

**Approaching the Impossible:  
Reconstructing Lillian Schwartz's *Googolplex* (1972)**

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Film is by design a reproducible medium. Making duplicate prints from an original source has been integral to the traditional filmmaking process since its advent in the early 1890s. This feature is so fundamental to the medium that social theorist Walter Benjamin describes this characteristic as its defining trait in his quintessential and ubiquitously cited essay about film, “The Work of Art in the Age of Mechanical Reproduction.”<sup>1</sup>

The practice of copying an image from one strip of film onto another has also lain at the heart of film preservation since the middle of the 20<sup>th</sup> century. For decades, archives have relied on film’s reproducibility to copy old, deteriorating films to newer film stock in order to preserve the work. During the 1950s and ‘60s this process gradually became standardized, but alongside these emerging guidelines, technical and ethical questions arose surrounding the historical and aesthetic integrity of a work of art.<sup>2</sup> For instance, if there are two versions of a film, which should be preserved, and how is this decision made? If material and tools exist to allow the film to be reconstructed with a degree of sharpness and quality that perhaps exceeds the caliber of the original, should the quality be elevated, or purposely diminished to mimic the look and feel of the film as audiences would have seen it when it debuted?

I will address these questions via a case study of recent efforts to reconstruct Lillian Schwartz’ short film *Googolplex* (1972) as part of an independent project through New York University’s Moving Image Archiving and Preservation graduate program. To that end, I will begin by differentiating the *preservation*, *restoration*, and *reconstruction* of moving

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<sup>1</sup> Benjamin, Walter. “The Work of Art in the Age of Mechanical Reproduction.” *Illuminations*. Trans. Hannah Arendt. New York: Schocken, 1986. 217-51. Print.

<sup>2</sup> Film Museum. *Digital Film Restoration Policy*. Vienna: The Austrian Film Museum (Österreichisches Filmmuseum), 20 Sept. 2011. PDF. Web. 1 Oct 2012. <  
<http://www.filmmuseum.at/jart/prj3/filmmuseum/data/uploads/Digital%20Film%20Restoration%20Policy.pdf>>

images, including a discussion of where and how the line is drawn between them. I will then address the ethical and aesthetic concerns inherent to these distinct processes in a real-world context by examining how these issues were brought to bear on the *Googolplex* project. In so doing, I will present the research conducted on the film's extant elements, and describe the decision to reconstruct rather than preserve or restore the work. Finally, a discussion of the methodology behind the reconstruction will elucidate some of the considerations specific to a film reconstruction project, and will provide a framework with which to address some of the challenges for film archivists who strive to maintain a film's integrity.

### **Preservation, Restoration, Reconstruction**

Before I discuss the differences between preserving, restoring, and reconstructing a film, I will begin by first explaining the need to preserve film at all. Film is an inherently unstable medium. Cellulose—from which celluloid is derived—is an organic compound, and its delicate chemical composition leaves film susceptible to both decay and physical damage. Film is fragile, and without the proper care and attention, the images it contains risk being lost forever. Although this concept may seem rather obvious to twenty-first century archivists—even perhaps to the modern layman—this was not always the case. Until the end of the 1920s film was not perceived by the public—or even by most involved in the profession—as something worth saving. Notoriously, junk collectors would frequently

acquire old nitrate prints simply for the small quantity of silver salts and the recyclable cellulose that the prints yielded when melted down.<sup>3</sup>

This attitude began to change in the 1930s with the foundation of dedicated film archives in New York, London, Paris, and other global capitals. However it was not until the early 1950s with the introduction of non-flammable cellulose acetate, or “Safety” film, that archives began to employ robust film preservation programs. An increase in resources devoted to copying film from highly flammable nitrate prints onto Safety stock resulted in a salvage mission across film archives that had been theretofore unprecedented. The sheer scale of this operation necessitated the development of best practices and an established set of standards.

Although the priority for most archives during these decades was to make new prints of abandoned commercial releases from the first several decades of motion picture production,<sup>4</sup> this soon began to change. As a deeper, more comprehensive understanding of film history began to develop, so too did the straightforward practice of duplicating film. As these standards were being developed and improved, the need to distinguish between preservation, restoration, and reconstruction became apparent.

Of these three processes, film preservation is the most straightforward to define. To preserve a film is to take a film’s best surviving elements and photochemically duplicate the material onto newer, more stable film stock. This surrogate copy becomes what is referred to as the ‘preservation master,’ and it is from this material that all subsequent viewing copies are made. This allows the best surviving elements to remain safe from the

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<sup>3</sup> Roud, Richard. *A Passion for Films: Henri Langlois and the Cinémathèque Française*. The Viking Press: New York, 1983. p. 10 and 26

<sup>4</sup> National Film Preservation Foundation. *The Film Preservation Guide: The Basics for Archives, Libraries, and Museums*. San Francisco, CA: National Film Preservation Foundation, 2004. Print. p. 1

additional handling and wear and tear that is usually associated with duplication, and allows that the new print to survive for many years to come. With an archival life of hundreds of years when properly cared for, film is still the most stable storage medium available.

The purpose of film preservation is to ensure that the material in question will still exist ten, twenty, two hundred years in the future. It is important to note, however, that within recent years the traditional definition of film preservation has been broadened to include a more holistic range of activities beyond the mere duplication of film.

“Increasingly,” notes the National Film Preservation Foundation, “[preservation] is understood as the full continuum of activities necessary to protect the film and share the content with the public. Film preservation now embraces the concepts of film handling, duplication, storage, and access.”<sup>5</sup> But what happens if the best surviving elements of the film in need of preservation have been damaged, and cannot simply be duplicated as-is?

Film restoration is based on the understanding that over the course of a film’s lifetime, its elements may become compromised.<sup>6</sup> If this happens it may be necessary to use a combination of tools and resources, many of which have been borrowed or adapted from commercial film production,<sup>7</sup> to return to the film its visual and aural components that have been lost.<sup>8</sup> By definition, claims film restorationist Ross Lipman, this is not a precise science:

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<sup>5</sup> Ibid. p. 4

<sup>6</sup> Film Museum. *Digital Film Restoration Policy*

<sup>7</sup> Ibid. p. 1

<sup>8</sup> Lindner, Josef. “Preserving Film (on Film) in a Digital Age.” *Journal of the Moving Image* 8 (2009), The Media Lab, Jadavpur University, 2009. Web. 16 Oct. 2012.

<[http://www.jmionline.org/film\\_journal/jmi\\_08/article\\_01.php](http://www.jmionline.org/film_journal/jmi_08/article_01.php)>.

Moving image restoration is undertaken on constantly shifting ground, taking a work from the past and bringing it to an ever-evolving present. This elusive task requires a judicious, carefully wielded mixture of science, artistry, and scholarship. At its heart, however, is choice. What is often unacknowledged is the extent of the process's subjectivity.<sup>9</sup>

In his beautifully written article on the subject of film restoration, Lipman acknowledges that because of the continuously shifting nature of the technology driving every stage of filmmaking—from production, to duplication, to exhibition—the task of restoring a film to its original viewing experience is fundamentally impossible and will always be “beyond reach.”<sup>10</sup>

Rather than try in vain to achieve something that isn't feasible, Lipman suggests that the task of restoring a film should be conceived of as an attempt to render an interpretation of the film that is “faithful to the spirit of the work.”<sup>11</sup> However by Lipman's own admission, the ‘spirit of a work’ is something undefinable, immeasurable, and completely beyond prescription. Herein lies the art of film restoration: In order to produce a restoration that captures the essence of a work, a restorer must make a series of choices—technical, mechanical, and sometimes even editorial—that are guided by historical research and aesthetic judgment. But what happens if the film in question is missing a scene, or even an entire reel?

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<sup>9</sup> Lipman, Ross. “The Gray Zone: A Restorationist's Travel Guide.” *The Moving Image*, Fall 9.2 (2009): 1-29. Print. p. 4

<sup>10</sup> *Ibid.* p. 5

<sup>11</sup> *Ibid.* p. 5

Whereas film restoration is based upon the idea of creating a newer, revitalized print of a film based on an existing version (or *versions*, as is sometimes the case), a film reconstruction is based on the idea of creating an “alternate [version] of [an] established [work] that never previously existed in that form.”<sup>12</sup> There are several circumstances under which the decision may be made to reconstruct, rather than restore a film. Usually (although not always, as we will see below) this decision is made because footage is missing from the surviving version. According to preservationist Josef Linder, “there are times when so much is missing from an element that it cannot be fully restored, but we may have enough evidence to do a speculative reconstruction.”<sup>13</sup> For example, a tactic that is commonly relied upon in cases like these is to insert either still production photographs or descriptive title cards as placeholders for the missing footage. Without these production stills or title cards the narrative might become unclear or seem unintentionally piecemeal, and so their inclusion becomes necessary to understanding the action at large.

However the tools that may be used in a reconstruction are not limited to production stills and title cards. To reconstruct a film is to create a new version of the film, which is constituted by the addition of any element that was not present in an earlier existing version. To give a few examples, this can include scores that have been added to play over silent films; the addition of sub-titles; or the use of an alternate take in place of missing or destroyed footage. Or, as in the case study of Lillian Schwartz’s film as I will describe below, the reconstruction may be more total.

## Case Study

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<sup>12</sup> Ibid. p. 8

<sup>13</sup> Lindner, Josef. “Preserving Film (on Film) in a Digital Age.”

*Googolplex* is a black and white abstract animation that explores sensory perception through a series of stroboscopic, computer-generated images. Schwartz and her colleagues were some of the first artists to experiment with the computer's capacity to generate random geometric abstractions. When Schwartz completed *Googolplex* in 1972, her film confidently strode the line between computer art and computer science, and was in the vanguard of both fields. Yet despite the film's historical significance and aesthetic value, by 2010 *Googolplex* remained unpreserved.

However the outlook for Schwartz's work began to improve when Bobst Library Research Fellow Walter Forsberg was introduced to Schwartz's work a little over three years ago. Walter had become fascinated with Schwartz's films after being introduced to them through a colleague at NYU. Walter was particularly interested in Schwartz's dual role as a computer programmer and artist, and saw her work as being representative of the first historical moment that saw the acceptance of the computer as an artistic tool. A recent graduate of New York University's Moving Image Archiving & Preservation program (MIAP), Walter began the endeavor to preserve Schwartz's work.

By 2011 Walter had already received a grant from the National Film Preservation Foundation to restore some of Schwartz's other short films, but due to funding constraints, *Googolplex* had not been included in this project. In need of an additional funding source to preserve *Googolplex*, Walter reached out to The Women's Film Preservation Fund (NYWIFT), the only program in the world dedicated to preserving the cultural legacy of women in the industry. As a woman working within two fields that have traditionally been dominated by men—computer science and film—Schwartz's work proved an excellent fit for the grant.



Walter's application for the funding to preserve *Googolplex* was successful, and the original production and printing elements were shipped from the Rare Book and Manuscripts division at The Ohio State University Libraries (OSU), where Schwartz's material is held, to the Moving Image Archiving & Preservation Department at NYU for detailed inspection and preservation preparation. Walter brought me onto the project to assist with what we initially presumed would be a straightforward preservation, but which quickly proved more complicated.

When Walter and I began inspecting the material OSU had sent us, we discovered that there were in fact two versions of the film: the first version, which had been the only version of which Walter had been aware when he initially wrote the preservation grant, was approximately five minutes in length. The second version was 8 minutes long. After putting both films in a machine called a gang sync that enables us to make a precise, side-by-side comparison of the prints, we determined that the two versions were substantially different at all parts.

Fortunately, although well into her 80s, Lillian Schwartz is alive and we were able to get in touch with her directly to see what she could tell us about the different versions. She informed us that after initially making the 8-minute version, she decided to submit the film to a festival that required all entries to be under six minutes in length, which led her to create the shorter, five-minute version of the film. According to Schwartz, the short version is what ultimately "came to be known as *Googolplex*."<sup>14</sup> This presented a conundrum: here we had two, equally legitimate films, each of which had been made by the same artist, in the

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<sup>14</sup> Phone Conversation with Lillian Schwartz. Interview by Walter Forsberg, Shira Peltzman, Alice Moscoso, and Lillian Schwartz. 13 Sept. 2011

same year, and each of which were called *Googolplex*; yet both films are completely distinct works of art. Given that we only had a grant allowing us to choose one version, which version of *Googolplex* were we to preserve?

There is no inherently ‘right’ or ‘wrong’ answer to this dilemma—equally valid arguments could be made to preserve either—or even both—versions of the film. The decision essentially boils down to an editorial decision that must be made with great care, and which ultimately serves to underscore Lipman’s assertion about “the extent of the process’s subjectivity.” In this case, we chose to preserve the short version for three principal reasons. First, the soundtrack we had for the short version was complete, whereas the soundtrack for the long version was not. Additionally, the grant money Walter received for the project would not cover all the costs associated with the preservation of the longer version. Finally, because the short version—which was in Schwartz’s words the version that had “come to be known as *Googolplex*”—had an exhibition history, whereas the longer version had not been seen by public audiences.

Although our decision to preserve the short version had been made, the revelation of the longer version left Walter and I with the larger concern that perhaps we might not have the best possible elements of the film in our possession. Using the best surviving source material is one of the fundamental tenets of film preservation because inherent to the process of duplication is something known as “generational loss”; every time a print is copied, the duplicate is slightly lower in quality than the original. We asked the OSU archivists to draw up a list of all the material in the Schwartz collection related to *Googolplex* in order to ensure that nothing better existed. To our surprise, upon

scrutinizing these records we came across a reference to a 35mm production element labeled “*Googolplex* 35mm edited for 16mm reductions.”

In this case, the discovery of the 35mm element was particularly exciting. During the 1960s and '70s it would have been extremely uncommon for experimental filmmakers working in Schwartz's vein to use the more expensive, professional 35mm format. But Schwartz's workflow was not typical: After using coded punch cards to create the images she wanted, she used a microfilm printer to write the images to 35mm. This machine was only built for 35mm film, compelling Schwartz to reduce the 35mm element to the smaller, cheaper 16mm format in order to edit the film. Given Schwartz's process, we speculated that this material was the film that had been output directly from the microfilm printer.

Upon inspecting the material, our hypothesis proved correct. The film was in pristine condition, but there was a catch: the 35mm element consisted of approximately 1,130 feet, or just over twelve and a half minutes, of raw, unedited, unassembled footage. If we were to use the 35mm element, it would mean devising a method that would allow us to piece together *Googolplex* from scratch, using the 16mm print as a guide. Although technically possible, this would entail poring over all 13,575 frames to find the precise location of every single image in order to accurately recreate the film. The end result would be a new 35mm preservation master with an image quality that would greatly exceed that of any preservation master that could be made from the 16mm print.

Given not only the sheer volume of work this would entail but also the fact that the images—all abstract, black and white geometric shapes—were devilishly alike, to say that this methodology posed a significant challenge would be a dramatic understatement. But in addition to the amount of work that the project would require, Walter and I were also

aware that because *Googolplex* never existed previously as a 35mm film, choosing this method would result in the creation of an anomaly—that is to say, the result would be a reconstruction of the work, as opposed to a straightforward preservation.

We approached this decision with caution, but ultimately decided to reconstruct the film. Our core rationale for reconstructing the film in 35mm was that it would allow us to create a new element with significantly higher contrast, resolution, and overall picture quality than a preservation of the 16mm ever could. Although it would have been feasible to simply preserve the 16mm print, in addition to the wear and tear that it had accumulated over the years, the print was four generations removed from the original source.

So far the process of reconstructing the film has taken over a year to-date. To achieve this task, Walter and I created a spreadsheet that is designed to serve as a comprehensive, annotated, sequential map of the film on an edit-by-edit basis. As soon as we started this mapping process, we began to see the development of an internal logic within the film: We would frequently encounter a single sequence that had been printed once, and then immediately afterwards we would find that it had been printed again either backwards, upside down, or sometimes both.

It soon became clear that because Schwartz had so frequently re-oriented the images, creating a preservation master using standard, photochemical methods of duplication might be extremely difficult, if not altogether impossible due to the rapid disappearance in recent years of film labs that were capable of performing this kind of labor-intensive printing. In the event that receiving a quote for the lab work is unfeasible, however, a digital toolset can be employed to solve the problem. Once our map of the film is

complete, it will be possible to scan the film at a 2K resolution, re-orient, and arrange the images in the correct order, and then output the digital file back to 35mm film.

Although in this case digital technology may prove the key to successfully completing *Googolplex's* reconstruction, it is crucial to note not every film needs to be restored with digital means. Paradoxically, it is due in large part to the exponential increase in the use of digital restoration tools that many of the film labs with the skillsets necessary to photochemically reconstruct *Googolplex* have gone out of business. This ambiguity is summed up nicely in the Austrian Film Museum's policy on digital restoration, which states: "Digital film restoration partly sacrifices the photo-chemical lineage of motion picture film, but it enables restorers to simulate some of its characteristics which would otherwise be impossible to recover."<sup>15</sup>

## **Conclusion**

The reconstruction of *Googolplex* has been a labor of love that has been almost two years in the making. Although the process is still ongoing, we are certain that the final result will ultimately be worth the effort. With the grant funding secure, Walter and I are looking forward to seeing the project to its completion by the end of this semester so that I can see the project to its completion well in advance of my graduation next May.

In sum, the decision to reconstruct a film should not be taken lightly. Accepting the responsibility to create a new interpretation of a work means making decisions that have the capacity to change how the film is perceived and experienced. In many ways, the fate of a reconstructed film lies firmly in the hands of its restorer; when we reconstruct a film, we

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<sup>15</sup> Film Museum. *Digital Film Restoration Policy*. p. 4

are producing a new version that is ultimately subject to the restorer's own vision, personal relationship to the film and above all, as Lipman articulated above, choice.

As I hope the above case study suggests, navigating these decisions is a challenging process, the repercussions of which can be significant. The decision to employ digital technology should not be automatic. Rather, the use of this toolset should imply a set of stringent parameters, the final goal of which should be a rendition that would not have been possible photochemically, and yet which still remains "true to the spirit of the work." It is my belief that the reconstruction of *Googolplex* will fulfill these criteria. As the Film Museum states so elegantly, "As long as film museums and archives intend to play an active part in media culture and its historiography, their interpretation of processes and artifacts from the past can only be expressed in the shape of a dialogue with the media technologies of the present."<sup>16</sup>

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<sup>16</sup> Ibid. p. 4