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Management and Preservation of Animation Cels
in Archives, Libraries, and Museums in the United States

A thesis submitted in partial satisfaction of requirements
for the degree Master of Library and Information Science

by

Angela René Schwarz

2018

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ABSTRACT OF THE THESIS

Management and Preservation of Animation Cels
in Archives, Libraries, and Museums in the United States

by

Angela René Schwarz

Master of Library and Information Science

University of California, Los Angeles, 2018

Professor Ellen J. Pearlstein, Chair

A review of management and preservation practices for animation cels in archives, libraries, and museums shows a lack of information dissemination of this media among the information memory field. A survey was conducted of 15 repositories along with interviews and site visits to determine what practices were being utilized by professionals. The results show that studio archives have not maintained care of their animation cels, while museums and special libraries have provided better stewardship. The results and recommendations are available to be used as an aid for repository personnel to preserve and manage their animation cel collection.

The thesis of Angela René Schwarz is approved.

Shawn G. VanCour

Johanna R. Drucker

Ellen J. Pearlstein, Committee Chair

University of California, Los Angeles

2018

DEDICATION

To Autumn

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I. Introduction

As a kid, growing up through the 1980's I would get up on weekend mornings to watch cartoons of *The Bugs Bunny Show*, *He-man*, *She-ra*, *Rainbow Bright* and a variety of other cartoons produced or distributed by Warner Bros. and Disney. In the 1990's, I would watch cartoons after school of Disney's *Tail Spin*, Nickelodeon's *Doug* and *The Rugrats*, and Warner Bros. *Animaniacs*, *Pinky and the Brain*, and *Looney Toons* cartoons. My fascination in animation was more than the cartoons that I watched but also the elements of production and the process to make them. During the 1980's the Disney Company re-aired vintage episodes of a tv series originally hosted by Walt Disney in the 1950's and early 1960's. In one of these episodes, Walt Disney ventures into the ink and paint department of the studio to reveal and describe an aspect of the process of creating an animation cel, an element of traditional animation production, to the audience. The camera focuses on a lady painting one of over a million cels used in an animation feature. However, by 1989 the detailed handwork of traditional animation ceased to be used by studios with the advancement of computer animation. But by that time one traditional animation element, animation cels, had been bestowed with new value by the public through the art world.

Since 1939 when the Walt Disney Studios first acted to sell animation cels to collectors and art museums like the Museum of Modern Art (MoMA), authentic animation cels have been in demand, at times

reaching a record high auction price of \$286,000 (Saracino, 2006). However, today prices range between \$100 to \$100,000 depending on the production and the piece (Heritage Auctions, 2018). Most cels that are sold by themselves sell for less than \$10,000, but production cels sold with the background from popular, famous, or old productions can sell for thousands (Amidi, 2011). For example, Heritage Auctions sold a 1935 Mickey Mouse and Goofy cel with the background for over \$95,000; and Van Eaton Galleries sold a cel and background from the Disney film *Sleeping Beauty* for over \$94,000 (Heritage Auctions, 2018; Amidi, 2011). Animation cels are not only a nostalgic piece of art that inspires and allows the public to have a tangible connection to their childhood but is also a rare American art form, one in need of preservation research, and management guidelines for professionals in libraries, archives, and museums. While there has been some research published on the composition and preservation of animation cels in recent years, it has not been disseminated to a broad audience. In addition, a majority of the research published was more for an audience of conservators than information professionals, as the language is scientific in manner and chemically sophisticated in vocabulary. During my research for this thesis, I noticed that a majority of the research conducted and published on the preservation of animation cels started after a 2006 thesis written by Karen Hong Saracino on animation cel preservation. Although historians and animation professionals have been investigating this medium for years, there is little accessible published information for professionals

in archives, libraries, and museums to guide them when assessing their organizations animation cel collection. The lack of information made available to the professionals that care for and manage animation cels is the largest issue for animation cel preservation. Conservators in the field that work with animation cels tend to be private conservators that are proprietary about their particular process and techniques for animation cel conservation, which can involve restoration. While conservators that work for organizations may do amazing research to aid the collection they preserve, that information has a tendency to remain with that conservator rather than being shared with others.

My focus for this thesis is the preservation and management practices of animation cels in archives, museums and special collections of libraries in the United States, which will provide another resource on animation cel preservation practices and contribute to the dialogue on the topic. Through the course of this thesis I will introduce readers to what is and makes an animation cel, brief highlights of animation history, current animation cel preservation research being conducted by major headliners in preservation, conservation, and film, as well as some of the practices being used to safeguard animation cels as an American art form. Next, I will discuss my research methods, including a survey I generated and conducted, and the results designed to determine what current practices are being used to preserve and manage animation cels from a sample of repositories in the country. The outcomes of the survey results along with information from

the interviews and site visits will allow for the development of recommendations to aid repositories of all sizes, in particular, smaller institutions that lack resources or have small collections of animation cels, with a goal of facilitating changes to current preservation and management practices. Furthermore, this thesis will add to the growing research of animation cels that can lead to guidelines for non-conservation professionals, if not standards, for this particular art medium in all types of repositories.

Thesis Statement

In my master's thesis I argue that due to a lack of disseminated knowledge in the composition and care of animation cels, memory information professionals, such as archivists and museum staff, tend to treat cels with methods developed for paper materials rather than graphic materials or art. Even though animation cels were originally created by animators as pre-production elements to be used for a short period of time and then disposed of or washed off to re-use the celluloid sheet, their value has transitioned over the decades to now be considered graphic materials or art. It is my contention that the lack of disseminated knowledge, and the need for additional research focused on animation cel optimum storage conditions, and environmental conditions required for the preservation of the ink and paint, leaves a majority of animation cels neglected and subject to further deterioration. My thesis project seeks to find the current practices

from a range of repositories to determine what practices have worked best to slow deterioration and should be continued when treating animation cels.

My research method is based on surveying and assessing animation cel preservation and management practices by a selection of archivists, collection managers, and animation production professionals in archives, museums, and special libraries that have large holdings of animation cels within the United States. I acquired and analyzed data about how personnel at repositories classify, store, and manage animation cels for preservation and how these stewards use methods for repairs which are borrowed from the conservation of paper materials. This data has been assembled through responses to a survey distributed to 15 repositories comprised of studio archives, such as Nickelodeon Archive, museums, general archives and libraries, such as Library of Congress Photographs and Prints Division, that have animation cel holdings in their collection. Additional data from interviews with professionals that work in preserving or conserving animation cels has also been included. The data produced was then analyzed to discover how a sample of archive, library, and museum stewards care for this medium of American art to provide recommendations and aid to disseminate information to repositories. In addition, this thesis will add to the growing research in regards to animation cel preservation and support a call for developing published guidelines or standards for the medium by professional organizations for information and cultural heritage non-conservation professionals.

Introduction to Animation Cels

Animation as a process defined in layman terms is the technique where each frame or sheet of clear celluloid is hand drawn and painted, then sent to be photographed over a background onto film stock using a special camera. While Disney is most noted for using the multi-plane camera, designed by Ub Iwerks, the technology and techniques of the animation process were pioneered before Walt Disney. For a more specialized definition, Saracino (2006, 19) quotes from Martin Krause and Linda Witkowski's book *Walt Disney's Snow White and the Seven Dwarfs: An Art in the Making Featuring the Collection of Stephen H. Ison* that the animation process is defined as

The process of creating motion from frame-by-frame techniques in filmmaking. In cel animation, the characters are first drawn on paper and then traced and painted onto cels. The painted cels are then placed over a background and photographed one frame at a time. When the completed film is projected at a rate of twenty-four frames per second, the illusion of motion is created.

An animation cel is a composite object made up of a thin 10 inch x 12 inch or 12 inch x 16 inch sheet of Celluloid (cellulose-based plastic) with a drawing in black ink, created using a quill pen or a photocopy (xerography) transfer from an animators' drawing on paper on one side of the plastic cel, and water-based colored paint, such as gouache, on the other (Saracino, 2006; Ness, 2015; Disney, 2016). However, in later years,

acrylic paint was used for polyester cels, which replaced cellulose acetate sheets for safety and longevity. The approach of inking and painting was twofold: first, when viewed from the inked side, the black ink outlined the paint producing a clean, straight edge image; and, secondly, from this same view the camera is seeing the paint layer through the celluloid support with a smooth surface rather than the view that exhibited evidence of rough brush strokes (Levitan, 1979; Stark, 2007). However, this approach also contributes to the difficulty in preserving animation cels. Their first and foremost issue is the difference in the preservation temperature and relative humidity requirements considered optimum for the paint and the plastic support. This is further discussed in the signs of degradation in animation cels section.

Ness (2015) explains further the history and process of xerography, or photocopying animators paper drawings to cels, and how it may have saved the Disney studio by lowering costs in the production of feature films. However, animators loved to see their actual drawings finally make it to the screen;—Walt Disney and audiences noticed the change in quality of the lines and art of the animation features released starting with *101 Dalmatians (1961)*. The change in character outlines was because there were some artistic differences between the animator's pencil drawings and when an inker or opaquer inked lines by hand, such as when the lines may become softer, thicker and refined with one line. The black lines from xerography were scratchy, unrefined, and thinner than the inked lines. While the

drawings where exact transfers of the animators' stylistic art, the transferred images lost some quality that audiences were used to seeing in hand inked Disney animated features, such as *Sleeping Beauty* and *Bambi*. In addition, cels had peg holes along the bottom of the cel. While each studio used their specific system, most used two pegs in early animation and variations developed after the 1940's. These peg holes are to keep the cels in alignment during inking with an animators' sketch and while being photographed with other cels in a scene.

Celluloid is a transparent or opaque plastic sheet of cellulose nitrate, but the name celluloid or 'cel' remained after a transition to other formulations of plastic sheets became available, such as cellulose acetate and polyester. Plastics produced with cellulose are made with some type of organic material, such as cotton or wood pulp. Cellulose nitrate is formulated by a process of mixing a form of cellulose with nitric acid, sulfuric acid, water, alcohol, camphor, colorants, and fillers. However, the process is not as easy as dumping everything in a vat, apply heat and mix. Manufacturers each had a different routine, but all were similar in formula. The organic cellulose material, acids, water, and alcohol, were slowly added together, heated, kneaded, and washed before the addition of camphor, colorants, and fillers to make celluloid. The plastic was then fabricated to its shape by extrusion or rolled (Reilly, 1991).

However, cellulose nitrate is not the only plastic sheet to have been used for animation cels. Research from Giachet (2014), and McCormick

(2014) have identified the composition of cels in the Walt Disney Animation Research Library, to include cellulose nitrate, variations of cellulose acetate (cellulose acetate, cellulose diacetate and cellulose triacetate) and polyester (Mylar) plastic, all of which are about .005mm thick, the same thickness as a piece of notebook paper. The Disney Animation Research Library holds over 60 million objects of Disney production and commercial art, including over 300,000 animation cels. That makes up 10% of the collection (Rogge, 2014).

The variations of plastics are due to safety and product advancements over the decades. Cellulose nitrate was first used as a support in photography and film before becoming a support for animation cels. But its first use was in 1862 as a cheap substitute to produce reproductions of tortoiseshell combs for ladies (Saracino, 2006). Issues with cellulose nitrate soon became apparent as it deteriorated becoming an unstable compound allowing the plastic to be highly flammable, as well as prone to deteriorate producing an odor that smells like camphor as the plasticizer evaporates from the plastic. Its flammability initiated the acceptance of cellulose acetate in the 1940's as a film support. Cellulose acetate comes in three variations: cellulose acetate, cellulose diacetate, and cellulose triacetate. In contrast to cellulose nitrate, cellulose acetate is more stable resulting in added longevity of use before deterioration. However, when any variation of cellulose acetate deteriorates it produces an odor of vinegar, known as hydrolysis or vinegar syndrome, but it too deteriorated becoming a safety

hazard for people and other nearby heritage materials. This initiated between 1960 to 1990 another change in the chemical make-up of the plastic support for film and animation cels during the last thirty years when animation cels were made in studios. The next form of plastic was polyester (polyethylene terephthalate (PET)). It is superior to all previous supports. It is stable, flexible and stronger holding up to more use, but over time polyester will deteriorate too. However, by 1989 computer animation changed the process of animation.

The other components of animation cels are the ink and paint used to outline and color the characters. Ink used by studios was in general a diluted form of black paint, but some other production studios have used carbon ink, aka India ink (Pichard, 2015; Worth interview, Tori interview). While other studios may have used a casein-based paint which did not hold up as well. Application of ink was administered with a quill pen. The paint is a water-based paint, typically gouache, but in later years when animation cels started being produced on polyester plastic, acrylic paint was used as it was able to adhere to the smoother and polished texture of the polyester. Each studio has their specific formula for animation cel paint, which in general consisted of a water-soluble binder, like gum-arabic, opaque talc for brightness and texture, pigment (color), and preservatives to prevent mold and other bacteria from growing (Campbell, 2000). All forms of paint and ink were water-soluble to easily wash off after production finished. The celluloid sheet was then re-used for another production or thrown into

garbage if stained by the colored paint or showing signs of use. However, because the paint and the plastic are made of organic material and chemicals, they both are susceptible to degradation over time as they are exposed to environmental conditions. A conservator is usually called in when deterioration has reached a certain point of changing the artistic image.

Signs of Degradation in Animation Cel Components

Animation cels are composite objects made up of the plastic support, the ink, and the paint. This combination of materials makes for challenges in trying to preserve the whole object since the paint and ink do not have the same preservation requirements as the plastic support. While the paint / ink prefer room temperature and relative humidity (RH) closer to 60%, the celluloid plastic support prefers the same temperature and relative humidity of film and photographs that are stored in 55°F and 50% RH. In the past, animation cels have been stored according to the needs of one of the components, generally the plastic support, leaving the other component to degrade and requiring a conservator to later assess issues with the object.

When a conservator exams plastic artwork they look at four general properties: chemical, optical, physical, and thermal (Shashoua, 2008). For each property, there are specific attributes known or tested to identify. For chemical properties, that would be solubility, reactivity with other materials in surroundings, chemical structure, arrangements, and types of bonding present in polymers. Physical properties include density, electrical,

mechanical, and thermal responses. Optical properties are detected by a visual exam, and include abrasions, shrinkage, yellowing, etc. and thermal properties are determined with physical attributes. However, museums look at a “loss of function, form or significance of the object” as well. (Bachmann, 1992)

Physical signs of degradation are shrinkage due to loss of plasticizer, abrasions, delamination of paints as a result of binding agents losing adhesion, brittleness, yellow discoloration, hydrolysis, warping, sweating, etc. A majority of these signs are the result of a chemical change at the molecular level of the plastics polymers, plasticizers, and additives. Chemical causes are reactions of the plastic to their surroundings. A number of environmental elements can start a chemical reaction in plastics, particularly, oxygen, ozone, water, radiation, light, and heat. As plastics must exist in some of these conditions, they are always exposed to conditions that will degrade them. If enough energy accumulates, then it can “break selected chemical bonds present in polymers and additives. Resulting in the reduction of molecular weight and the formation of new chemical structures”. These changes can “increase plastics’ sensitivities to moisture and temperature” (Shashoua, 2008; Hunt, 1992). Images of animation cels that exhibit various signs of degradation can be found in the press releases by the Getty Conservation Institute concerning the animation cel project, and by Yale’s Institute for the Preservation of Cultural Heritage, both of which can be found in the bibliography of this thesis.

Degradation of the paint and ink is a whole other story. Primarily, some paint colors will fade with time and exposure to natural light, but more of an issue is when paint starts flaking off as it loses adhesion to the plastic base. Another problem is due to animation cels being a composite material, as previously mentioned, the main elements being the plastic support and the painted image. These elements have different requirements for storage. Cold storage recommended for photographic and film elements will slow the degradation of the plastic, but the temperature can be a problem for maintaining the moisture needed in the paint to preserve the paint suppleness. The elements will both shrink but at different rates causing the paint to crack and pull apart, distorting the image. The cold temperature also affects the paints' binding agents, accelerating loss of adhesion, resulting in the paint cracking and flaking off. (Giachet, 2014)

Original paint layers are extremely hard to fix, requiring a very delicate and steady hand for detail. Reproducing the original paint formulas is almost just as difficult since formulas from original studios were trade secrets in the past and are still so today. Animation art restorers who restore animation cels as a business may have conducted tests to identify compounds in order to recreate the same paint formulas. These tests require specialized equipment that not all archives and museums can access. Or, restorers may have befriended someone who had access to the paint formulas who then allowed the restorer access to the paint formulas (Worth interview, 2017). Most paint has been identified as a gouache, an opaque

type of watercolor, for cellulose plastic cels. Due to polyester's "polished surface being difficult to wet by traditional gum-based paints, synthetic paint media, like vinyl or acrylic are preferable" (McCormick, 2014; Lerner, 2005). Most recently, Beltran (2017) concluded research on environmental conditions of relative humidity that cause gouache paint to delaminate, to crack or soften, along with causing celluloid to warp or flatten. This research shows some promise in the future toward the development of a method to re-adhere the original paint back on the cel.

Brief History of Animation

While my master's thesis centers on American animation, it is important to point out pioneering forerunners of animation around the world, because without the innovation and collaboration of others an idea or art form cannot move forward and grow. And animation did grow. Professional caretakers of animation elements need to know the history of animation to develop an understanding of the processes used over the course of history as they may encounter them in their career. I chose to use Stephen Cavalier's book *The World History of Animation* as a major source referenced in this section of my thesis to discuss the history of animation and in relation to moving images. While his book is not the only source of history in my thesis, it is the primary source I rely on because it contains a wealth of knowledge about a broad range of animation, both domestic and international. Cavalier starts the history of animation with elements of

animation having been seen in cave drawings, Egyptian funeral markings, and other early civilization societies, but this beginning is as much for moving images as it is for animation. Over time, inventors developed creations as precursors for moving images. In 1696, one of these precursors to moving images was invented by producing an optical projection of still images using a transparent slide and light onto surfaces (Merriam-Webster, n. d.). This creation was called a ‘magic lantern.’ These magic lanterns became widespread entertainment in traveling shows. It was from one of these shows in London, over a hundred years later, that Swiss-born Peter Mark Roget, a doctor, became interested in the ideas of moving images. In 1824 he wrote an essay, which years later was re-titled “Persistence of Vision with Regard to Moving Objects” (Cavalier, 2011, Cole, 2001). In this essay, he explains how the human retina briefly retains the last seen image after the object disappears, which allows for the fast, consistent repetition of images to flash before the eye and be seen as a continuous image. While today there is skepticism about this theory (Cole, 2001), it did, however, create and produce a profound effect on the history of moving image industry and those that today create films. After the publication of Roget’s essay, numerous optical inventions were patented such as Englishman John Ayrton Paris’s thaumatrope in 1825, Belgian Joseph Plateau’s phenakistiscope in 1831, and Englishman William Horner’s daedalm in 1834. The daedalm was later renamed by American William F. Lincoln in 1860’s as the zoetrope, which resulted in the invention becoming

much more popular at the time. In 1877, Frenchman Charles-Emile Reynaud invented the praxinoscope (Cavalier, 2011). It consists of a cylinder and a strip of paper with twelve frames for animation. When the cylinder rotates the images create an illusion of a moving image. All of these optical inventions were precursors to present-day film cameras, including the multi-plane camera used for animation production that will be discussed further in the section about animation cel components.

It is not until the turn of the 20th century that a separation between animation history from other genres of film can be seen. In 1900, Arthur Melbourne-Cooper of St. Albans, England produced an ad to raise funds for the English troops fighting in the Boer War in South Africa that could be considered the first production of animation. He filmed small matches from a matchbox writing on a blackboard approximately six years ahead of American and French animation pioneers. The method of production was similar to the form of clay animation, a method of stop-motion animation. The same genre of animation as traditional cel animation. But it wasn't until 1906 when James Stuart Blackton, an Englishman, produced what is today considered the first cartoon, *Humorous Phases of Funny Faces*. Over the next few years, other animators in Europe produced work, but their efforts were lost during WWII, like the Italian brothers Arnaldo Ginna and Bruno Corra's four abstract films. It was during these early years in animation that a difference in style also emerged: the two primary categories being "realistic" and "cartoony." One style attempts a "stylized realism"

while the other conceives to “imitate reality.” It was Emilie Cohl, and a small group of Parisian artists called the Incoherents, who in 1908 believed “anything goes and the impossible is certain,” and with their “universe of antirealism” formed a precursor for the surrealist animation to come later, such as *Steamboat Willie*, *Betty Boop*, *Daffy Duck*, *Wallace & Grommit*, and all other works in this style “in which reality is twisted, stretched, chased, exploded, and run off a cliff” (Cavalier, 2011).

The inception of cel animation and the celluloid developed in 1913 when John Randolph Bray, a newspaper comic-strip artist transitioned to animation and came up with the process of creating background images on translucent paper and using gray tones on animated films. However, Bray was not one for being honest. Historians believe he would visit other animators’ studios by invitation in the “spirit of cooperation,” and then steal their ideas as his own in patents. These deeds produced controversy with both Winsor McCay, who produced *Gertie the Dinosaur* in 1911, and Frank Nankivell (Cavalier, 2011). However, Bray did build the largest animation studio before WWI in America, attracted the talents of the Fleischer brothers, Earl Hurd, Paul Terry, and Walter Lantz, to name a few. The animation process that was most popular for decades was patented by Earl Hurd in 1914 while he worked for Bray. This process used paper backgrounds and overlapping painted celluloid sheets for characters. However, it didn’t become a standard until 1924. It was during those ten years that Bray and Hurd worked together requesting commissions for the

use of their methods in animation. These early years also mark the beginning of American animation, which dominates the field for much of the last century considered as the most successful. (Cavalier, 2011)

Over the next fourteen years, notable animators produced commercially successful works like Otto Messner's *Felix the Cat* in 1919 which was the most famous animated character until the introduction in 1928 of Mickey Mouse in *Steamboat Willie*. In 1925, Lotte Reiniger created the earliest surviving animation feature *Die Abenteuer des Prinzen Achmed (The Adventures of Prince Achmed)*. Unfortunately, all the Berlin copies were destroyed during WWII. It was not until 1954 that the British Film Institute (BFI) happened to find a single remaining lost copy in their inventory, yet it was not restored and shown to the public until 1970. (Cavalier, 2011)

The Golden Age of cartoons or, otherwise categorized as the domination of American animation, dates between 1928 to 1957 in feature films. The years preceding this era produced ample work as a “blueprint” for future animators to be commercially and artistically successful. A culmination of art styles, production techniques, and inventions navigated animation toward a sustainable art form, it only “needed someone to pull it all together —Walt Disney” (Cavalier, 2011). So, the golden age of American animation really starts with Disney's release of *Steamboat Willie (1928)*. The cartoon received special accolades due to its sound synchronization with animation. Other cartoons with sound did not have

the same sound synchronization that Disney produced for audiences to be able to connect with the characters emotionally. There is no better proof of this than the acclaim received by Disney's full-length animated feature *Snow White and the Seven Dwarfs* (1938). Over the next 30 years, animators produced several popular characters in animated films that are still known today, including Disney's *Silly Symphonies* series, *Betty Boop* and *Popeye the Sailor* by Max Fleischer, Merian C. Cooper's stop-frame animation *King Kong*, Warner Bros. and Tex Avery's variety of *Looney Tunes* characters, William Hanna & Joseph Barbera's *Tom & Jerry*, and a group of ex-Disney artists called United Productions of America or better known as UPA, *Gerald McBoing-Boing* and *Mr. Magoo* (Cavalier, 2011).

However, all good things come to an end, and this happened to animation features and shorts in 1948 when the U.S. Supreme Court ruled in *United States vs. Paramount Pictures, Inc.* to outlaw "block booking" to theaters. Block booking allowed major studios to contract out a large selection of new film productions to independent theater owners. However, there may only be one or two A-list films included in twenty or more lower grade films and shorts. While this system allowed the production studios to profit, it put a financial strain on independent theater owners who had to agree to films sight unseen and with the barest of information, rather than selecting which films to exhibit in their theater like the studio-run theater chains. There were times when films contracted in these blocks were left in their canisters never to be seen by audiences. At the time animation

shorts were shown at the beginning of features and contracted out with these same blocks of film selections. But with the ruling to outlaw block booking, studios could no longer rely on budgets from pre-sold features and shorts. This ruling resulted in studios to lose money from lower grade film productions, Disney, Warner Bros., and other studios that produced animation shorts and features were not exempt from this outcome. By 1958 it had become unviable to produce animated shorts for feature films. In comes television. As the industry changed towards this new technology, the animation processes developed as well. Although American animators and studios dominate most of the golden age, animators in Europe and other countries were producing animation too. It was with television and a change in the industry that animators from other countries were able to expand their audience across oceans with English versions of animation features and shorts. Some examples include Serge Danot's 1970 *Pollux et le char bleu* (*Dougal and the blue cat*), Belgium Peyo's 1976 *Les Schtroumpfs* (*The Smurfs*), and Australian Yoram Gross's 1977 *Dot and the Kangaroo* (Cavalier, 2011).

During the 1980's is when a decline happened in animation features and cartoons being produced by animation cels, and animation productions transitioned over to computers. Disney's *The Little Mermaid* (1989) is the studio's last feature film produced with animation cels. Animation moving beyond 1989, took a complete turn to the computer with a program developed by Pixar called Computer Animation Production System better

known as CAPS (Ness, 2015), which once again changed the way future animation films and cartoons were made. Although today animation features use computers to produce the final product, animators still start with paper and pencil drawings to develop characters and storyboards (Campbell, 2000; Nickelodeon & Disney ARL site visit).

By knowing the history of animation, a caretaker learns the processes used to create animation elements at the time they were created. This information also allows for the caretaker to know about different types of knowledge that will aid in the management, preservation, conservation and, if necessary, restoration of an animation cel. Their historical value is just one of the values animation cels exhibit as evidence for why they should be preserved. While an animation cel's historical value is evidence of a production process that is no longer used and is therefore obsolete, the other three values animation cels present are nostalgic, social, and economic. As discussed in the next section, animation cels' social value derives from collectors' nostalgia for the pieces. This encouraged an economic value as collectors drove up the price in auctions, further drawing the attention of studios to market their cels as merchandise. Another economic and social value derives from the fact that during the production of animation cels between 1920 to 1990, women were widely hired to ink and paint the cels providing a job for women in an industry dominated by men (Johnson, 2017). These three values exhibit reasons for why animation cels should be preserved.

Current Animation Preservation Research and Practices

Animation cels produced in the early years of animation features were only meant to last a few weeks in the final stages of a film's production. Afterward, black and white painted animation cels were washed off in an acid wash, while color images were disposed of since the color pigment would stain the celluloid sheets (Biederman, 2001). By the late 1980's to early 1990's all animation studios had transferred from hand drawings by artists, who had developed many of the animation techniques, over to CAPS or similar computer-aided design software. The last Disney full-length feature completely done by hand-drawn cels was 1989's release of *The Little Mermaid* (Cavalier, 2011).

Since most animation cels were destroyed, finding original cels from early films is a rare find, one looked for by most collectors. Disney is the only studio, from my research, to have known evidence of early animation production material that dates prior to the 1950's. This result may be due to Disney starting out as an animation studio, rather than with live productions like the majority of studios. Hence Walt Disney valued key elements of productions differently from other studios. This value can be exhibited due to Walt designating a storage place in the basement of the Ink & Paint building on the studio lot known fondly as the "morgue" from his days working for newspapers. He would keep material for artists to use for reference and inspiration, which continues today in Disney's Animation Research Library. It is because of this limited availability of material from

a by-gone era in moving image and animation history, along with the popularity with collectors and high sale prices, that repositories are feeling the pressure to preserve remaining animation cels (McCormick, 2014; Sacracino, 2006).

Audiences who watched cartoons and animated features as children grew attached to animation characters and would collect available animation cels in response to emotional ties to those specific characters. The cultural demand to preserve these art forms is what is turning a once production element into artworks and respected animators into respected artists outside of the animation genre. Auction houses and art galleries that specialize in animation cels will price pieces for Snoopy and Charlie in the hundreds to thousands of dollars, the same goes for Scooby Doo and Friends and Hanna-Barbera characters, Warner Bros. Looney Toons can be found in America at a value in the high hundreds and up depending on the character and scene. It is the early Disney animation cels before 1960 and xerography that demand the tens of thousands of dollars (Solomon, 1988). The actual production elements used in the films are more valuable, not only monetarily but historically than commercial reproductions. Collectors consider the detail and artistry of these cels as artwork and studios, archives and museums have taken notice. The context as an artwork alone seems to indicate cels are meant to be preserved by repositories. Museum exhibitions of animation suggest that repositories that currently have cels initially procured their pieces for artistic and preservation reasons since the 1981

Whitney Museum of American Art exhibition of Disney Animation and Animators, the first museum exhibition of animation (Canemaker, 2017). Future collections by museums and archives would be subject to a change in view of the material as artwork and not solely part of film elements.

The Society of Animation Studies (SAS) was founded in 1987 during the transition period from hand-drawn to computer designed animation, by Harvey Deneroff, who was a Ph.D. student in Los Angeles at the time. SAS has developed into a worldwide organization aimed towards the preservation of animation styles and techniques. Today, this organization has members from academia and the animation industry from all over the world. The SAS publicize research articles in their online peer-reviewed journal *Animation Studies* that concern the preservation of animation, both traditional and computer rendered. They also have an online blog to discuss various topics of animation spanning its history and holds annual conferences around the world. In a 2017 SAS article, it was pointed out that while expertise and skills from other fields, such as media archives and museums, have been helpful, animation studies still need a “specific approach” (SAS, 2017) and standards for general practices of description and preservation.

In 2009, the Disney Animation Research Library (Disney ARL) and the Getty Conservation Institute (GCI) initialized what has become a ten-year project to identify the chemical composition of animation cel plastic, ideal storage environment parameters and the possibility of re-adhering

flaking or damaged paint to the cels. Information on this project and current findings can be found in numerous sources, from published research findings from the project team, news releases from the Getty and popular online sites (McCormick, Preserving, 2014; Morris, 2015; D23, n.d.; Beltran, 2017). In 2015, the Yale Institute for the Preservation of Cultural Heritage (IPCH) and professionals from the Yale University Gallery of Art (YUAG) began working on a similar project for Disney animation cels in the YUAG collection. Yale's project results in a collaborative effort between IPCH and GCI to determine animation cel deterioration processes and ideal environmental conditions (Yale, 2015). On an international level, the Cinémathèque Française since 2013 has been in the process of conducting research on graphic arts on plastic materials in collaboration with Centre de Conservation et de Recherche des Musées de France (C2RMF). A donation by the British Film Institute (BFI) to the Cinémathèque Française of 35 cels from the French animation masterpiece, directed by Paul Grimault and screenplay by Jacques Prévert, *Roi et L'oiseau* (literal translation: The King and the Bird, English title: The King and the Mockingbird) has become a priority for preserving. The animation feature was the first from France with production starting in 1947 and not completed until 1980. The original title was *La Bergère et Le Ramoneur* (The Shepherdess and the Chimneysweep) based on a Hans Christian Andersen fairy tale of the same name (Pichard, 2014; UCA Archives, 2014).

It is evident that a community of academia, animation researchers, animation industry professionals and collectors care about the preservation, conservation and overall management of animation cels. While the animation genre has lost millions of examples over the years due to the previous value, economy, and material composition, the current animation community is working to save the remaining artwork.

Conservators Methods: Private v. Institutional

Research for this paper led to the discovery that there is a difference in how private conservators preserve animation cels compared to how conservators from an institution may approach the material. Many private conservators are contracted to work on a collector's artworks, or museums reach out to them for help preserving their materials. In some circumstances, collectors have directly instructed private conservators to completely re-paint the image (aka recreation) as a form of restoration. From research, it is understood that other conservators may analyze the paint and retouch the image to fill in any flaking paint (Stark, 2007; Bain, 2002; Biederman, 2001). The practice of recreating the image can monetarily and historically devalue the animation cel by removal of the original paint material from the object. Restoration of material becomes an ethical issue for conservators. Ward states that "it is the activity that most depends upon the skill, judgment, and sensitivity of the individual, and it also presents the most exacting ethical challenge." He goes on to state that the interaction of conservator with objects varies in degrees and by

discipline. “There can only be one standard in conservation (the best that circumstances allow), but the degree of treatment may depend on” a variety of variables, such as resources, and future plans for the object (Ward, 1986). He notes that “the importance of a work of art usually lies in the image that the artist created, rather than in its material. Therefore, while the original material must be preserved...the restoration of the image takes precedence, and the introduction of new materials to that end is perfectly acceptable.” (Ward, 1986). While conservators can preserve aspects of the cel, such as the celluloid, the flaking of water-based paint is harder to correct. Some restoration methods can be re-creation rather than restoration depending on the collector’s or organization’s preference. Knowledge gained about animation restoration comes from interviews with animation archivists who have spoken with private conservators and interviewees who have been in the animation production and animation cel restoration business. I was unable to interview a private conservator due to the fact that their knowledge and techniques are used in their business to make a living and are proprietary in nature. Conservators that work within archives or museums may meet the ethical challenges of treatments of animation cels differently than private conservators. Details from the Disney Family Museum in San Francisco tell of practices that use more conservative treatments when dealing with flaking paint, such as filling in gaps with acid-free colored paper behind the animation cel. This practice fits in more with the ethical issue of maintaining the original art. Conservators are also able

to complete their preventative work more effectively when they have continuous access to collections (Ward, 1986), whereas private conservators are working with an item for that one time and only have to ensure its enduring preservation through steps taken at the moment. These ethical challenges could explain some of the differences in practices.

Museums and archives retain animation cels for multiple purposes such as a record of the history of a studio, or artist, for research in the medium, or because of its popularity with audiences. And with very few conservators currently available who are skilled in treating animation cels, organizations have only two choices: perform conservative preservation methods to stabilize the image and support and wait for future conservation techniques, or hire a conservator to “fix” the image.

Preservation Management & Standards

To date, preservation management and standards followed by archives and museums for animation cels are borrowed from a range of other materials, such as paper, photography, film, paintings, and graphic arts. Other resources consulted for this thesis include *The Preservation Management Handbook* edited by Ross Harvey and Martha R. Mahard, Society of American Archivists publication *Preserving Archives & Manuscripts* by Mary Lynn Ritzenthaler, and the chapter “Preventative Preservation” by Steven Weintraub in the *Manual of Museum Planning* edited by Barry Lord. Sacracino (2006) iterates that there are no standards of preservation, management, cataloging, etc. for animation cels. Archives,

museums, and special collection libraries may catalog animation cels today as either photographs and prints or graphic arts. However, repositories have no specific standards of preservation for animation cels. With little knowledge of what to do for deteriorating cels, professionals can only preserve cels as best as possible and wait.

II. Research Methods & Outcomes

Methods

Various primary and secondary sources were utilized to gather information to inform the outcomes and recommendations of my thesis. Primary sources employed include in-person interviews, site visits and a survey I generated and conducted solely for this thesis. The survey was completed by archivists, collection managers, curators and other information professionals of organizations known to have animation cel holdings in their collections. Secondary sources comprised of online news release articles of research being conducted on animation cels by well-known research centers and collaborations between some of these research centers, published findings from these same research centers which were geared towards conservation professionals, and published books and articles on a variety of other topics that relate to the preservation and management of animation cels.

While the secondary sources do provide some information on animation cels and the individual components, the interviews, site visits and survey offer more direct knowledge about the management of animation cels. The interviews allowed me to converse with professionals that work with animation cels on a daily or regular basis. This allowed me to learn what professionals look to for guidance and what information they still wish to see. It was also in interviews that some archivists expressed a need for guidelines of animation cel preservation and management as they progress

through their own collections. The site visits present me with an opportunity to see how collections are being managed and provide insight into what usual practices are being used by various organizations. Although the survey is administered to a small sample of repositories, the survey results informed me of additional and more detailed information about repositories that have animation cels in their collection and how they manage them.

Interviews

In the course of my research, I interviewed nine professionals from various backgrounds in animation. The interviews included five studio archivists, one film editor, one conservator, one collections manager, one director of an online animation archive and a retired business owner of an animation cel restoration business. While two separate private conservators were contacted for interviews, neither answered any interview questions. This leaves an area that lacks some context in animation cel preservation and conservation, since repositories will contract private conservators to work on animation cels if there is no internal conservator. Comments from other interview participants who contracted work with private conservators and articles from private conservator business websites allow some perspective of what responsibilities and tasks a private conservator may take on for animation cels at a client's request.

My first interview was with Anna Martino, Sr. Manager, Kevin Iwaki, Collections Coordinator and Micheal Pazmino, Archives

Coordinator of the Nickelodeon Animation Archive and Resource Library on November 10, 2016, in Burbank, California. They discussed their process in receiving boxes of animation cels from overseas and selecting key cels of scenes from animated shows to preserve and include in the archive. Nickelodeon's archive is relatively new, as it expanded five years ago from a tape vault and now houses painted cels, pencil drawings, storyboards and various formats of media. The team of three archivists has been working on cataloging and rehousing the collection of animation cels for the last few years. Mr. Iwaki explained how he constructed the framed housing for individual cels from archival standard acid-free board and archival tape as seen below in Figure 1.



Figure 1: One example of the housing Nickelodeon's Archive Collection Coordinator Kevin Iwaki constructed to protect the archives animation cels. The animation cel is of Chucky from Nickelodeon's show *Rugrats* (1990-2006). Photo by Angela Schwarz

When asked about animation cels that need more than preservation, he commented that a private conservator is contracted to address issues with particular cels for Nickelodeon. Additionally, the archivists' commented on the lack of knowledge of how to best preserve animation cels and pointed out that the sole resource on the subject they had been able to locate is the thesis written in 2006 by Karen Saracino. During the interview, a box of animation cels was present to exhibit the state the animation cels are in when they arrive at the archive. The large box is worn and crumpled from handling and weight of other boxes from the long trip overseas. When the boxes are received by the archive, they are initially stored in a climate controlled off-site location until the archivists are able to process select cels into the archive out of the millions of cels being shipped to them. Inside the box, hundreds of cels are separated by paper and stored in the box vertically, as if in a file cabinet seen below in figure 2, illustrating some of the



conditions cels go through in their life time.

Figure 2: State of animation cels when shipped from other animation studios overseas to Nickelodeon archivists'. Cels are separated by non-archival paper. Photo by Angela Schwarz

Another interview was with Eric Chin, Senior Archivist and Rachel Parham, Archivist from NBCUniversal Archives and Special Collections on December 12, 2017, in North Hollywood, California. This interview encompassed many elements of animation, not solely animation cels. While the archive does have animation cels, the majority of their collection are animation drawings on paper and maquette models of the characters. The studio's limited animation cel collection was due to the difficulty in storing animation cels in the past along with being of lesser value to the studio than the pencil drawings and other animation elements. Further, NBCUniversal closed and re-opened an animation studio multiple times over the last forty to fifty years. NBCUniversal Archives too had boxes shipped to them with hundreds of animation elements from overseas and are needing time to carefully go through them and select the key elements they will catalog and keep for preservation. However, day-to-day tasks and new accession materials takes up a majority of their time preventing them from getting to the animation anytime soon.

Additional interviews mentioned provided further background information on animation cels. Discussions included how the different repositories catalog and manage animation cels in their individual collections, a brief history of Warner Bros. animation studios, and the conservative conservation practices in an organization to preserve animation cels as they wait for fully studied methods they expect to receive

from the Disney ARL and Getty Conservation Institute research project to guide conservation professionals.

Site Visits

Five site visits were conducted for this project. While two were arranged as site visits for student chapters, I took the opportunity to use it as additional research for my thesis. The other three site visits focused more on animation cels and practices by conservators and archive professionals. Site visits attended include the Disney Animation Research Library, Academy of Motion Picture Arts and Sciences Margaret Herrick Library, Warner Bros. Photograph Stills Library, NBCUniversal Archives and Special Collections, and Nickelodeon Animation Archive and Resource Library. Each brought their own issues and solutions for animation cel management and preservation. However, I did notice that locations that had animation cels on-site, rather than stored off-site using an outsourced storage facility located in a mountain, like Iron Mountain, or with a different outsourced company, constructed similar housing using some sort of archival board and plastic sleeving to protect the animation cel when shelved horizontally in storage.

The site visit to the Disney Animation Research Library (ARL) in Glendale, California on February 1, 2018, with the Society of American Archivists student chapter was an essential visit for accessing information about the care and management of animation cels. As the largest collection in North America, if not the world, of animation cels, the Disney ARL

houses over 65,000,000 pieces of art in their collection, including an unknown exact number of animation cels. However, published articles approximate the number to be over 150,000 sheets of celluloid.

Tori Cranner, Art Collections Manager at the Disney ARL, was our guide through the library and provided valuable knowledge of their approach to storage and preservation. The group was shown different departments of the ARL with introductions and presentations by various people to provide an overall view of how Disney preserves its collection at present and what digital strategies they look to instill for future preservation. While the actual products used to store and preserve were not discussed at this site visit like they are during Saracino's visit in 2006, the group's visual examination of how animation cels are stored still agrees with Saracino's description of cels separated by archival treated paper and in archival mat board folders. The one exception I did notice is that groups of folders are now housed in small boxes together with labels that include the title and scene of the film. This change is due to the ARL being in the middle of a conservation project with the Getty Conservation Institute. The ARL is working to re-house all their animation cels from folders to flat boxes, while also putting the scenes back in sequence order. The ARL stores most of their art, including animation cels, at 60°F and 55% Relative Humidity, which from research I have found is the best conditions for storing animation cels. Another preservation project the ARL is organizing is digitizing all the collection items in the library, including the animation cels,

to allow animators and other Disney departments to look up objects for reference at their desk while they are working rather than stop their work and go to the ARL to view items for reference. From a preservation perspective, this will reduce the amount of handling of the objects and changes in environment objects are exposed to every time items are pulled from storage.

Another site visit conducted was to the Academy of Motion Picture Arts and Sciences (AMPAS) Margaret Herrick Library in Los Angeles, California on November 8, 2017, with Dawn Jaros, Conservator. Ms. Jaros, who specializes in paper conservation, provided a perspective from a conservator who works within an organization, which may differ from a private conservator. Her responsibilities include aiding in the maintenance of the collection and collections of other organizations who may store their collection with the AMPAS, such as the ASIFA-Hollywood collection of animation elements, including animation cels. The Association Internationale du Film d'Animation (ASIFA) or International Animated Film Association is an international organization for animation production and preservation. The chapter in Los Angeles is known as the ASIFA-Hollywood. It was estimated that the Library manages over one thousand animation cels, including the ASIFA-Hollywood collection. Ms. Jaros follows the on-going project between the Disney ARL and the GCI, among other resources, to guide her when dealing with animation cels. During my visit, examples were shown of degradation issues on animation cels within

the collections at the Margaret Herrick Library. While the example problems were minor in comparison to examples Disney provides in their conservation project, some delamination and cracking could be seen on cels. The level of degradation of cels at the Margaret Herrick seems to be minimal with most of the issues being damage to paint and some odors of vinegar. Not much shrinkage has been noticed by staff. Furthermore, animation cels that were xeroxed show issues of their own as the photocopied lines crack and fall off the celluloid leaving a small blank space or no detail over the paint. However, the Library's main goal is to stabilize the elements rather than to do anything that may harm or cause the object to deteriorate faster. It was also mentioned that animation cels are cared for by the graphic arts archivists alluding to the classification of animation cels at this location to be a form of graphic art.

The other three site visits provided further information on how each repository catalogs, stores, and preserves their collections. The parent organization chose to either manage and preserve the animation cel collection on site with a permanent archivist, manage and preserve off-site by an outsourced company like ProTek, that provides archivist to evaluate, organize, label, and digitize the materials before storing the original material off-site elsewhere, or managing the collection from an outsourced, offsite location stored deep in a mountain. This last scenario exhibits less knowledge of what items are in the collection and their current condition but does preserve the collection in a suitable environment for preservation.

Survey

In late January 2018, surveys were sent via email using Google forms to fifteen repositories in the United States. Institutions were selected based on knowledge of them having animation cels through Saracino's thesis or other research, the repositories' digital catalog, or affiliation to film and UCLA, and the small sample size was designed to keep the project manageable for the time available. While the sample size is small, the selected repositories do provide a representative selection of institutions that care for animation cels across the United States. The selected repositories are also the location of the largest collections of animation cels in the United States. This selection, and the detailed responses provided to the survey questions, are why I believe the data from this sample of repositories supports my conclusions. A major component of my thesis project was generating and conducting this survey of 15 repositories that were categorized as one out of four types of information institutions. The repository types included studio archives, museums, special libraries, and archives. Each type of institution is administered by a different type of governance. While studio archives are operated under a for-profit business model, museums, special libraries, and archives, in general, operate under a non-profit or foundation status. Other special libraries and archives fall under an academic governance model if affiliated with a university. This difference in governance values and mission may contribute to the difference between repositories' levels of management and preservation of animation cels. The number of repositories selected for each category type

was between three to five institutions. A final number for each category was five studio archives, three archives, four museums, and three special libraries. While the Disney Animation Research Library was included in the special libraries category, there can be some debate that the Disney Animation Research Library is a studio archive. The reason I categorized the Disney ARL as a special library was due to the institution's name, the fact that there is a separate Disney Archive on the Disney Studio lot, because their function is to be more of a usable resource for animators and researchers, and in part to round out the number of special libraries with animation cels. A full list of repositories can be found in Appendix B.

My survey was modeled after the Heritage Health Index survey from 2004 with questions focused towards animation cel collections (Heritage Preservation, 2005). The survey is thirty-eight questions about a repository's whole collection, animation cel collection, environmental conditions, staffing, and exhibition. Although the survey can be considered long, it does ask for valuable information on the overall management and preservation that animation cels are exposed to in different repositories. This will allow for a better analysis between the practices used by the different types of repositories and the health of the repositories in the survey sample. Furthermore, having a long and thorough set of questions will also allow for a better analysis of which methods have been practiced most often by professionals and how these methods may be affecting the animation cels in their collection.

Data Analysis and Outcomes

Data analysis of results from the surveys includes answers received from eight out of the 15 repositories that were sent a survey. These eight repositories are: Disney Animation Research Library (Disney ARL), NBCUniversal Archives & Collections, Nickelodeon Animation Archive & Resource Library, Prints & Photograph Division of the Library of Congress, Cartoon Museum, Museum of Modern Art (MoMA), Charles M. Schulz Museum & Research Center, and a partial survey from the UCLA Film & Television Archive. This equals about 53% of the selected repositories that completed the survey. However, one archive (UCLA F&TV) to respond completed the first six questions and left the rest blank as they did not have any animation cels in their collection. Of the remaining seven repositories, three said they could not complete the survey due to a confidentiality policy, to the collection being housed off-site and not cataloged, or because an outsourced company manages the collection and internal archivists of the organization could not respond to the survey questions. However, an interview and site visit was conducted with two of these organizations prior to the survey being sent out. The other four institutions did not respond at all. So, in fact, 11 repositories responded in some fashion whether negative or positive to the survey. This equals about 73% of total responses with an approximate 20% of repositories that had animation cels but were not able to complete the survey for various mentioned reasons.

Of the eight institutions that completed the survey, one is a special library, one is an archive, three are museums, and three answered as studio

archives. The one archive that completed a part of the survey is the one repository that did not have any animation cels. As no other archives completed the survey, this leaves the category somewhat unrepresented in the survey results. From the three surveys that indicated the institution to be a studio archive, the Disney ARL was included in this category. This differs from where I considered the institution to be categorized as a special library when selecting repositories. Since the Disney ARL falls under the Disney Company corporate governance and the primary users are the Disney animators, ARL staff consider the Disney Animation Research Library to be another studio archive. Although 50% of the repositories completed the survey, the variation in the number of surveys received per category does not provide a balanced outlook over the types of institutions. However, responses collected from the surveys will provide a basis of methods used on an individual repository level. The percentage of an institution's governance is distributed in a more equal division between three corporate for-profit governances and four non-profit foundation governances with the one archive under an academic governance. Overall, survey answers seem rather similar with some variations and some questions left blank. The survey questions can be found in Appendix D and responses can be found in Appendix E.

In the first section of the survey, questions one through 10 aims to create a basis of information on each repository's animation cel collection in comparison to their whole collection. These questions indicate the type

of information institution and governance that influence the collection management decisions. Additional questions determine that the repository does have an animation cel collection and the number of animation cel holdings in comparison to the number of their whole collection, as well as how animation cels are cataloged. From the eight surveys, one denotes that 0% of the institution's collection includes animation cels, four indicate the repository's collections are made up of around 1 – 19% of animation cels, one survey indicates that 20 – 39% of the repository's collection includes animation cels, and the other two do not know the percentage of animation cels in their collection. However, from amounts listed in question five and six from one of these two surveys, I can calculate that animation cels make up less than 1% of the whole collection. Responses for repositories total collection holdings range between 7,000 to 160,000 with three not answering the question. Amounts for animation cel holdings range between 100 to 500 with four survey respondents unsure about the number of animation cels in the repository. Yet, literature research indicates that the Disney ARL repository, listed as unsure, cares for around 150,000 animation cels in their collection.

While most institutions started collecting animation cels in the latter half of the 20th century, two started collecting animation cels earlier, one studio archive in 1923 and one museum in 1939. A number of survey respondents answered that collected animation cels range into the late 1990's to 2000 and skipped question nine. Question nine asks for a

breakdown of what percentage of the animation cel collection was produced during specific decades. All the repositories agree that animation cels are not cataloged as a medium of paper as previous research has indicated, but rather as art or as their own material, animation cels. One institution indicates that they are cataloged as special collections. This majority consensus from repositories that animation cels are cataloged as artwork indicates that classification for animation cels has changed over the last twelve years from earlier research in Saracino's thesis where some repositories classified animation cels as paper.

The second section of the survey questions the environmental conditions of the repositories' collection space. However, an important oversight was made when no questions were included asking what the actual temperature and relative humidity are for each repository for their animation cel collection. Even so, seven surveys indicate that conditions are regulated for temperature, relative humidity, light, and ultraviolet light. But one studio repository has limited areas that have conditions fully regulated, and another studio archive has no relative humidity control for its collections. Furthermore, all institutions use gloves and flat archival housing to handle and store animation cels. However, environmental measurements and control products vary among the institutions. Some indicate measuring the collections environment using thermohygrometers, and some mention use of light filters, and one special library indicates that animation cels are stored at the same temperature as photographs. Storing animation cels in

temperatures recommended for photography and film has been typical for the material since the plastic support is known to be better preserved in colder temperatures. But the colder temperature can cause damage to the paint. None of the repositories specify using any other products to control conditions of storage. This may be due to archival folders and boxes now being permeated with molecular traps to capture any off-gassing from the plastic support or other gases harmful to the stability of materials. As for adequate storage space, five locations agreed that 100% of their collection is stored well. One location's respondent thought 60-79% of the collection was stored safely, and another location's respondent did not know if the whole collection was stored in adequate space. Similar answers prevailed when asked what percentage of animation cels are stored in adequate space, one museum institution indicates 0%, a studio archive indicates only 1-19%, a third repository replied don't know, while the remaining four repositories say 100% of their animation cels are in adequate and safe storage space. Space is valuable to any repository. Although most surveyed locations have adequate space for their collections, there are those that have not yet updated their space or performed an assessment of their animation collection.

Yet, responses about whether an assessment of the general conditions of the animation cel collection has been done are much more varied. Three have completed a visual evaluation of their animation cels, two have not, one is not up to date, and another is in the process of completing a new evaluation. The time between assessments also varies.

The three studio archives have not done one in numerous years until recently. One studio had not assessed their animation cel collection in 25 years until recently when a new building was constructed. Another rarely assesses their collection. The last indicated only one assessment had been done in recent years due to a conservation study. This is out of the animation cels lifetime starting in 1923, which is the most surprising because the studio had been collecting animation cels for decades and has been a leader in animation production and preservation. Mindy Johnson's book titled *Ink & Paint: The Women of Walt Disney's Animation* (2017, 361) and a site visit indicate that the collection was moved once before moving to a state of the art building in 1999. An evaluation of materials before, during or after this move would have been done by the caretakers at the time. The groups visual observance of every item having been housed in a box with a label and cataloged to a shelf indicates that the collection was assessed prior to the conservation study. Yet, evaluations are not done regularly as seen with the museums and new staff of the organization may not know the history of the collection without thorough research. The three museums and the special library have set policies on when the collection needs to be assessed which also includes the animation cel collection. But one indicates the items' main assessments are done when they arrive at the repository. However, two others indicate an assessment is done every two to five years with one of them also evaluating the cels that are pulled for exhibitions. This additional evaluation for exhibitions is typical for museum

preservation of collection items to maintain provenance and to provide a condition report for exhibition contracts.

The way in which animation cels are stored at an item level is quite important since the celluloid can stick together over time, paint can stick to plastic, causing complications in preserving the materials. While four out of seven (57%) repositories store animation cels separated by archival tissue paper or in a folder and then grouped in a box, one did not answer, one stores cels individually in a folder and a box, and one other stores cels with tissue paper dividers and in a flat box. But the consensus is preserving the cels and the amount of storage space by storing individual animation cels laid flat separated by some archival material divider and then small amounts of grouped cels are stored horizontally on the shelf in a small (thin) flat box. However, from site visit discussions, regular evaluations are encouraged every few years to ensure the animation cel is not sticking to the divider and to evaluate the condition of the cel.

Section three of the survey includes questions about which staff handles and cares for the animation cel collection, including if outsourced professionals are contracted to work with the cels. In addition, questions include topics of funding and exhibition. The three studio archives have slight differences in which staff performs preservation and conservation tasks. The one animation studio with an older collection has a paid conservation/preservation staff member, whereas the archive staff of the other animation studio and the one film/tv studio conduct the conservation

and preservation duties as needed for their collection. All three studios have less than 10 staff members who work with the animation cels. One has seven staff, one has two staff that work with animation cels out of the four archive staff, and the last studio has three staff to manage its archive collection and all three handle the cels.

The one special library has paid conservation and preservation staff, volunteers, and archive staff that handles and performs duties as needed to preserve animation cels. While they have 150 staff members in the whole unit, about 1-19% of this staff works with the animation cels. This is roughly 29 staff members, the highest number of staff in this survey research to conduct preservation of animation cels. The three museums have a similar number of staff compared to the studio archives. Two of the museums have six and four staff members equaling about 1-19% of total staff, while the other museum has only one staff member equaling about 20-39% of total staff to preserve the collection. Yet, the staffing for conservation and preservation shifts. The museum with the most staff members that work with animation cels is the only museum surveyed to not have a paid conservation/preservation staff member, but rather has regular staff conduct tasks as needed and contracts an outsourced conservator to perform any necessary work on animation cels. The two museums with smaller staff have a paid conservation/preservation staff member. In addition, the museum with only one conservation/preservation staff member also uses volunteers to care for its animation cel collection.

Overall, there is an equal division of repositories that have a paid conservation/preservation staff member versus regular archive staff performing conservation/preservation tasks as needed. One of those repositories has paid conservation/preservation staff and regular staff that performs conservation/preservation tasks as needed. Only one museum with a small staff and the special library allow volunteers to work with collections, and just one repository uses an outsourced conservator. Reasons for these staffing results among repositories can vary, but organizations may want to keep material and decisions internal to control the provenance and methods performed to conserve or preserve the animation material. Since half of the repositories have a paid conservation staff, conclusions can be made that repositories, most museums and special libraries, are valuing their whole collection to ensure that a properly trained conservation staff is on site to manage and care for the variety of collection materials. However, the fact that the other 50% of the repositories have regular collection staff conducting conservation/preservation tasks shows that additional research and knowledge of how best to preserve animation cels is needed in the archival and library field. Interviews suggest that many of these regular staff members perform conservative methods of preservation and conservation until further and better research and knowledge are disseminated among the archival and library field.

Signs and causes of deterioration for the animation cels among the repositories collections appear to be typical for the art material. The studio

archives with more recent animation cel collections comment on needing proper assessment strategies, along with the removal of bad storage materials and practice, and proper accessioning of the animation cel collection. As assessments have not been done for all the collections, deterioration signs were limited to paint flaking, cel distortion and cracking, and off-gassing from the celluloid plastic. On the other hand, museums listed causes and signs of deterioration to be tape and staples, dirt/grime, as well as the classic deterioration signs of the material, flaking paint and curling celluloid. Again, there is an institutional difference between studio archives and more typical information institutions of museums and special libraries. A majority of the studio archives have yet to assess their animation cel collection, while the museums and special library have included the materials into their whole collection. This difference can be for a variety of reasons. The studio archives have thousands, if not millions, of items in their whole collection with animation cels only a small part of that collection. Museums can specialize in one or more particular materials providing more focus on animation cels in their collections. The special libraries can exhibit cross issues of having millions of items with animation cels only a small collection out of the whole but are able to focus on the animation material due to the size of staff and resources.

A majority of repositories have funding for conservation and preservation activities in their budget. Yet, only two of them have 1-19% for their overall budget allocated specifically for the

preservation/conservation of animation cels, even though one is a museum and the other is a studio archive. These two repositories happen to be well-known repositories of famous cartoons and animation characters. In addition, these two repositories have different staffing, as one has a paid internal conservation/preservation staff member and the other contracts external conservators when needed. The remaining repositories may not divide up their budget per collection materials, but rather may use the funds for conservation and preservation activities determined by the materials severity of deterioration. This lack of budgeting for preservation and conservation activities seems to hinder preservation activities for a repository's animation cel collection as only two repositories claim that 90% or more of their collection is in no need of preservation, both of which are cartoon and animation museums with an ability to focus on animation cels in the collection, which may account for why their collection is in such good order. While two others were unable to answer due to not answering the questions or in the middle of an assessment project, the last three repositories which consist of two studio archives and one special library assess that 100% of their animation cel collection is in need of basic to urgent need of preservation. The reason for why 100% of their animation cel collection is in need of preservation is not clear. It could be due to respondents being unclear on how to answer the survey questions, a lack of priority by the studio archive, previous bad storage and assessment strategies, or select staff knowledgeable in animation cel collection. Each

repository's reasons vary due to mission or function within the parent organization, staffing, funding, and priority for their animation cel collection.

The final survey questions asked about exhibition practices. When it comes to exhibiting animation cels most repositories exhibit cels vertically mounted in a frame on the wall, while one uses an easel with backing. There was only one museum repository that mentioned exhibiting animation cels laid flat in a display case, but this depends on the exhibit. The special library exhibits cels in a mat that is then contained in a plexi-pack with silica gel. The Disney ARL described a previous exhibition enclosure in 2014 at the American Institute for Conservation of Historic and Artistic Works (AIC) annual conference. They used a window mat, matboard backing with the cel attached by Japanese paper hinges, a sheet of Artsorb (a silica gel RH buffer), and RH measurement strip. These examples seem to be the current best way to house animation cels until further research is known.

The duration an animation cel is on exhibit is more varied as two repositories exhibit pieces three to six months, one exhibits six to twelve months, while the other exhibits up to six months in one year, but no more than twelve months in five years. Other repositories responded that exhibition duration varies. As exposure to environmental conditions during exhibition can contribute to animation cel deterioration, repositories in general limit the duration of exhibition and handling while traveling to

preserve the elements but allow the public to enjoy viewing the materials for a limited time.

Overall, the survey, interviews, and site visits bring together an understanding that each repository is different. Each is administered according to their function, whether that is the preservation of company history for company business or the preservation and access of an American art form for research and the public. Studio archives exhibit placing a lower value on their animation cels when compared to other types of repositories, by the lack of priority placed on assessing and caring for the collection. This is changing as a few of the studio archives contacted during research for this thesis were in the middle of an assessment of animation elements including animation cels, or plans for an assessment was in the near future. The cartoon and animation specific museums along with one of the studio archives appear to have a handle on managing and caring for their animation cel collection. The repositories with collections of multiple materials other than animation cels tend to have a slower momentum in assessing and preserving their animation cel collection.

Recommendations

The culmination of research methods in the form of an extensive survey, site visits and interviews along with a literature review, are the basis for the following recommendations that focus on the management and preservation needs of animation cels. These recommendations are directed towards information memory professionals, such as archivists, collection managers, registrars, and special collection librarians, with little or no knowledge of animation or animation cels that may exist in their repository. The recommendations are to aid them in managing and preserving this limited art form. ***However, a warning needs to be mentioned that caretakers must proceed with caution when working with animation cels and keep the original artwork unaffected as possible when applying preservation practices. If conservation treatment is determined to be needed, please consult a professionally trained conservator.***

First, acquire an understanding of the animation process and development of animation cels. Professionals that work with animation cels need to have an understanding of the production process of animation and the components that make an animation cel. This will help professionals to determine where a particular cel was located in the camera layer levels during the production of a film scene which can determine how valuable that cel is to preserve over similar one. As multi-plane cameras had up to seven layers, each layer will have different components for characters and scene action in one picture of a scene that includes twenty-four pictures to

complete a scene. In general, the second layer was considered the key element as it had the most action of the scene and would be used more than other cel layers. This makes the key animation cels more valuable than a first or third layer which may have an arm or leg for movement. There are numerous published works that further explain the animation process.

Second, administer conservative general care practices for animation cels. All repositories suggest wearing gloves when handling animation cels to prevent fingerprints on the plastic support. Should cels need to have fingerprints or dust cleaned from the image, a soft cotton cloth can be used to lightly rub fingerprints and to remove dirt from the plastic support. Never use the cloth on the paint as the cloth can rub the delaminated or fragile paint off. As the paint is water-soluble, using water on or near animation cels should be prohibited to prevent any chance of water spilling onto the cels and re-wetting the paint causing it to dilute or smear. Cels need to remain flat to prevent paint from cracking or otherwise degrading. As cellulose nitrate and cellulose acetate off-gas various constituents in the plastic, which can cause cellulose nitrate to be highly flammable, airing out these animation cels on regular occasions is recommended for safety.

Third, provide appropriate preservation storage for animation cels. There is no way to prevent the natural deterioration process of organic material like cellulose or ingredients in the paint, but methods can be used to slow the progress of degradation. Repositories can use archival materials

that have silica gel in the material, such as Artsorb, to minimize exposure to humidity; archival matboard with molecular traps using zeolites can also be used to reduce the buildup of off-gassing (Rempel, 1996). Animation cels are not like other graphic and art materials and would be best preserved if individual cels were placed in window mats to allow off-gassing to escape and support the animation cel on a flat surface. Then a handful of cels in mats can be placed in flat boxes to be stored on the shelf. This will reduce the pressure and friction on the image of each animation cel. Special care needs to be taken with the paint, in particular when dealing with unstable paint or humid conditions. The paint will absorb the moisture in the air becoming tacky and stick to plastic supports, other painted images and other materials. Interleaving cels with archival paper or folders, a method not typical of other collections, is highly recommended. Disney ARL uses glassine to sleeve individual animation cels and prevent them from sticking to other materials. All materials used should be of archival standard and acid-free.

Fourth, regulate proper environmental conditions of storage facilities for storing animation cels. Temperature, relative humidity, light, and ultraviolet energy all have degrading effects on animation cels. And being a composite object made of materials that do not have the same preservation condition requirements can make it difficult to protect animation cels from these effects. In previous years the temperature used for animation cels were the low 60°s Fahrenheit or below that are used for

film and photography to preserve the plastic support. Current research suggests that a higher temperature closer to that for paintings is ideal for animation cels' multiple components. This temperature range is 68°F to 72°F. While the temperature for paintings is too warm for the plastic, a comparable temperature for animation cels would be a range of 60°F to 65°F, preferably closer to 65°F. Relative humidity (RH) is much the same story. Animation cels have been stored at an RH of 50% or lower all to preserve the plastic support. However, research conducted in the Disney ARL and GCI project indicate that the ideal RH for animation cels to preserve the plastic and the paint is closer to 55% to 60% relative humidity (Beltran, 2017). This allows the air to retain enough moisture to keep the paint from drying out and cracking, but not so moist as to cause the plastic support to start warping. Essential preservation when using temperature and relative humidity is the stability of these conditions as temperature affects relative humidity. However, if a choice has to be made between maintaining the relative humidity or temperature, maintaining the relative humidity is best.

The level and type of light can have additional effects on animation cels. In preservation practices, there is visible light and ultraviolet light (UV) that require professionals to take care of the amount of light an object is exposed to over time. Visible light is required to work in storage space and view objects, but anything else may cause undue damage to cels. While visible light is measured in lux or lumens per square meter, ultraviolet light

is measured in microwatts of ultraviolet radiation per lumen of visible light ($\mu\text{W}/\text{l}$). UV produces high energy of radiation which is rather damaging to several objects in repositories, daylight being the source of considerable UV. However, artificial UV light sources include some fluorescent, metal halide, and mercury vapor lights all which should be avoided in repository lighting fixtures. Light sources that emit more than $10 \mu\text{W}/\text{l}$ need to be reduced. While most visible light is acceptable, to best preserve animation cels visible light should range between no more than 50 and 100 lux. Some methods that can be utilized is to use shades, films, or filters attached to the top of shelves and pulled down to cover the shelves to further filter light, decrease the number of light fixtures in an area, decrease the wattage of the light bulbs, and utilize light dimmers that turn lights off with no active movement.

Additional environmental condition control that can be implemented if the repository has the funds, is to install an air filtration system to prevent and remove dust and out gassed vapors from inside the building. While this may be out of some institutions' budgets for some time, it should be considered for future plans.

Fifth, monitor the collection. The repositories that best knew their collection from the surveys were the ones that had a regular collection assessment policy implemented in their institution. Examining the condition of the collection enables staff members that perform conservation and preservation tasks to be aware of any changes that occur over time due

to age, storage, environment or exhibition. Maintaining accurate records of when evaluations are done, what changes are noted, exhibition notes of traveling exhibits, and provenance history would all be good to have when managing animation cels. Any changes need to be clearly documented and be maintained for new and existing staff members. Performing regular evaluations of collections can also permit discovery of any pest infestations or other issues with or in the storage space before the problem becomes too big.

Sixth, a continuation of animation cel research is needed along with dissemination of information to information professionals. My research has shown that there is information available on the individual components of animation cels and there is a growing emergence of research being conducted and published on animation cels themselves aimed toward the conservation field. However, there is a noticeable lack of information about and standards for the preservation of animation cels for information and library professionals, such as archivists. In smaller staffed repositories, where a conservator is not on staff, as exhibited in some of the surveys received in this project, it is important for archivists and librarians to be aware of management and preservation methods for animation cels in their collection. Although Disney's ink and paint department do produce limited reproductions of chosen cels, in general, animation cels are no longer produced as they once were and sharing current and future research will help to preserve animation cels for future audiences to enjoy.

Implementing these guidelines will not be an easy task, but can start with articles on the research and data from this thesis submitted to professional organizations that have the infrastructure and authority to set standards. Some organizations in mind are the Society of Animation Studies (SAS); the Visual Materials section and other sections that relate to animation cels in the Society of American Archivists (SAA); and the American Library Association (ALA). By disseminating the data, and recommended guidelines, additional support can be garnered for the guidelines from information and cultural heritage professionals who can aid in influencing decision makers in the mentioned organizations. Another course of action is presenting a poster at the national conference for these organizations. The ALA and the SAA are the best organizations with authority that can bring credibility to the guidelines with their peer review and committees to set standards.

Conclusion

My thesis project has shown that there is limited literature published on management and preservation of animation cels for information memory professionals. Most published materials on the subject, however, are aimed toward a conservator readership. While there are numerous publications on the various forms of cellulose nitrate, cellulose acetate and polyester celluloid used in film and photography along with the numerous publications on art and art forms, there are still no written publications specifically about the management and care of animation cels. Many of the archivists and librarians that manage and care for animation cels rely on information relayed from paid internal conservators. However, information professionals who do not have the ability to converse with an internal conservator or have a budget to consult with a private conservator are left with vague information to guide them in the management and preservation of their repositories' collection.

To date, there are no standards set for preservation practices of animation cels in any information memory field, and common terminology for animation cels comes from film and animation production. In addition, classification of animation cels is still uncertain as the various personnel that I interviewed or surveyed consider animation cels to be a range of mediums, such as graphic art, art, special collections, or their own separate classification, animation cels. However, classification has changed over the last ten years when some repositories classified animation cels as paper or

photographs and now most classify animation cels as some form of art. Despite these issues, most information professionals are managing their collection in a rather suitable and conservative manner while waiting for better practices and standards.

Data gathered from my survey along with interviews of additional repository personnel exhibit that there is a divide among the types of repositories that manage animation cels and the priority these institutions place on assessing and preserving their animation cel collection. Studio archives show less momentum in evaluating and accessing their animation cel collection over the multiple other materials in their collection. Museums and special libraries take various priority levels on managing animation cels depending on the material focus of the museum or special collection, but still place a higher priority on assessing and accessioning animation cels that come into their collection when compared with the studio archives. However, the animation studios are currently in progress of assessments of their animation cel collections, exhibiting a change to their priorities for managing their animation cel collections for the future.

Collectors of animation cel art have been pursuing items since the 1930's after the Disney studio sold its first animation cel to the Museum of Modern Art. But it was the high demand for animation cels in the 1980's that made animation cels a unique American art form that collectors paid thousands of dollars to obtain. Animation art has remained a highly

collectible item at auction and with added research in the preservation of animation cels becomes an even more recognized important artform.

Current storage and preservation methods for animation cels are easy for any repository to incorporate into their collection as they would already be doing them for their other collection materials. Controlling the environment conditions, proper storage and handling, and knowledgeable staff are easy ways to further preserve animation cels as new research is conducted to better understand the needs of animation cels. Yet, a recognized set of standards for information professionals regarding animation cels will better result in uniform management and future preservation practices for this complex American artform.

Appendices

Appendix A: List of Interviewees

Eric Chin, Sr. Archivist,
NBCUniversal - Archives & Collections,
Interview with author
December 12, 2017, North Hollywood, CA

Tori Cranner, Art Collections Manager,
Disney Animation Research Library,
Email interview with author
March 12, 2018

Rick Gehr, Film Editor,
Warner Bros. Entertainment, Warner Bros. Animation,
Interview with author
February 6, 2018, Thousand Oaks, CA

Kevin Iwaki, Collections Coordinator,
Nickelodeon Animation Archive and Resource Library,
Interview with author
November 10, 2016, Burbank, CA

Dawn Jaros, Conservator,
Academy of Motion Picture Arts & Sciences – Margaret Herrick Library
Interview with author
November 8, 2017, Los Angeles, CA

Anna Martino, Sr. Manager,
Nickelodeon Animation Archives and Resource Library,
Interview with author
November 10, 2016, Burbank, CA

Rachel Parham, Archivist,
NBCUniversal - Archives & Collections,
Interview with author
December 12, 2017, North Hollywood, CA

Micheal Pazmino, Archives Coordinator,
Nickelodeon Animation Archive and Resource Library,
Interview with author
November 10, 2016, Burbank, CA

Stephen Worth, Director,
Animation Resources.org,
Interview with author
November 4, 2017, Los Angeles, CA

Note: Stephen Worth is also a retired animation cel restoration business owner of Vintage Ink & Paint Restoration.

Appendix B: List of Repositories

Studio Archives:

Warner Bros. Studio Archive

Universal Studio Archive

Nickelodeon Studio Archive

MGM Studio Archive

Archives:

Association Internationale du Film d'Animation, ASIFA-Hollywood:
Animation Archive

UCLA Special Collections

UCLA Film & TV Archive

Museums:

Museum of Modern Art (MoMA)

Charles M. Schulz Museum

Cartoon Art Museum

Walt Disney Family Museum

Special Libraries:

Academy of Motion Picture Arts and Sciences (AMPAS),
Margaret Herrick Library

Library of Congress, Photographs and Prints Division

Disney Animation Research Library

Appendix C: Survey Cover Letter

January 9, 2018

Institution Information

Address

Dear 'Participants Name,'

Please find a survey for my thesis project designed to collect data on the preservation and conservation practices used for animation cels by multiple types of collecting repositories in the United States. The survey results will provide indispensable research data for my paper. If you could please take some time to complete the questionnaire and return by February 2, 2018. I would deeply appreciate your time and informational input.

Any data or information provided is for the sole purpose of my thesis project. I will keep your individual responses completely confidential. Only the data will be reported; your individual responses will never be published or identified in the thesis, unless formally indicated otherwise.

Thank you in advance for your participation. Please feel free to contact me should you have any questions regarding the survey.

Best,

[Signature]

Angela Schwarz

UCLA MLIS candidate 2018

Animation Cel Management and Preservation Practices Survey

To be completed by person(s) in charge of animation cel management, preservation & conservation.

Institutional Information

Name

Address 1

Address line 2

Address line 3

City, State, and Zip

Participants Name

Position

Responsibilities for preservation activities

1) Which of the following describes your institution's function? (select one)

- Studio archive
- Museum
- Archives
- Special Library

2) What type of governance does your intuition follow? (select one)

- Corporate or for-profit
- Non-profit or foundation

University or academic

3) Do your collections include animation cels?

Yes

No

4) What percentage of your collection is made up of animation cels?

(Select one)

0%

1-19

20-39

40-59

60-79

80-99

100

Don't know

5) What is your institution's total number of collection holdings?

6) What is your institution's total number of animation cels?

7) How long has your institution been collecting and caring for animation cels? (Please indicate a year of first accession)

8) What is the age range of your animated cels collection? (Please list the year of oldest and youngest cels)

9) What percentage of animation cels are from the indicated decade?
(Please don't leave any blanks. Sum of answers should equal 100%)

1900-1909

1910-1919

1920-1929

1930-1939

1940-1949

1950-1959

1960-1969

1970-1979

1980-1989

1990-1999

10) How does your institution classify animation cels, and why? (paper, graphic art, art, etc.)

Environmental Conditions

11) Do you use environmental controls to regulate **temperature** for the preservation of your collection? (select one)

Yes, all areas

In only a few areas

No areas

Don't know

12) Do you use environmental controls to regulate **relative humidity** for the preservation of your collection? (select one)

Yes, all areas

In only a few areas

No areas

Don't know

13) Do you use environmental controls to regulate **light** levels for the preservation of your collection? (select one)

Yes, all areas

In only a few areas

No areas

Don't know

14) Do you use environmental controls to regulate **ultraviolet light** levels for the preservation of your collection? (select one)

Yes, all areas

In only a few areas

No areas

Don't know

15) How are animation cels handled? (gloves, no gloves, in housing, etc.)

16) What environmental control products are used for animation cels? (Silica gel packets, thermohygrometers, light filters, etc.)

17) What estimated percentage of your total collections is stored in areas you consider to have adequate space to accommodate the current collection with safe access? (Select one)

0%

1-19

20-39

40-59

60-79

80-99

100

Don't know

18) What estimated percentage of animated cels is located in a storage area you consider to have adequate space to accommodate the current collection with safe access? (select one)

0%

1-19

20-39

40-59

60-79

80-99
100
Don't know

19) Has a survey of the general condition of your animated cel collection been done (an assessment based on visual inspection of the collection and where it is held)?

(select one)

Yes
Only of a portion of the collection
Not up-to-date
All of the above
No
Don't know

20) How often are condition assessments done on the animation cel collection?

21) In what way are your animation cels stored? (Choose the one that most represents your collection)

Individual items (cels) separated by folders and in a box
Individual items (cel) separated by tissue paper and in a box
Individual items (cel) separated by folder or tissue paper and grouped together in a box
Cels grouped together (no separation) and stored in a folder and a box
Cels grouped together (no separation) and stored in a box
Cels grouped together (no separation) and stored in a folder on the shelf

Other: Please explain

Staffing and Assessments

22) Which of the following most closely describes your current staffing for conservation/preservation? (select all that apply)

Paid conservation/preservation staff

Volunteers

Conservation/preservation duties assigned to various staff as needed

Conservation/preservation services obtained through an external provider

No staff person has conservation/preservation responsibilities

23)How many archive and/or museum staff total does your institution currently employ that conduct preservation or conservation tasks?
(Answer as detailed as possible)

24)What percentage of staff care for the animation cels collection?
(select one)

0%

1-19

20-39

40-59

60-79

80-99

100

Don't know

25)For animated cels that are currently in need of treatment identify all the causes of damage.

26)Do you have funds specifically allocated for conservation/preservation activities in your annual budget?

Yes

Not specifically, but funds are available

No

Don't know

27)What percentage of the funds indicated in question 20 goes towards preserving/conserving animated cels?

- 0%
- 1-19
- 20-39
- 40-59
- 60-79
- 80-99
- 100
- Don't know

[The answers to questions 28 through 31 should equal 100%]

28)What percentage of your animated cels are in no need of preservation?

29)What percentage of your animated cels are in need of preservation?

30)What percentage of your animated cels are in urgent need of preservation?

31)What percentage of your animated cels are in unknown condition?

32)Are pieces of your animation cel collection exhibited?

- Yes
- Some pieces
- No
- Don't know

33) If exhibited, are animation cels mounted on the wall or laid flat in a case?

If other, please explain:

34) What are the environmental conditions animation cels are exposed to when exhibited? (light, temperature, relative humidity, display fasteners, and mounts, etc.)

35) What is the Institution's standard duration for exhibiting objects like animation cels?

36) Is anonymity important to you?

Yes

No

37) May I quote you?

Yes

No

38) Any additional comments you feel would benefit my research?

Appendix E: Survey Results

The institutional and participants name and responses to questions 36, 37, and 38 are not provided for participants anonymity.

Institutional Information

- 1) Which of the following describes your institution's function?
(select one)
 - 3 Studio Archives
 - 3 Museums
 - 1 Archive
 - 1 Special Library

- 2) What type of governance does your intuition follow? (select one)
 - Corporate or for-profit 3
 - Non-profit or foundation 4
 - University or academic 1

- 3) Do your collections include animation cels?
 - Yes 7
 - No 1

- 4) What percentage of your collection is made up of animation cels? (Select one)
 - 1-19%
 - 0%
 - 20-39%
 - 1-19%
 - 1-19%
 - Don't know
 - Don't know
 - 1-19%

- 5) What is your institution's total number of collection holdings?
- 160,000,000
 - 500,000
 - NA
 - 65,000,000
 - NA
 - NA
 - 40,000
 - 7000
- 6) What is your institution's total number of animation cels?
- 436
 - 0
 - No count available
 - Unknown
 - Unsure
 - NA
 - 100
 - 500
- 7) How long has your institution been collecting and caring for animation cels? (Please indicate a year of first accession)
- 1977
 - 1990
 - 1923
 - 2002
 - 1939
 - 2002
 - 1987
- 8) What is the age range of your animated cels collection?
(Please list the year of oldest and youngest cels)
- 1914-1980
 - 1990-2000
 - 1923-1989
 - 1985-2000
 - NA
 - 1960-2018

- 1935-2010
- 9) What percentage of animation cels are from the indicated decade? (Please don't leave any blanks. Sum of answers should equal 100%)
- Unknown
 - 1990-1999
 - Unknown-these have not been cataloged
 - 1980-1989 60%
 - 1990-1999 40%
 - NA
 - 1960-1969 25%
 - 1970-1979 25%
 - 1980-1989 25%
 - 1990-1999 25%
 - 1930-1939 10%
 - 1940-1949 10%
 - 1950-1959 20%
 - 1960-1969 30%
 - 1970-1979 10%
 - 1980-1989 10%
 - 1990-1999 10%
- 10) How does your institution classify animation cels, and why? (paper, graphic art, art, etc.)
- Art
 - Art; they are artistic pieces and we treat them as such.
 - Animation cels. They are considered their own element since nothing else is like them.
 - Art
 - Special Collections
 - Artwork
 - Cel, cel and background

Environmental Conditions

- 11) Do you use environmental controls to regulate temperature for the preservation of your collection? (select one)
- Yes, all areas 6
 - In only a few areas 1
- 12) Do you use environmental controls to regulate relative humidity for the preservation of your collection? (select one)
- Yes, all areas 4
 - In only a few areas 2
 - No areas 1
- 13) Do you use environmental controls to regulate light levels for the preservation of your collection? (select one)
- Yes, all areas 6
 - In only a few areas 1
- 14) Do you use environmental controls to regulate ultraviolet light levels for the preservation of your collection? (select one)
- Yes, all areas 5
 - No areas 1
 - Don't know 1
- 15) How are animation cels handled? (gloves, no gloves, in housing, etc.)
- Gloves, housing when exists
 - Varies – gloves, DIY housing, folders
 - Always with gloves. Housing varies. Everything is in some kind of box, but interior housing varies. If rehoused they are in mats with protective polyethylene sheets. A very small percentage of the cels have been rehoused (pending conservation study). Most cels are

stacked in archival boxes with tissue or paper between them.

- Gloves, acid free folders and containers
 - Gloves
 - Gloves and in matboard housings
 - No gloves, stored in flat files
- 16) What environmental control products are used for animation cels? (Silica gel packets, thermohygrometers, light filters, etc.)
- Thermohygrometers and light filters in storage space, temperature same as photographs.
 - Not applicable
 - Environmental and light controls in storage areas. Everything is in a box to protect from light and dust. No micro environmental controls (gel packs etc) are being used at this time.
 - None
 - No answer
 - Microchamber matboard and storage boxes
 - Thermohygrometers
- 17) What estimated percentage of your total collections is stored in areas you consider to have adequate space to accommodate the current collection with safe access? (Select one)
- 100%
 - 60-79%
 - 100%
 - Don't know
 - 100%
 - 100%
 - 100%
- 18) What estimated percentage of animated cels is located in a storage area you consider to have adequate space to accommodate the current collection with safe access? (select one)
- 100%
 - 1-19%
 - 100%

- Don't know
- 100%
- 100%
- 0%

19) Has a survey of the general condition of your animated cel collection been done (an assessment based on visual inspection of the collection and where it is held)? (select one)

- Yes 3
- Only a portion of the collection 0
- Not up-to-date 1
- All of the above 1
- No 2

20) How often are condition assessments done on the animation cel collection?

- When they arrive
- We just started so it has been 25 years since anyone looked at the cels.
- Only one has been done at this time as part of the conservation study.
- Rarely
- NA
- Intermittently when pulled for exhibits and full inventory every 5 years
- Every two years

21) In what way are your animation cels stored? (Choose the one that most represents your collection)

- Individual items separated by folders and in a box
1
- Individual items separated by tissue paper and in a box
1
- Individual items separated by folder or tissue paper and grouped together in a box
2

- No answer
1

Other: Please explain

- Mixed, most of the collection stored in boxes and map cases, with permalife paper separation.
- Flat files, separated by paper, damaged/deteriorating items stored separately.

Staffing and Assessments

22) Which of the following most closely describes your current staffing for conservation/preservation? (select all that apply)

- Paid conservation/preservation staff 4
- Volunteers 2
- Conservation/preservation duties assigned to various staff as needed
4
- Conservation/preservation services obtained through external provider
1
- No staff person has conservation/preservation responsibilities

0

23) How many archive and/or museum staff total does your institution currently employ that conduct preservation or conservation tasks? (Answer as detailed as possible)

- We have separate preservation unit with 150 staff, but all staff working with collections have phased preservation responsibilities.
- 3 (including myself)
- 6 people on the collections staff who rehouse the collection and 1 trained conservator.
- 1 staff
- 4 staff

- 6; collections manager, 2 registrars', archivist, asst. archivist, traveling exhibitions manager (who has conservation background)
- 1 staff

24) What percentage of staff care for the animation cels collection?
(select one)

- 1-19%
- 100%
- 100%
- 40-59%
- 1-19%
- 1-19%
- 20-39%

25) For animated cels that are currently in need of treatment identify all the causes of damage.

- Flaking paint; mixed media damage-especially pressured sensitive tape.
- Bad storage and handling and lack of assessment strategies in place
- Many of the cels were damaged before the archives and the collection is currently in a conservation survey. Signs of damage are paint flaking, distortion of the cels, off gassing smell, and cracking of the cels.
- Needs proper accessioning and removal of original storage
- No answer
- Tape and staples on the cels, dirt/grime
- Flaking of paint, curling of celluloid

26) Do you have funds specifically allocated for conservation/preservation activities in your annual budget?

- Yes 5
- No 2

- 27) What percentage of the funds indicated in question 20 goes towards preserving/conserving animated cels?
- Don't know
 - NA
 - 1-19%
 - 0%
 - Don't know
 - 1-19%
 - 0%

[The answers to questions 28 through 31 should equal 100%]

- 28) What percentage of your animated cels are in no need of preservation?
- 10% (1)
 - 0% (2)
 - NA (3)
 - NA (4)
 - 95% (5)
 - 90% (6)
- 29) What percentage of your animated cels are in need of preservation?
- 70% (1)
 - 100% (2)
 - NA (3)
 - NA (4)
 - 5% (5)
 - 5% (6)
- 30) What percentage of your animated cels are in urgent need of preservation?
- 2% (1)
 - 90% (2)
 - NA (3)
 - NA (4)
 - 0 (5)
 - 5% (6)

- 31) What percentage of your animated cels are in unknown condition?
- 30% (1)
 - 0% (2)
 - NA (3)
 - NA (4)
 - 0 (5)
 - 0 (6)
- 32) Are pieces of your animation cel collection exhibited?
- Yes 3
 - Some pieces 3
 - NA 1
- 33) If exhibited, are animation cels mounted on the wall or laid flat in a case?
- Usually mounted on wall
 - Framed on wall
 - Both
 - Other
 - No answer
 - Both, depending on condition and cel set-up
 - Wall mounted

If other, please explain:

- Easel with backing and book tape

- 34) What are the environmental conditions animation cels are exposed to when exhibited? (light, temperature, relative humidity, display fasteners, and mounts, etc.)
- All exhibition items are placed in mats, sealed in plexi-packs with silica gel to absorb moisture.
 - All of the above [examples].
 - All of the above examples. All are considerations when exhibiting art work.
 - In display case, exposed to light and temperature of surroundings
 - No answer

- Light, temp, RH
- UV light, 40% humidity

35) What is the Institution's standard duration for exhibiting objects like animation cels?

- No more than 6 months in one year; No more than 12 months total in 5 years
- Varies
- We do not exhibit original production cels. We do exhibit cels reproduced by our [internal] department using original ink and paint techniques. These become exhibition copies and are stored and maintained in the same manner as our other art. The fact that these are reproductions is noted on the exhibition labels.
- 3-6 months
- No answer
- 3-6 months in low lighting
- 6-12 months

Glossary

Acrylic paint – A fast-drying paint made of pigment suspended in acrylic polymer emulsion. Acrylic gouache paint is like traditional gouache but uses an acrylic binder. Used on animation cels of polyester plastic supports.

Animation – Filmmaking genre of multiple techniques that create the appearance of movement by the manipulation of, various photographs of images or objects transferred to film, computer-generated imagery (CGI), or using the stop-motion technique of pixilation.

Animation Cel – A transparent sheet of celluloid plastic, .005 mm thick, 10 in x 12 in, up to 12 in x 16 in., with painted elements (images) on both sides used in the animation process. A final essential element is the production of animation features and shorts.

Binder – Component that provides cohesion to a layer containing several compounds.

Bloom – The production of additives in cellulose plastics migrating to the surface and then becomes solid.

Brittleness – Chemical deterioration in all plastics, usually the result of a loss of plasticizer. Plastic easily breaks apart.

Buckling – Distortion caused by chemical degradation or shrinkage.

Camphor – A white crystalline solid which can be extracted from the different parts of *Cinnamomum camphora* trees found in Asia and Florida or can be synthesized. Used as a plasticizer for cellulose nitrate.

Catalyst – A substance that changes the rate of a chemical reaction without undergoing permanent change in its composition.

Cel – Shortened term for “celluloid.”

Celluloid – A transparent sheet of plastic .005 mm thick, usually 10 in x 12 in, but up to 12 in x 16 in and used as a support in traditional animation.

Cellulose acetate – A type of plastic used as a support for film elements produced by the mixture of several compounds by the action of acetic acid and sulfuric acid on a cellulose (organic) material.

Cellulose nitrate – A type of plastic used as a support for film elements produced by the mixture of several esters of nitric acid produced by the action of nitric acid on a cellulose (organic) material.

Composite – Combined material created by the synthetic assembly of two or more components.

Degradation – Signs of include delamination, bloom, buckling, brittleness, flaking, hydrolysis, warping, yellowing.

Delamination – Separation of individual layers. Paints lose adhesion to plastic support.

Flaking – Localized separation of paint layers in the image of an animation cel.

Gouache – A type of water media, paint consisting of pigment, water, and a binding agent, like gum Arabic, and some additional inert material. Used for opaque methods of painting.

Hydrolysis – A chemical reaction between water and acetic acids in acetate plastic which supports degradation. An odor of vinegar can indicate the presence of hydrolysis.

Lux – Unit of illuminance. Characterizes the luminous flux received per unit of surface area.

Maquette – 3D model statue produced for animators to have an example when drawing any side of a character.

Macroenvironment – Atmospheric conditions prevailing in an ample space where items are preserved.

Microenvironment – Atmospheric conditions in a small enclosure where items are preserved.

Microclimate – Climatic conditions prevailing in a small space, which are different from the ambient conditions.

Multi-plane camera – Special motion picture camera designed for the production of animation films by Ub Iwerks while at Disney Studios. The camera provides the ability to move a number of pieces of artwork past the camera at various speeds and distances to create a 3D effect on a 2D plane.

Odors – Certain smells that may indicate that degradation is effecting the cel.

- Vinegar: Acetic acid produced by degrading cellulose acetate.
- Mothballs: Camphor plasticizer in cellulose nitrate but not always an indication of degradation.

Opaque – Blocks light or visibility of what is underneath the paint.

Opaker – Title of people who paint or ink animation cels at a studio.
Also known as an Inker.

Polyester (polyethylene terephthalate (PET)) – A transparent plastic used as a film base support made of a polymer of ethylene glycol and terephthalic acid. It is very strong and stable.

Traditional Animation (2D) – The process of characters drawn on paper then traced and painted onto cels. The painted cels are then placed on a background and photographed one frame at a time. Creating motion by the successive drawings simulating movement by slight progressive changes at a rate of 24 frames per second.

Vinegar Syndrome – See Hydrolysis and Odors

Warping – Physical distortion of plastic support due to loss of plasticizer, and application of heat. Exhibited by ripples.

Xerography – The process of dry copying an image onto a support where black or colored powder adheres to parts of a support that remains electrically charged after being exposed to light. Also known as electrophotography or photocopying.

Yellowing – Discoloration that affects a color image.

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