalities in the industry. Manovich states “the fact that [*Aesthetics of Film*] never mentions special effects techniques reflects the general lack of any historical or theoretical interest in the topic by film scholars” (299). Drawing such a conclusion from a single film criticism text seems wholly inadequate. However, the larger problem is the lack of relevance. Film aesthetics and criticism scholars focus on analyzing cinematic works as art; their

² Edition not specified; first published in 1979.

³ The *line* refers to the demarcation on the top page of a film budget that separates the *above the line* creative talent (screenwriters, producers, director, actors, etc.) from the *below the line* crew (cinematographer, grips, gaffers, costumer, editor, etc.). The above the line individuals are responsible for the success of the film.

interests are not a reflection of the use of special effects by filmmakers and craftsman within the cinema industry. It is not surprising these texts do not delve into optical and mechanical effects, as special effects cinematography is a highly technical skill learned in a hands-on environment.

Second, as Manovich points out “cinema works hard to erase any traces of its own production process, including any indication that the images that we see could have been constructed rather than simply recorded” (298). When done correctly, the majority of these effects should be invisible, adding to the emotional and kinesthetic response of the viewer without drawing undue attention to themselves.

Third, the search of UC San Diego’s library is inconsequential. The number of books in a typical university library is not indicative of the popularity of special effects practices among filmmakers in the cinema industry. Additionally, UC San Diego is not a film school and would not be expected to have a great number of technical books related to the details of special effects cinematography.

Finally, Manovich’s claim that special effects cinematography was pushed to the periphery by practitioners can easily be refuted by simply referencing a list of popular and financially successful films which have included them (see Appendix). Viewing such a list, it is clear that pre-digital special effects were widely used in the industry. It may be true that the historians and critics referenced by Manovich ignore the contributions of special effects in film production, but that has no relevance to their actual frequency of usage during filmmaking.

Manovich asserts that fictional cinema is largely made up of unmodified analog photographic footage in order to emphasize the index. He then elevates the index to a

requirement for fictional cinema, thereby eliminating non-indexical footage from cinema by definition.

Digital cinema is not indexical. Manovich believes indexicality is an ontological condition for cinema, and that digital footage, including digitized live-action footage, cannot be indexical. He claims “once live-action footage is digitized (or directly recorded in a digital format), it loses its privileged indexical relationship to prefilmic reality” (300). However, it is not as clear why live-action footage would lose indexicality when digitized, or why unmodified footage of the real world directly recorded by a digital camera cannot be indexical.

In order to evaluate the indexicality of digital cinema directly recorded in a digital format, we must first understand analog camera mechanics and the photochemical process by which traditional cinema images are created. In very simplified terms, the traditional analog film camera consists of a focusing *lens*, a *shutter*, which opens and closes to control the flow of light to the *filmstrip*, which is held in position by the *gate*. With the shutter closed, the camera advances the filmstrip, advancing the next unexposed frame of the filmstrip into the gate. The shutter opens for a specified amount of time, and the light rays bouncing off real-world objects in front of the camera pass through the lens, where they are focused on the single frame of film in the gate. The shutter then closes and the camera advances the film strip again to repeat the cycle.

This film stock consist of grains of silver-halide crystals layered in gelatin, bonded to a base.⁴ When photons bump into the silver-halide crystals, the energy causes a

⁴ The earliest celluloid film stock base was made from highly flammable cellulose nitrate. Due to many deaths in both film stock factories and theaters, less flammable *safety film* was later made from cellulose acetate. Current film stocks are made from cellulose acetate or polyester.

photochemical reaction, changing the nature of the crystals. This moment of impact between a photon and film grain describes Manovich's privileged indexical relationship. Photons leave *deposits of reality* when impacting the silver-halide grains.

Digital cameras share many features with their analog predecessors, and record the same light rays bouncing off of real-world objects. Berys Gaut explains "the crucial difference between a digital camera and a traditional camera is the replacement of a photochemical film with an electronic sensor ... the lenses, optical systems, shutter mechanisms, and so on, can be identical" (48). The electronic sensor records the impact of photons, just as silver-halide crystals do in film stock. However, the digital camera replaces the silver-halide crystals with the photosensitive receptor sites of the sensor. While the camera shutter⁵ is open, the sensor's receptor sites capture the energy from impacting photons. The camera then reads the accumulated charge and digitizes the value, recording the numerical data to a file.

At this point in the photographic process, the indexicality of analog and digital recordings are essentially the same — *deposits of reality* have been recorded as light intensity and color for each point of exposure.⁶ The analog image data has recorded to film stock and the digital image data has been recorded to a file. Next, the recorded image data must pass through development processing.

⁵ Digital cameras use either a tradition hardware shutter or an electronic shutter. Essentially, an electronic shutter simultaneously activates each sensor site for the allotted exposure time, reads the accumulated exposure data, and then resets the sensor site in preparation for the next activation.

⁶ Although celluloid film is often thought to have unlimited resolution, its resolution is actually limited by the number of silver grains suspended in the film substrate. Each grain is analogous to an electronic sensor site in a digital camera. Both digital camera sensors and film scanners are now capable of surpassing the resolution of traditional silver grain film stock.

After exposure, film stock must be processed in a series of chemical baths to set the exposed silver grains and wash away the unexposed silver-halide. The resulting negative image is affected by light exposure, chemical bath ratios, timing, agitation, temperature, chemical solution purity and even the cleanliness of the equipment used throughout development. The film negative can be dramatically manipulated, both intentionally and unintentionally, by small fluctuations in this development process, consequently affecting the indexicality of the resulting negative. This index degradation continues throughout post-production. The photographic negative must be *printed* to an *interpositive* (intermediate positive) and back to a negative repeatedly through a similar chemical development process, degrading and endangering the index with each print. When the film is completely finished to a *master print*, it is then printed to many negatives for distribution to theaters. Each time this master is printed, the image slightly degrades again. Finally, with each movie theatre projection, the distribution reels gather scratches and dust, further altering the image.

Raw digital image data files, commonly referred to collectively as *digital negative*, avoid degradation of the recorded image, maintaining the indexical data representing the exposed hue, saturation and luminosity for each exposed frame.⁷ This digital data can be passed between computers and distributed world wide without degradation. The digital negative is dramatically less lossy than traditional film stock, which results in a more accurate indexical relationship with reality.

⁷ Each digital camera brand uses its own proprietary data compression format. Data compression, designed to balance data accuracy with a smaller digital file size, can result in loss of detail in the digital negative, degrading the image. However, several cameras now offer *uncompressed raw* data for maximum image data accuracy.

Manovich claims images directly recorded in a digital format cannot be indexical, but both analog and digital cameras produce indexical image data. Gaut recognizes the only significant difference is the methods of recording light data:

Given the similarity of generative methods, it is implausible to claim one is a photograph and the other is not. The important difference lies in the means of recording the light and the digitizing of the subsequent information; but the root feature of photography, that it is the mechanical recording of the appearance of things by fixing a record of the light emanating from them, applies in both cases. (48)

Manovich also claims that traditional live-action footage, once digitized, loses its indexicality. Thousands of traditional live-action film negatives have been scanned and converted to digital negatives; these traditional live-action negatives were initially formed by light bouncing off objects in the real world and were therefore indexical prior to digitization. Once digitized, the image data is simply stored in a different base medium, as numerical data points instead of silver grains. Digitizing the negative immediately after initial development effectively terminates the image deterioration caused by an analog post-production workflow and maintains the greatest amount of indexical data.

It seems Manovich believes digital footage, whether directly recorded on a digital camera or digitized from live-action footage, cannot be indexical simply by virtue of being digital. He justifies his rejection of digitized and directly recorded digital footage indexicality by suggesting “the computer does not distinguish between an image obtained through a photographic lens, an image created in a paint program, or an image

synthesized in a 3-D graphics package, since they are all made from the same material — pixels” (300). This is both incorrect, and an oversimplification of computer image production processes.

First, Manovich misunderstands the relationship of the analog and digital mediums, confusing the recording medium with the display technology. While a traditional film image may be said to be indexical, the causal index is actually captured in the film negative. The indexicality of the visual image results from the display of the indexical data stored in the film negative. The equivalent digital index is stored in the digital negative data in an array of binary data, or *bitmap data*. Digital negatives are not made of pixels, but of numbers describing the color and intensity of light at mathematical points.⁸ These numbers are the analogous to the silver grains in a developed film negative. Gaut clarifies:

Given the essential role of bitmap images in digital cinema, we can thus define digital cinema as the medium of moving images generated by bitmaps. Note the formulation ‘generated by’. A visual image by definition is visible, i.e., can be seen, and that requires it to have visual properties. But a bitmap is a mathematical, abstract entity — an ordered set of integers — and numbers ... cannot be seen. So a bitmap is not an image: rather, it is a *mathematical representation*, i.e., a mathematical model, *of* an image. The digital image itself is an image generated by a bitmap that specifies it. (14)

⁸ Pixels are a display technology, the smallest element in a display device.

Once footage is digitized, or when shot directly on a digital camera, numerical (bitmap) image data must be translated by software to generate visual (pixel) images.

Second, Manovich disregards the most basic post-production procedures of digital filmmaking. Image data from different sources, such as that from scanned celluloid (bitmap data) or a 3-D program (vector data) are distinctly different, and require corresponding software designed to interpret that specific image data format. Without the appropriate software they cannot be combined, manipulated or even viewed.

Third, even if Manovich was correct in his assumption that computers do not distinguish between images sources, the same could be said of the traditional film negative. Images on film stock can also be altered and manipulated through dozens of common techniques such as chroma key compositing, flashing, and push and pull processing. The grains of silver in a film negative do not distinguish between an image created by light leaking into a film canister, bouncing off an object in front of a camera or exposure from photographing a hand drawn animation cel. The grains of silver-halide on a filmstrip record photon energy without discerning the causal energy source.

Manovich posits “pixels, regardless of their origin, can be easily altered, substituted one for another, and so on. Live-action footage is thus reduced to just another graphic, no different than images created manually” (300). The very possibility of manipulation seems to trouble Manovich; “given that an artist is easily able to manipulate digitized footage either as a whole or frame by frame, a film in a general sense becomes a series of paintings” (304). His concern that digital images can be easily manipulated is well founded. There are hundreds of software programs designed for the specific purpose of manipulating digital image data. However, the possibility of

manipulation does not destroy the index; the manipulation must actually occur. Gaut concurs:

Certainly, digital imaging software makes available painting techniques that break the essential causal link between a photograph and its subject. But the mere possibility of using such techniques does not show that, if they are not employed, the resulting image is like a painting, any more than the possibility of overpainting a traditional photograph shows that traditional photographs are like paintings. (47)

Destruction of the index does not follow from Manovich's appeal to the possibility of digital manipulation. Consequently, unmodified digitized or digitally captured negatives, like their analog counterparts, do maintain a privileged indexical relationship with reality.

Cinema redefined. Manovich proclaims that digital filmmaking has fundamentally altered the nature of cinema, devolving it back into painterly animation.

The manual construction of images in digital cinema represents a return to the pro-cinematic practices of the nineteenth century, when images were hand-painted and hand-animated. ... Consequently, cinema can no longer be clearly distinguished from animation. It is no longer an indexical media technology but, rather, a subgenre of painting. (295)

To support this theory, Manovich offers a formula for digital cinema:

digital film = live-action material + painting + image processing + compositing + 2-D animation + 3-D animation⁹

⁹ For Manovich, "painting, image processing and computer animation refer to the process of modifying already existent images as well as creating new ones" (302).

This definition of digital film starkly contrasts with his definition of traditional film, where he excludes all modifications, including painting, processing and animation.

Applying the same exclusions to digital cinema, the formula now looks like:

digital film = live-action material + ~~painting~~ + ~~image processing~~ + ~~compositing~~ + ~~2-D animation~~ + ~~3-D animation~~

Manovich is making an inconsistent comparison, contrasting unmodified traditional films to modified digital films. When applying the uniform conditions to traditional live-action and digital live-action footage, the resulting negatives are consistently indexical.

Even when intentional manipulation of the digital image data does occur, it is not obvious that the index is destroyed. Gaut points out:

[M]any digital editing methods are akin to traditional darkroom techniques; such techniques include cropping, adjusting exposure times to change the overall lightness of an image, dodging (reducing light to part of an image) or burning in (increasing light to part of the image), the use of texture screens (to impart a particular texture to the photograph), the choice of paper for printing to adjust contrast and other features, combination printing (combining two negatives to make one print), and so on. If such darkroom techniques do not make traditional photographs into paintings, the same is true of the equivalent digital techniques. (47)

Technology has made the digital equivalents of these traditional methods easier, faster and more flexible, but that does not necessarily make them more destructive. When more significant digital post-production painting, image processing or animation modifies digital live-action image data, the index is compromised. However, that is also

true of traditional films, which is precisely why Manovich excludes animated, avant-garde and special effects films from cinema's super-genre. The indexicality of traditional and digital film footage is equivalent when comparing analogous traditional and digital films.

In summary, Manovich proclaims fictional cinema is live-action, which he defines as unmodified analog photographic footage. All films that do not fit this narrow definition, such as animated films, are excluded from consideration. The remaining films which do fit this definition share a common attribute: they are indexical. Manovich then claims digital films cannot be indexical and are merely a form of animation. Therefore, he concludes, fictional cinema is transformed by digital cinema and must be redefined as a non-indexical form of animation.

There are several problems with Manovich's argument, starting with his initial claim that the fictional cinema super-genre is live-action. With this definition, Manovich simply dispenses all animated films as non-cinema; he does not provide an alternate classification. By proclaiming live-action (unmodified photographic recordings) as the super-genre, Manovich advances the index to a condition of fictional cinema. However, there are many popular and financially successful analog fiction films that include special effects cinematography and have been modified in both production and post-production. By Manovich's definition, these films not indexical. Their very existence refutes his indexical stipulation. Manovich's next major claim is that digital cinema cannot be indexical and is a form of painterly animation. As shown, unmodified live-action digital cinema is as indexical as unmodified live-action traditional cinema; the very possibility of modification does not destroy the digital index any more than it

destroys the traditional index. Finally, he concludes that digital cinema, as animation, reduces fictional cinema to merely a form of animation.

The inclusion of digital cinema is a conundrum; Manovich excluded traditional animation outright because it was not live-action. He also excluded avant-garde, modified and special effects films because they “revolted against the indexical identity of cinema.” These non-indexical films are part of some undefined, non-cinema *other*. However, after establishing that digital cinema cannot be indexical and that it is a form of animation, Manovich includes it as part of cinema’s super-genre. By including it, he concludes that it alters the nature of that cinema, devolving it to animation. It seems puzzling to exclude one form of animation and not the other; if cel animation is excluded as non-cinema, why is digital cinema, as animation, also not relegated to non-cinema status? Manovich may argue that there is a distinct difference between early animation techniques and their digital counterparts; conceptually, “given enough time and money, one can create what will be the ultimate digital film: 129,600 frames (ninety minutes) completely painted by hand from scratch, but indistinguishable from live photography” (305). For Manovich this is “a new kind of realism, which can be described as ‘something which looks exactly as if it could have happened, although it really could not’” (301). If this *realism* is the criteria for inclusion in the cinema super-genre, then many traditional film whose seamless effects are indistinguishable from live-action should also be included, and the indexical requirement would be eliminated.

V. Cinema As Art

The motion picture industry first employed photography in the late 1870s. Eadweard Muybridge used multiple cameras to successfully capture his famous animal locomotion series in 1878. The following year, Muybridge created the first photographic motion picture projector, the *zoopraxiscope*. New motion picture recording and display devices quickly followed, from Thomas Edison's coin-operated peep-show *kinetoscope*, found in New York arcades, to the Lumière Brothers *cinématographe*, used to both record films and project them onto a large screen in France. High profits spurred the development of many competing motion picture recording and display technologies. "As a new technology at the end of the nineteenth century, cinema did not immediately appear with a defined essence as a medium, but rather, displayed an amazing promiscuity (if not polymorphic perversity) in both its models and uses" (Gunning 35).

The plethora of camera and projector technologies meant there were many formats of photographic film. Eastman Kodak began selling celluloid roll film designed specifically for motion picture photography in 1889, dramatically increasing the speed of film production. Because shorter production times resulted in greater profits, the burgeoning industry quickly adopted roll film. Noël Carroll believes philosophers like Manovich "in general appear to place far too much emphasis on photography as a recording device" (Carroll and Choi 57). Motion picture artists were less concerned with the veracity of their images than they were with the ability to make profitable content. Carroll notes, "the reason that photography has proven so attractive to film artists is that it is a fast way of producing the basic ingredients of moving fictions — namely, moving images — cheaply and quickly" (Carroll and Choi 57).

However, the earliest projected films, such as the 1895 Lumière brothers' single reel¹⁰ *actualités*, are often used as evidence of the importance filmmakers placed on the photographic index. Carroll explains:

[The Lumière Brothers films] appear to be little more than documentary records of whatever flitted before the cameras of the itinerant Lumière photographers. ... Putatively, it was not as though some comment or feeling on the part of the photographers regarding their subjects emerged from the screen. What there was to see and wonder at was arguable nothing more than the simulacra of reality mechanically reproduced with neither the intervention of a subjective artistic interpretation nor formal invention." (9)

While the Lumières' 1895 suspenseful comedy *Le Jardinier (The Gardener)* is completely ignored in these arguments, *Arrivée d'un train en gare à La Ciotat (Arrival of a Train at La Ciotat)* is a commonly cited example of an *actualité* deriving its value solely from the index.¹¹ The artistry of this film is completely disregarded; the camera position at the end of platform and diagonal shot composition lend to the impression of the train bearing down on the viewer, emphasizing the movement within the frame. During projection, the first frame of an *actualité* was projected on the screen as a still image. The projectionist would then run the film, bringing the still frame to life. Even with the technological restrictions of short, uncut films shot on an immovable camera, it was clear the intended star of these moving pictures was the motion itself.

¹⁰ The *actualités* were shot and displayed in 16 fps on a single reel of film, with a 50 second runtime.

¹¹ The film's indexicality is celebrated in the apocryphal story of the audience mistaking the projected image for reality, running away in terror as the train approached.

As cameras became smaller and film stock became more light sensitive, filmmakers were able to express their vision with more creative camera work. Carroll acknowledges that even in nascent cinema:

[C]inematography itself already also had ample resources to enable the filmmaker to go beyond mere recording and defamiliarize her subject matter. ... the filmmaker may frame and object in a way that lifts it out of its ordinary context, enabling us to see it afresh — to apprehend certain of its properties that may have gone heretofore unnoticed in the normal course of perception. Likewise, freeze frames, slow and accelerated motion, high- and low-angle shots, as well as close shots and camera movement cannot be dismissed as nothing but the simulacra of the act of seeing with one's own eyes. (41 - 42)

Like other artists, traditional filmmakers were concerned with expressing a personal vision, not simply reproducing reality.

Technological innovations were driven by demand for more creative control and flexibility. Sync sound and color sensitive film stock were major breakthroughs, but creative production techniques were constantly evolving to overcome the artistic limitations of the physical and chemical photographic process. These practices are still used in traditional filmmaking today. Selection of film stock (speed, color balance, exposure latitude, look) and subsequent negative development processes (cross processing, push and pull processing, bleach bypass) affect the grain, color, saturation and contrast of the finished film. During principal photography, lighting, lens choice, framing, shutter angle, camera angle, filters, variable image recording rates, exposure,

focus, and depth of field and pacing contribute to the final narrative. Effects cinematography creates and extends new realities with overlays, superimpositions, rear and front projections, miniatures and models, glass shots, matte shots, and matte paintings.¹² Post-production techniques bring the disparate footage together with optical printing, editing, color correction and grading, and sound design and mixing. All of these techniques, and many more, are used to create the motion picture diegesis. When done well, these individual techniques are invisible; they are intended to elicit a particular emotional and kinesthetic response from the audience without impeding the suspension of disbelief required to engage in the fictional narrative.

Cinema was born as the art of moving pictures. The indexical and immutable nature of celluloid has long been the impetus for technological innovation; each new cinema technology has expanded filmmakers' artistic expression. Thousands of tools and techniques in cinematography, editing, sound, color and effects have evolved to enhance film narrative. Traditional filmmakers manage to create unique film diegeses despite the index, not because of it. Digital cinema technologies and techniques are the latest progression in a long history of advancements in the art of visual storytelling.

¹² While these traditional effects are constructed with real objects in front of the camera and are therefore indexical, they are intended to be perceived as a real part of a non-existent world. These artworks are similar to traditional animation cels. The 2-D or 3-D art is hand created and filmed; the resulting photographic images have an indexical relationship with the artwork, but the resulting images capture a fake world intended to appear as the real world in front of the camera.

VI. Conclusion

When proclaiming the super-genre of fictional cinema “tells a story,” Metz is stated the obvious. Merriam-Webster’s abbreviated definition of fiction is *something that is not true*, but the expanded definition adds the specific element of story:

fic·tion *noun* \ˈfɪk-shən\
 something invented by the imagination or feigned; *specifically*: an invented story

Fictional filmmaking is not an attempt to capture truth, but rather is an elaborate process of inventing a cohesive diegesis intended to elicit a specific emotional and kinesthetic response from a particular audience. The photographic process was utilized in the majority of films created over the last century because it allowed for fast, inexpensive production of footage. Digital filmmaking has similarly increased the production speed and decreased costs, while also enabling filmmakers to create imaginary worlds that indexical celluloid could never capture. Carroll recognizes this shift:

[W]hat drives the process is not the desire to produce recordings as recordings but rather recordings that can function as parts of fictions. For both viewers and filmmakers, what is primarily of importance about cinema, most of the time, is its capacity to convey moving fictions visually. Thus, we will consider it the same art form if and when the relevant images are generated by computers rather than photographed by cameras.

(Carroll and Choi 57)

Manovich disagrees, reiterating the importance of immutable celluloid when concluding: “In the twentieth century, cinema played two roles at once. As a media technology, its role was to capture and store visible reality. The difficulty of modifying the images once

recorded was precisely what lent it value as a document, assuring its authenticity” (307). Historically, this has been true for news, security, military, sports and training footage. The indexicality of unmodified live-action footage is the hallmark of footage whose very value is determined by its veracity. However, Manovich continues: “This same rigidity has defined the limits of cinema as a ‘super-genre’ of *live-action* narrative.” Manovich believes the index is as important to fictional live-action footage as it is to documentary footage; he ignores the important distinction between *fictional* footage, which assumes its value by telling a fabricated story, and *factual* footage, which gains its value from accurately capturing real events.

Although the index is as valid in unmodified digital footage as it is in traditional footage, the index is not an essential to fictional films. Fictional film footage portrays an invented story in an invented world, and therefore does not need to depict unmodified recordings of real events. Gunning points out “the indexical argument can be invoked more clearly (and usefully) for films used as historical evidence. It remains unclear, however, how the index functions within a fiction film, where we are dealing with a diegesis, a fictional world, rather than a reference to reality” (47). The veracity of the index is not essential to something that is, by definition, *not true*. This raises the interesting question concerning the validity of the digital index in non-fiction footage. Is unmodified digital footage accepted as valid historic evidence? While significantly more malleable than traditional footage, digital footage is accepted as legitimate evidence when authenticated and unmodified; an entire industry has emerged to verify images, whether traditional or digital, have not been manipulated. Recent software developments have automated validation of digital footage. Computers can, contrary to

Manovich's belief, differentiate between pixels in visual images generated by digital image data.

Digital filmmaking has not changed the fundamental nature of fictional cinema; the index remains intact in both traditional and digital live-action footage until that footage is modified or manipulated. The real *digital revolution* has been in film production, post-production and delivery. Advancements in technology have allowed filmmakers to create films faster and cheaper, and in a more environmentally friendly way. Smaller, lighter cameras allow filmmakers to shoot footage that would previously have been impossible to capture. Increased computation power of computer hardware and software has enabled artists to manufacture visually realistic imaginary worlds. New developments in digital delivery have eliminated the massive expense of film prints, allowing films to be beamed to theaters by satellite. These digital filmmaking tools didn't materialize accidentally. Many digital tools are analogous to their analog predecessors that have been evolving for decades.

This paper has shown that digital filmmaking tools and techniques have not changed the essential nature of fictional cinema. Unmodified digital footage is as indexical as unmodified traditional footage. Post-production manipulation and computer effects may break the index, but this would also be true of analogous traditional post-production techniques. However, this is of little consequence, as the index is not an ontological condition of fictional cinema, which is a creative art form and, by definition, *not true*. Consequently, cinema requires no redefinition as it has not been fundamentally changed by digital technologies and techniques.

Appendix

This appendix contains a limited selection of financially and/or culturally significant films which include traditional special effects. Only documented special effects have been listed. Cel animation has been omitted, as its usage is not the focus of this topic.

Year	Film	Effects
1898	The Corsican Brothers	Double exposure
1898	Un Homme de Têtes	Multiple exposures
1899	On a Runaway Motor Car through Piccadilly Circus	Slow motion
1900	The Bathers	Optical printing
1901	The Indian Chief and the Seidlitz Powder	Quick motion
1902	A Trip to the Moon	Cut scenes, stop motion, matte paintings
1926	Metropolis	Miniatures, matte paintings, Schüfftan process, compositing, optical printing
1933	King Kong	Miniatures, matte paintings, rear projection, mechanical effects
1939	Gone With the Wind	Matte paintings
1939	Wizard of Oz	Miniatures, matte paintings, keying and compositing, optical printing
1941	Citizen Kane	Miniatures, matte paintings, optical printing
1942	Casablanca	Forced perspective
1956	Forbidden Planet	Matte paintings, miniatures
1956	The Ten Commandments	Models, miniatures, traveling mattes, compositing, optical printing
1959	Ben Hur	Matte painting, rear projection
1963	Jason and the Argonauts	Miniatures, stop motion, compositing, optical printing

Year	Film	Effects
1968	2001: A Space Odyssey	Miniatures, motion-control, front projection, wire removal, mirror shots, slit-scan, rotoscoping, compositing, optical printing
1972	Deliverance	Day for night
1973	The Long Goodbye	Flashing
1977	Star Wars	Miniatures, models, traveling mattes, motion-control, keying and compositing, rear projection, stop motion
1978	Superman	Front projection, matte paintings, miniatures, slow motion, wire removal, mattes, keying and compositing
1982	Blade Runner	Miniatures, matte paintings, mattes, keying and compositing

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