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THE CONSTRUCTION OF PRESERVATION KNOWLEDGE IN THE ARTISANAL
DIGITAL REFORMATTING OF ANALOG VIDEO RECORDINGS

By

ZACHARIAH S. LISCHER-KATZ

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ABSTRACT OF THE DISSERTATION

The Construction of Preservation Knowledge in the Artisanal Digital Reformatting of Analog Video Recordings

by ZACHARIAH S. LISCHER-KATZ

Dissertation Director:
Dr. Marija Dalbello

The primary purpose of this research is to gain understanding into the processes of knowledge construction and the underlying epistemic practices and assumptions of media preservationists working in the artisanal mode of preservation to produce digital manifestations of complex visual documents, specifically analog video recordings. It focuses on “artisanal digital reformatting” in institutional sites of small-scale, high-skilled digital copying.

This dissertation research studied 13 media preservationists (eight digitizers, four administrators, one quality control specialist) recruited from six preservation labs. Data were generated in the form of discourses and observations of material practices by conducting semi-structured interviews, video-recorded observations, and review sessions in which participants reflected on the video-recordings of their workplace practices. Data were analyzed using qualitative-interpretive methods, including discourse analysis and interpretive phenomenological analysis.

The findings of this research suggest that artisanal digital reformatting is an interpretive act of visual translation that unfolds within epistemological,

phenomenological and cultural dimensions of participants' workplace practices. This work blends "mental and manual" dimensions of technical labor in which participants incorporate their trained vision, embodied judgment and historical knowledge to detect and diagnose typified visual errors to produce "legitimate" digital copies. Participants identify tensions between trust, credibility and the applicability of new practical knowledge as it circulates across three zones of knowledge construction in the context of their situated activities: personal, institutional and community zones of knowledge. Analysis of digitizers' moral commitments to archival imperatives and their efforts to enact them in practice suggests that normative considerations operate alongside the practical requirements of digital copying.

Through an analysis of participants' practices and discourses, a coordinated array of epistemic techniques and visual practices were identified. This research analyzed the experiences of digitizers carrying out their work to understand how they train their perceptions as well as the affective dimensions of their work. This research then considered how participants integrate knowledge from the wider occupational community of media preservationists into digitization work. Finally, this research explored how normative aspects of practice shape the construction of knowledge, by analyzing participants' moral commitments to archival imperatives and their efforts to enact those commitments in practice.

DEDICATION

To the memory of my father

Neil M. Katz

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CHAPTER 1: INTRODUCTION

1.0 Description of Research Area

This research was inspired by my personal experiences working in the moving image preservation field conversing with preservation professionals, instructors and students, and exploring archival collections of visual documents. While working at New York University's Moving Image Archiving and Preservation program from 2006-2012, I interacted with students who were always inquiring about *the* standard for preserving different types of visual documents. The students expressed their desire for clear and concise rules that they could apply for preserving file and video in any preservation context. When I visited the Library of Congress's Packard Campus for National Audio Visual Conservation (PCNAVC) for the first time in 2008, I was introduced to two distinctive modes of digital production that the staff characterized as "mass throughput" and "boutique" levels of digital reformatting. These experiences made me wonder how preservation knowledge is integrated into different modes of digital production and alerted me to the lack of clarity in the preservation community around the central role of standards and specifications. The distinction between high-output, low-skill production (*mass digitization*) and low-output, high-skill production (*artisanal digitization*) in the context of digital reformatting points to competing conceptions of the role of routinization and standardization in preservation practice.

The emergence of mass digitization projects and the growing acceptance within the preservation community of the use of digitization as a technique for preservation since 2004, when the Association of Research Libraries formally endorsed digitization as

a preservation strategy, calls for investigation of the increasingly central role of digital reformatting in mediating access to visual documents, and especially artisanal approaches to complex visual document forms. From the Google Books project and the HathiTrust digital library project, which are scanning millions of books and making a portion of them available on the Internet, to other large digitization projects conducted by a variety of university libraries and government agencies, digital reformatting has become a common practice carried out at an increasing scale in a variety of institutions and contexts (Conway 2010a, 2013) from 2004 to the present time. Running parallel to these projects concerned with increasing economies of scale in digital production, has been the emergence of the practice of artisanal digital reformatting, which involves small-scale, high-skill production of a variety of complex visual document formats, such as film and video, which resist the uniformity and standardization required for mass production.

Digital reformatting refers to the use of digitization technology to translate information from analog originals to legitimate digital copies for preservation purposes, and it is an important area of development in preservation activities. The difficulty of making complex decisions in technical processes of digitization is becoming more pronounced as these projects move beyond text and image digitization to the digitization of a variety of complex and often fragile visual documents. The work of digitizing visual documents, understood as a type of preservation, involves translating analog documents into digital manifestations using an array of visual technologies and the educated visual judgments of preservationists. These practices are configured and stabilized by preservation knowledge. Preservationists working within contexts of institutional and professional normative practice configure and activate digital reformatting systems

within established knowledge regimes in order to produce digital manifestations that they perceive to be “legitimate.” The dominant discourse in information studies constructs these digital manifestations as truthful reproductions of the original document’s “information content,” however, practices of artisanal digital reformatting also involve re-constructing the identities of the originals being copied. Furthermore, the work of digital reformatting can be seen to embed epistemological assumptions about the nature of information and it plays an important role in constructing the visuality of digitized collections of complex visual documents. Studying the work of digital reformatting visual materials has interesting epistemological implications because this practice relies on the construction of specialized knowledge about what counts as “legitimate” digital re-construction of originals. Digitization, therefore, plays a significant role in shaping conceptions of visual knowledge. Digitization in institutional contexts raises fundamental epistemological questions about the social processes that shape and delimit the boundaries of what counts as justified true belief within the context of preservation knowledge and its materialization in practices of digital reformatting.

This dissertation project considers how knowledge is constructed in artisanal forms of digital production in the context of preservation knowledge by looking at the emergent practice of artisanal digital reformatting of analog video recordings. Using the concept of *artisanal* helps to capture small scale, high-skilled digitization projects, in contrast to high-output, low-skill modes of production that characterize the imperatives of mass digitization work. Karen Coyle (2006) suggests that mass digitization involves both an increase in scale and a decrease in the quality of the products of digitization. Mats Dahlström and Joacim Hansson (2012) argue for the active and skilled role of the labor of

digitization, developing the term “critical digitization” in order to differentiate small-scale projects that critically engage with their digital labor from mass digitization projects that focus primarily on quantifiable levels of output. Distinguishing between different modes of digital production allows for a consideration of how different types of knowledge are configured in order to carry out each type of work. Digitization of visual documents, typically conceptualized as a purely technical activity, can thus be understood as an active process of interpretive translation from one medium to another that involves a complex array of types of knowledge. The conceptualization of *artisanal* digital reformatting further draws attention to the craft-based aspects of this mode of digital production, which expands the focus beyond routine and explicit forms of knowledge documented in standards, guidelines and workflows, to include embodied and cultural-cognitive dimensions, including the role of visual perception in the normative construction of preservation practice. Jeffrey Schnapp and Michael Shanks (2009) suggest “craft bears witness to the complementarity of know-how and propositional knowledge of ethical and political responsibility and productive capacity” (p. 148). A close analysis of the practices of craft-based, artisanal rather than semi-skilled, routine labor allows this proposed research to gain insight into the construction of preservation knowledge as a form of “making.”

Preservation knowledge as defined in this research refers to the specialized technical knowledge necessary for carrying out the work of preservation, the body of theories and philosophical assumptions used to inform and legitimize this work, as well as the commonly held understandings and beliefs held by preservationists (what W. Richard Scott, 2003 refers to as the “cultural-cognitive elements” of institutionalized

knowledge), including constructions of legitimate and normative knowledge about preservation practice and how the actual working of knowledge is being constructed in practice. This research adopts a perspective to knowledge in the tradition of Peter Berger and Thomas Luckmann (1966), which assumes that social reality is constituted intersubjectively through language use, social interaction, and institutional processes. It looks at the construction of knowledge by examining the social processes of *objectivation*, *institutionalization* and *legitimization*, and a social constructionist approach will support this inquiry into the social processes involved in the shaping of the discourse of preservation knowledge around the emergence of artisanal digital reformatting in the period 2004 to 2015.

This dissertation looks specifically at cases where preservationists are working with complex visual document formats, in this case analog video tapes, because some of the standards and best practices for working with these types of materials are still under development and not completely stabilized. Standards and best practices are important codified forms of preservation knowledge and they are often transmitted through published reports, professional and academic conferences and journals, educational programs, and oral communication between social actors, emerging as embodied knowledge within the enacting of digital reformatting practices. This knowledge is sustained through cognitive effort in the preservation community, in part through the circulation of standards and the production of documentation by preservationists. Narrowing the focus of this research to the digital reformatting of a particular subset of visual document formats, analog video, is useful because its emergent nature makes the processes of knowledge construction around them more likely to be easily observed than

those around other types of visual documents, such as collections of photographs, where greater consensus may already exist among preservationists.

The main research objective of this dissertation is to gain understanding into the processes of knowledge construction and the underlying epistemic practices and assumptions of media preservationists who work in the artisanal mode of preservation to produce digital manifestations of complex visual documents, specifically analog video recordings. This main research objective involves looking at the construction of knowledge within the work of artisanal digital reformatting at the levels of institutionalization and discourse, practice and perception, and constructions of normativity. The following sections will describe these three dimensions of analysis: (1.1) discourse and institutionalization; (1.2) social practices of preservation and constructions of visibility; and (1.3) the construction of legitimized preservation knowledge and normative practice.

1.1 Discourse and Institutionalization

The practices of artisanal digital reformatting of visual materials and the construction of visibility are structured through discourse and processes of institutionalization. The study of discourses is a central part of the social constructionist approach. Kimmo Tuominen, et al. (2002) explain how a constructionist approach focuses “on discourse as the vehicle through which the self and the world are articulated,” and that “the things we hold as facts are materially, rhetorically, and discursively crafted in institutionalized social practices” (p. 278). In studying artisanal digital reformatting of visual documents, this level of analysis involves analyzing statements and micro-practices of preservationists as

they carry out their work to understand how practice and “ways of seeing” of preservationists are socially constructed.

1.2 Social Practices of Preservation and Constructions of Visuality

Conceptualizing artisanal digital reformatting and preservation knowledge as a discursive field¹ supports an integrated analysis of how discourses, social practices, and material artifacts contribute to the actualization of codified knowledge of preservation standards and specifications documents within constructions of artisanal digital reformatting of visual documents. Understood as a social practice, artisanal digital reformatting can be seen to rely on trained human bodies to see, evaluate and make decisions throughout their work. In their discussion of the socialization of the functioning of the human body, Berger and Luckmann (1966) suggest “social reality determines not only activity and consciousness but, to a considerable degree, organismic functioning” (p. 182). Thus, the eye, too, must be socialized to see in legitimized ways in order to carry out digital reformatting tasks and evaluate digital products effectively. This dissertation project takes seriously the notions of educated perception and embodied knowledge, and the role they play in actualizations of preservation knowledge in social practice, by analyzing the phenomenological experiences and embodied social practices of preservationists as they carry out the work of artisanal digital reformatting of visual documents.

1.3 Construction of Legitimized Preservation Knowledge and Normative Practice

By making social practices central to the study of knowledge construction in the context of artisanal reformatting, this research looks at how particular social actors (i.e., media preservationists) actualize and reproduce the cognitive and normative elements of

¹ Reiner Keller (2013) succinctly defines *discursive field* as “the arena in which different discourses vie for

preservation knowledge within their work. In this view the activities of preservationists are constrained by what it is possible to say or do within a discourse, but also play an active role in the creative shaping of local practice and institutionalizing local knowledge. Discourses, practices and ways of seeing also contribute to legitimizing preservation practices and in constructing normativity around codified forms of knowledge, such as standards, codes of ethics, and documentary practices of preservation activities. Evaluating how preservationists construct knowledge and establish normative practice in their work is essential to understanding not just how knowledge is institutionalized and discursively constructed, but also how ways of seeing and ways of knowing support constructions of normativity in the cultures of preservation work. Integrating these analyses of discourse and visuality into an analysis of the construction of normative practice provides an integrated approach for understanding processes of knowledge construction in the context of preservation work. This integrated approach draws from several interlocking theoretical frameworks in order to support empirical inquiry into three dimensions of knowledge construction, discourses, visual practices and constructions of normativity.

1.4 Outline of Dissertation

Following this introductory chapter, this dissertation continues with Chapter 2, which outlines the context in which artisanal digital reformatting emerges, by reviewing the history of preservation knowledge and identifying trends. This is followed by Chapter 3, which reviews the relevant research literature in information studies in order to establish artisanal digital reformatting of visual documents as a research context and identify gaps in existing research. Chapter 4 outlines the research objectives and defines key concepts

used in this research. Chapter 5 outlines the theoretical framework for this dissertation. Chapter 6 describes the research methodology. This is followed by Chapter 7, which describes preliminary research that assisted in shaping the research design and analytic strategies. Chapters 8 through 11 present the analysis of the research data, containing excerpts from the data to illustrate the findings. Chapter 12 concludes by summarizing the key findings from Chapters 8 through 11, and identifying theoretical and practical implications, discussing limitations of the research, suggesting future directions for extending this research, and reflecting on how my understanding changed through the process of conducting this research.

CHAPTER 2: BACKGROUND

2.0 Chapter Overview

In the following chapter I provide an historical background to situate the practice of artisanal digital reformatting of analog video recordings within its historical and cultural context. In section 2.1, History of Preservation Knowledge, I trace a history of preservation knowledge, looking at the development of preservation technologies, institutions and knowledge production; and in section 2.2, The Emergence of Digital Reformatting of Visual Documents as a Field, I describe the emergence of digital reformatting of visual documents as a field of research and practice. This will provide context for understanding and interpreting the practices and discourses of artisanal digital reformatting.

2.1 History of Preservation Knowledge

In this section I will establish artisanal digital reformatting as an emergent phenomenon by situating it within key trends in the historical development and institutionalization of preservation knowledge. To do so I will first summarize research on the history of preservation and identify key trends in the development of knowledge within the field of preservation, covering the period 1824 to 2015; and second, outline the historical context for the emergence and institutionalization of digital reformatting, which begins around 2004 (See: Appendix I – Key Events in the History of Preservation Knowledge). 1824 marks the beginning of efforts to systematically develop knowledge related to the preservation of recorded information, with the earliest documented empirical investigations into preservation related issues (i.e. the work on paper decay conducted by scientist John Murray working in Britain), and 2004 marks a turning point in the history

of digital reformatting with the emergence of mass digitization and the Google Books project, and the institutional acceptance of digitization for preservation purposes, with the endorsement by the Association of Research Library (ARL) of digital reformatting as a preservation strategy.

The preservation field is typically defined in terms of preservation professionals working in institutional settings, such as libraries, archives and museums. This definition excludes preservation practices outside of institutional settings, such as personal collections. Anne Gilliland (2014) suggests that defining the scope of the institutionalized field of preservation is not easy because there are many different terms used to describe the roles of preservation professionals and the definition of their work within their institutional settings:

Many terms have been applied to the preservation field as broadly construed, including ‘conservation,’ ‘preservation management,’ ‘digital preservation,’ ‘digital curation,’ and ‘heritage science.’ Each of these terms connotes distinct epistemological, cultural, and practical approaches and tends to be attached to particular disciplines. (p. 55)

Instead of focusing on the nebulously defined preservation field or the complicated titles of diverse types of preservation professionals, this research takes institutionalized preservation knowledge as a primary phenomenon of study, one that circulates across disciplinary and institutional boundaries. This approach also allows for the inclusion of a range of institutional contexts, while excluding personal collections and non-institutionalized preservation knowledge in order to focus on the institutional framework of analysis and the emergent preservation knowledge of artisanal practices of reformatting.

At the same time, this research focuses on a particular type of work, so this research uses the concept of “occupational community,” defined by John van Maanen and Stephen Barley (1984) as “bounded work cultures populated by people who share similar identities and values that transcend specific organizational settings” (pp. 314-15). This concept is preferred to *professional communities* here because the degree of professionalization of the field of media preservation remains an open empirical question. A variety of overlapping areas and configurations of work overlap and permeate media preservation, making it problematic to conceptualize it as a distinct and cohesive profession. This is evidenced by the range of “fields” and professional allegiances that could be fit under “media preservation”: Moving image preservation, film preservation, video preservation, audio preservation, time-based media conservation, etc. Depending on the “field” or type of institution the work takes place in, practitioners might belong to a range of professional organizations including: Association of Moving Image Archivists (AMIA), Association for Recorded Sound Collections (ARSC), International Association of Sound and Audiovisual Archives (IASA), American Institute for Conservation of Historic and Artistic Works (AIC), and others. Lacking essential traits such as a clearly defined body of specialist knowledge or a system for credentialing practitioners, media preservation resists *taxonomic definition* (Saks, 2012) as a profession. That said, professional identity still plays a role in preservationists’ understanding of their work, even if the overall profession is not precisely definable. Following the tradition of workplace studies (see: Suchman 1987, Orr 1996, and many others), the focus in this study is on the work of digitization from the perspective of practitioners of that work.

Conducting a meta-analysis of the existing literature on the history of preservation knowledge is necessary for establishing the context for the emergence of artisanal digital reformatting of visual materials, beginning around 2004. This meta-analysis draws on existing preservation histories to chart the development of preservation knowledge by plotting key events, inventions and standards on a timeline. The full timeline is available in graphical form online here: <http://www.tiki-toki.com/timeline/entry/484475/History-of-Preservation/> (it was constructed using online timeline software, Tiki-Toki, www.tiki-toki.com). This historical meta-analysis is limited to the first emergence of library preservation as a distinct field of knowledge beginning in the first half of the 19th century as scientific investigations began to be conducted in laboratories, and focuses primarily on its institutionalization within archives, libraries and museums. This meta-analysis was conducted based on historical information drawn from existing literature on preservation history including Lee E. Grove's (1966) history of early preservationist John Murray; Barbara Higginbotham's (1990) history of American library preservation, 1876-1910; Michael Buckland's (1992) study of the invention of microfilm rapid selectors, 1920-1940; Michèle V. Cloonan's (2015) edited collection of historical and contemporary perspectives on preservation dating from 740 BCE – 2012; Sherelyn Ogden's (1979) study of the impact of the 1966 Florence Floods on the preservation literature, 1956-1976; Pamela W. Darling and Sherelyn Ogden's (1981) history of the preservation movement in the United States, 1956-1980; Caroline Frick's (2010) history of the film preservation movement in the United States, 1920-2009; and Anna H. Perrault's (2005) review of the history of microfilm in libraries, 1839-2001. Information about more recent historical events around digital libraries and digitization were gathered by reviewing research on

the history of digital libraries, including Marija Dalbello's (2005a; 2005b) study of the experiences of key personnel in the construction of the Library of Congress's National Digital Library Project, 1995-2000; Jeffrey Reed, et al.'s (2013) report on the adoption of digitization standards at the National Archives and Records Administration; and Chern Li Liew's (2009) review of digital library work, 1997-2007.

The meta-analysis suggests that the history of preservation knowledge can be described as a progression of increasing systematization and professionalization, culminating in the emergence of a distinctive institutionalized field of knowledge and practice by the early 1970s, situated within archives, libraries and museums. In Appendix I – Key Events in the History of Preservation Knowledge, I provide a timeline of key events in the preservation history literature in order to identify the key trends in the development of preservation knowledge.

Based on this meta-analysis, I identified five major periods of development in the history of preservation knowledge. The first period, "Early Experimental Era of Preservation Research, (1823-1910)" begins with early experimental work on the physical problems of book decay, carries through the professionalization of the library field (the American Library Association is founded in 1876), roughly spanning the period 1824-1910, and leads up to the next wave of preservation research in the early 20th century; the second period I refer to as the era of "Microfilm Experimentation in Libraries, (1920-1956)." There is a gap between these two periods because the time between 1910 and 1925 is characterized in the literature on the history of preservation as a lull in preservation research and development. The first research on the use of photography for preservation purposes was conducted in the U.S. and in Europe,

including the founding of the photo reproduction department of the New York Public Library beginning in 1896 and the work of Guido Biagi in Italy in 1904 and Charles Mills Gayley at the University of California, Berkeley in 1905, was conducted from 1880 to 1909, but after 1909, this research trajectory appears to have lost its momentum (Higginbotham, 1990). According to Barbara Higginbotham (1990), by 1910 “growth, prosperity, and the international exchange of ideas and research began to slow” and that this year “represents the close of the period of initial research into the causes of deterioration in library materials by the U.S. Bureau of Standards and the Royal Society of Arts (London)” (p. 4). Higginbotham (1990) also suggests that World War I (1914-1918) further disrupted research in Europe on preservation issues during this decade.

Thus, following this decade and a half lull in preservation research, the second period can be seen to begin sometime between 1920 and 1925 when microfilm imaging technologies and microfilm retrieval systems (which had already seen widespread use in insurance companies for records management purposes since the early 1920s) were experimented with as tools for preservation and access by Herman Fussler (1942), and experimental research on material decay and book binding standards continued in the work of Harry Lydenberg at the New York Public Library and at William Barrow’s deacidification research lab (Higginbotham, 1990). The third period, “Era of Preservation Professionalization (1956-1980)” covers the time period in which preservation knowledge moved from a loose collection of techniques, tools and concepts to emerge as a cohesive professionalized discipline in the early 1970s. This period begins in 1956, when the Council on Library Resources (CLR)² was founded and *Library Trends*

²CLR would become the Council on Library and Information Services (CLIR) with the merger with the Commission on Preservation and Access (CPA) in 1997.

published a special issue devoted to preservation research, and continues until the early 1980s, in which a new era of intensive standards development and experiments in the creation of digital collections began. The fourth period identified is termed the “Era of Digital Library Research (1980-2004),” which begins with the experiments conducted by the Library of Congress to provide access to images and texts via optical disk technology, starting around 1982, until 2004 when the first wave of digital library projects were being completed and digital reformatting began to be recognized by the Association of Research Libraries (ARL) as a preservation strategy (Arthur, et al., 2004). The fifth and final period identified was the “Emergence of Digital Reformatting for Visual Documents and Mass Digitization (2004-2015).” This period began in 2004 with ARL’s endorsement of digital reformatting and Google’s announcement of its Google Books mass digitization project, and continues to the present day, with standards for digitizing complex visual document formats, such as film and analog videotape continue to be developed.³ The five periods are displayed below on a timeline in Figure 1 – Periods in History of Preservation Knowledge.

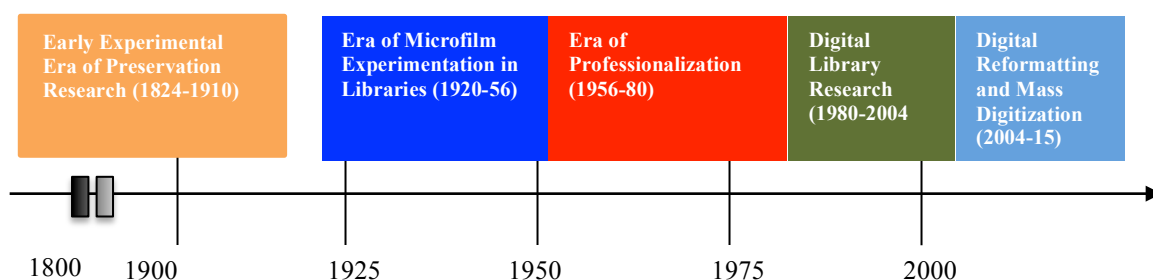


Figure 1 – Periods in History of Preservation Knowledge

³This period also saw increasing concerns in the preservation field about how to preserve digital information, but this area of preservation research is outside of the scope of this dissertation.

Establishing these five periods in the historical development of preservation knowledge helped to identify three major historical trends shaping its production and circulation, which I have termed *empirical inquiry*, *standardization*, and *centralization*. *Empirical inquiry* emerges with scientific experiments in the early years of the first period of preservation history (1824-1910) and continues to the present day in work being carried out by such organizations as the Image Permanence Institute. Initial efforts at *standardization* begin towards the end of this first period, when the American Library Association began pressuring publishers to adopt standards for the binding of library editions around 1909, and would emerge more strongly in the second period of preservation history (1920-1956) with the publication of the first formally adopted library binding standard (ALA's "Minimum Specifications for Class 'A' Library Binding" in 1935). *Standardization* intensifies in the fourth (1980-2004) and fifth periods (2004-2015) with an explosion in the development of standards and specifications related to preservation. The *centralization* of institutionalized preservation knowledge begins in the third period (1956-1980), with the development of important organizations (such as the founding of CLR in 1956) and initiatives (such as the founding of the Preservation Program at the Library of Congress in 1967), and continues through the fourth period (1980-2004) with work at the Library of Congress on digitization and the National Digital Library Project (1995-2000), continuing through the fifth period (2004-2015) with the further development of preservation research programs at the Library of Congress and CLR's later incarnation, CLIR (Council on Library and Information Resources).

2.1.1 Empirical Inquiry

Empirical inquiry refers to the work beginning in the mid-19th century to apply scientific methods to the development of knowledge for preservation work, both in terms of managing the materiality of documents and organizational activity (including managing staff, material resources, and developing policies for conservation treatments and disaster recovery). On the one hand, material techniques concerned the shaping of micro and macro storage environments through architecture, heating and cooling, air filtration and lighting controls, fire suppression systems and special containers; chemical and physical treatments including deacidification, lamination and rebinding; and copying techniques using Photostat, Xerox copying, photography and microphotography, and eventually, digitization and digital preservation. On the other hand, administrative techniques were developed around the establishment of guidelines and procedures that could be adopted within a preservation organization in a top down fashion in order to legitimize local preservation work to normative pressures imposed by experts and larger organizations within the preservation community.

2.1.2 Standardization

Trends towards *standardization* can be seen in terms of both a particular mode of constructing knowledge in the field of preservation and a means for transmitting it within and outside the organizations engaged in standardization initiatives. The production of standards, as codified forms of knowledge encoded within documents, is used to circulate knowledge about new preservation techniques across space and time. While it took decades for a systematic approach to preservation to develop as a distinctive field in the early 1970s, even before preservation coalesced as a professional field, efforts at

standardization worked to develop ways of systematically considering risks to items and collections beginning in the 1930s with standards for book bindings. In addition, the work conducted by large organizations such as the National Archives and Records Administration (NARA) and the Library of Congress to develop standardized guidelines for digitization practices starting in 2004, played a significant role in the institutionalization of knowledge about new preservation techniques through standardization initiatives, such as the Federal Agencies Digitization Guidelines Initiative (FADGI). Understood as “models for reality” (Busch, 2011), standards are also commonly used throughout other parts of modern society to ensure consistency across space, time and scale, and help to centralize control.

2.1.3 Centralization

Standardization can be seen to support efforts at *centralizing* the production and transmission of knowledge in the field of preservation. The development of preservation as a field went along with initiatives designed to centrally concentrate expertise, through nation-wide initiatives funded by the Library of Congress and the National Endowment for the Humanities that developed reports, preservation centers and other resources for guiding preservation work. The implicit goal of standards developers is that their standards will be implemented by all other preservation organizations.

It is within the context of these trends of empirical inquiry, standardization, and centralization that the digital reformatting of visual documents can be seen to emerge in the early 2000s. Empirical inquiry in the 1990s into user perception of imaging quality (e.g. in the work of Michael Ester, 1990) laid the groundwork for the development of digitization technologies; standardization has continued to be an important tool for large

organizations such as the Library of Congress to institutionalize knowledge about preservation techniques and disseminate it for adoption by other institutionalized contexts of preservation. There has been some push back against the trends of standardization and centralization, as groups of preservationists working with complex visual formats develop guidelines for their own local practices and sometimes adopt a “do-it-yourself” (DIY) or “maker” ethos. For instance, some preservationists are using 3D printers to create preservation tools and equipment (See: Neumüller, et al., 2014) and other preservationists have been building their own digitization systems using open source technologies such as the FFv1 video format; see: Marsh, 2015). They work in opposition to centralized and standardized preservation knowledge (See: Rinehart and Ippolito, 2014 for a discussion of DIY preservation in the age of digital media). These historical trends help to set the stage for the emergence of digital reformatting of visual documents as a field of research and practice.

2.2 The Emergence of Digital Reformatting of Visual Documents as a Field

Preservation knowledge concerning the application of digital reformatting to complex visual documents is still under development. Digital reformatting refers to the use of digitization technology to translate information from analog originals to legitimate digital copies for preservation purposes. Conway (2010a) points out that for visual documents “the preservation community has not made the sort of transformative progress with standards, best practices, appraisal and selection strategies, and other procedural requirements that undergird past successes with book and paper preservation” (p. 72). Part of the problem identified by Conway (2010a) could be attributed to the very recent systematization of subfields concerned with preserving visual documents. For instance,

the moving image preservation subfield has only recently gone through a process of professionalization in the middle of the fourth period of preservation history (1980-2004). Gregory Lukow (2000) traces the emergence of moving image preservation as a distinct profession to the early 1990s, which is nearly one hundred years after the first development of moving image technology in the 1890s and over fifty years from the beginning of the founding of the International Federation of Film Archives (FIAF) in 1938. The Association of Moving Image Archivists (AMIA) was founded in 1992 and it was at this time that concerns about a cohesive professional identity were becoming common in the practitioner literature (Edmondson, 1995). In addition, during this time a number of important reports by the Library of Congress were published that identified the increasingly dire threats that material decay and technological obsolescence posed to the audiovisual heritage of the United States. These included the 1993 publication of a four volume report by the National Film Preservation Board of the Library of Congress, *Film Preservation 1993: A Study of the Current State of American Film Preservation* (Melville and Simmon, 1993), and the 1997 publication of a five volume report, *Television and Video Preservation, 1997: A Report on the Current State of American Television and Video Preservation* (Murphy, 1997). These two expansive and authoritative reports identified the central problems facing the preservation of film and video-based documents at a national level, helping to establish a set of common concerns for the nascent professionalization of the moving image preservation field.

A series of important research initiatives within the scholarly community to develop and evaluate technologies for digitally reformatting visual documents followed, including research in the contexts of art conservation and moving image preservation to

develop techniques for preserving specific formats of visual documents. For instance, Howard Besser (1999) discussed guidelines for designing systems to digitally reformat collections of photographs of fine art, and Jane Hunter and Charmin Choudhury (2003) developed guidelines for preserving complex multimedia objects in a museum context by evaluating tools through a series of case studies. For the moving image preservation field, Jerome McDonough and Mona Jimenez (2007) reviewed the range of methods being developed for preserving analog videotape using digital reformatting methods. Karen Gracy (2007) studied the practices of film preservationists and how they construct meaning around contested concepts such as “preservation,” “access,” “film as artifact” and “film as asset.” All of these research activities, spurred by a growing concern for the preservation of complex visual documents, show that preservation technology and methods of digital reformatting, as well as its social construction and application within preservation institutions started to play an important role in the development of preservation knowledge during this time period.

Since 2002 there have also been two other major developments that have shaped the field of preservation knowledge around complex visual documents: the founding of new educational programs and the founding of a national center for preserving moving image media and sound recordings by the Library of Congress, which have worked to further institutionalize and centralize knowledge about preserving visual documents within the preservation field. The first major development was the founding of three audiovisual media preservation graduate programs in the United States. The University of California, Los Angeles – Moving Image Archive Studies (founded in 2002)⁴, New York

⁴ <http://mias.gseis.ucla.edu/>

University – Moving Image Archiving and Preservation (founded in 2004)⁵, and the Selznick Graduate Program in Film and Media Preservation, at the University of Rochester and the George Eastman House (Graduate program founded in 2005; a 1-year certificate program has been offered at the Selznick School since 1996)⁶ are graduate-level educational programs dedicated to educating students in preserving visual materials. While designating themselves as “moving image preservation” programs, they also educate students about preserving sound recordings and various types of digital media. These formal educational programs have become important means for constructing the field as a professional practice, transmitting knowledge of established preservation techniques to nascent preservation professionals, institutionalizing norms and standards of practice for the preservation of a range of complex media formats, and further integrating the preservation of complex visual documents into the broader mainstream of knowledge accepted within the media preservation field.

In 2007, following closely behind the founding of these three educational programs, the Library of Congress opened up its new Packard Campus of the National Audiovisual Conservation Center (PACV)⁷, which was a major advancement in large-scale practical efforts to preserve audiovisual documents. The PACV is responsible for preserving the audiovisual heritage of the United States and it continues the efforts of the Library of Congress’s goal of centralizing and standardizing preservation knowledge of how to digitally reformat and preserve audiovisual content through such initiatives as the Federal Audiovisual Digitization Guidelines Initiative (FADGI), which works to establish

⁵ <http://tisch.nyu.edu/cinema-studies/courses/ma-in-moving-image-archiving-and-preservation>

⁶ http://selznickschool.eastmanhouse.org/masters_about.html

⁷ <http://www.loc.gov/avconservation/packard/>

digitization guidelines for federal agencies and publishes their specifications for other organizations to adopt (Fleischauer, 2010). The PCAVC is equipped to store and digitally reformat a range of media types, including film, video and audio formats (Mashon, 2007). This large-scale, government-supported organization has become the largest collection of moving image and sound documents in the world (Library of Congress, 2012), and continues to play an important role, through its practical work of producing digital manifestations for preservation and access purposes, and developing standards through FADGI to further codify and institutionalize knowledge for the digital reformatting of visual materials.

2.3 Chapter Summary

In this chapter I have presented a summary of existing literature on the history of preservation (section 2.1), and described the key moments in the emergence of digital reformatting of visual materials as a field of research and practice (section 2.2). Through this process I have identified key trends of *empirical inquiry*, *standardization* and *centralization* in the development of preservation knowledge, defined the historical context for digital reformatting, and established artisanal digital reformatting as an emergent phenomenon. As a specialized field with a growing body of knowledge, preservation is seen to have a complex history that ties together multiple fields of knowledge production and professional practice. In the following chapter I will review relevant research literature in order to situate my study of artisanal digital reformatting of analog video recordings within the context of existing research.

CHAPTER 3: LITERATURE REVIEW

3.0 Chapter Overview

This chapter reviews the research on the study of visual information, preservation research, and preservation knowledge. The following areas of literature will be addressed: (3.1) approaches to visual information; (3.2) approaches to studying preservation; and (3.3) research that focuses on preservation knowledge as its object of study. “Preservation research” is constituted by systematic research that seeks to develop new solutions to preservation problems, contributing to a body of practical and generalizable knowledge for the field of preservation professionals. “Research *on* preservation knowledge,” on the other hand, involves the study of its production, circulation and actualization within the social contexts of preservation work. Addressing these two bodies of literature separately is necessary for understanding the epistemological assumptions that preservation research embeds within the techniques and technologies of preservation, while at the same time gaining an understanding of the current state of research in this area.

Looking at the research on visual information sets the stage for understanding how a practice centered on the re-production of visual documents, the artisanal digital reformatting of analog video recordings, fits within existing research on visual forms of information. *Approaches to Visual Information* (3.1) reviews: (3.1.1) traditional information studies research that considers visual information; (3.1.2) visual methods of data collection and analysis applied in information studies; and (3.1.3) research in information studies that considers the education and socialization of vision.

In the next section, *Approaches to Preservation Research* (3.2) reviews existing preservation research in order to identify the philosophical assumptions and definitions of information of the dominant research approaches. This review of preservation research focuses on the library and archives literature where preservation of information has been systematically and empirically researched. Other areas of research around preservation, such as in the fields of art conservation and restoration, have different historical lineages than preservation knowledge, and are not included in this review. Historically, knowledge from these fields had been transmitted by apprenticeships and had not been systematically codified in standards and specifications to the same extent as had been done in archives and libraries research (as outlined in Chapter 2).⁸

Three main approaches to preservation research and their assumptions were identified: (3.2.1) *Perceptual Approach* defines information as physical and objective, models preservation within an information transfer model, and bases its epistemology in psychophysics; (3.2.2) *User-centered Approach* defines information as cognitive, models preservation in terms of users and their uses of documents, and bases its epistemology in cognitive constructivism; and (3.2.3) *Institutional Approach* defines information as cultural-cognitive, models preservation within institutionalized regimes of interpretation, and bases its epistemology in social constructionism. The following section, (3.3) *Research on Preservation Knowledge* reviews research that examines different dimensions of preservation knowledge: (3.3.1) *Objects of Preservation* reviews research that addresses how objects become constructed within preservation knowledge, including

⁸ There are increasing connections in recent years between museum conservation and moving image preservation around what is termed “time-based media conservation” (Laurenson, 2006), associated with the introduction of increasingly complex analog and digital media-based artworks into museum exhibitions and collections.

the construction of document values and users' perceptions of document attributes; (3.3.2) *Products of Preservation* reviews literature that studies the products of preservation processes, including the quality of digital products; (3.3.3) *Transmission of Preservation Knowledge* reviews research that considers knowledge transmission within networks of experts, groups of preservationists and between organizations, and looks at institutional change and the production and circulation of standards and other forms of codified knowledge; (3.3.4) *Preservation as Social Practice* reviews research that takes sociological approaches to studying the work of preservationists and work that conceptualizes preservation as a social practice; and (3.3.5) *Pragmatics of Preservation* reviews research that seeks to improve preservation techniques and establish best practices using case studies, surveys, and literature reviews.

Since visual information is a central concern to studying artisanal digital reformatting of visual documents, I will begin this literature review by reviewing existing research in information studies that has examined this area.

3.1 Research on Visual Information

Since the documents being digitally reformatted in this dissertation research are valued for their visual information, it is important to first review the literature that has discussed conceptions of the visual in information studies. Research in information studies that is concerned with visual information can be grouped into three main areas of research: (1) visual information studied from traditional information studies research approaches, (2) the application of visual methods of data collection and analysis to information studies research, and (3) research that looks at the education and socialization of vision.

3.1.1 Traditional Information Studies Research Applied to Visual Information

The concerns of traditional information studies centered on issues of classification, organization and retrieval of visual documents have been widely pursued. In one of the earliest studies that considered visual information, Karen Markey (1984) studied interindexer reliability among catalogers working to catalog images in library collections. More recently, A. Messina, et al. (2006) looked at metadata schemas for visual documents. Systems for classifying and indexing visual documents have been studied by James Carmichael, et al. (2008), Ruth Bergman and Hila Nachlieli (2011), Duy-Dinh Le, et al. (2011), and Jan Nouza, et al. (2012). Information retrieval research for visual documents has been conducted by Azadeh Kushki, et al. (2004), Rui Li, et al. (2010), B. Smolka, et al. (2004), Noel E. O'Connor (2006), Filip Florea, et al. (2006), and Christos Varytimidis, et al. (2013). Paul Enser (1995; 2000) conducted important early work on developing systems for “pictorial information retrieval,” and comparing concept-based versus content-based searching paradigms, and Enser (2008) described the evolution of information retrieval of visual documents. Daniela Petrelli and Daniel Auld (2008) looked at the problems associated with an automated retrieval system of historic video recordings. These types of research projects show how visual information has been incorporated into traditional information studies research areas, focusing on the development of classifications and information retrieval systems for handling recorded visual information. Common to this work is an acknowledgement of the difficulty in establishing classificatory schemas for collections of visual documents, attributed to the subjectivity of interpreting visual documents.

Other research considers the technical attributes of the digitization systems and the products that they produce. Research in this area is concerned with identifying the most suitable file formats (Politou et al., 2004), maintaining interoperability between systems and formats (Kramer and Sesink, 2003), and developing techniques for evaluating visual quality (Kountchev, et al., 2007; Wang, et al., 2010; 2012; Bruni and Vitulano, 2013). This area of research tends to follow a “perceptual” approach to preservation (discussed further in section 3.2.1 Perceptual Approach), which assumes a model of information transfer based on the work of Claude Shannon and Warren Weaver (1949). Because vision is assumed to be based on the transfer of physical sensations, therefore the same visual document can be unproblematically reproduced by transferring signals from one representational system, such as an analog video recording, to another representational system, such as a digitally-encoded file.

3.1.2 Visual Methods Applied to Information

Over the last decade, information studies research has also begun to utilize forms of visual analysis as methods for collecting and analyzing data, as first shown in the work of Jenna Hartel and Leslie Thompson (2011) and Hartel (2014a; 2014b), who use participant drawing as a method for mapping participants’ information environments. Sociologist, Phaedra Daipha (2010) took an ethnographic approach to study meteorologists and how they used visual information in their work environments, focusing on practices of looking, visual expertise, and visual decision-making. Using ideas from visual pragmatics, Marija Dalbello and Anselm Spoerri (2006) analyzed the construction of visual understanding in historical data visualizations. Additionally, work has been conducted to embed or extract information from digitized visual documents.

Florian Kleber, et al. (2008) and Abby Stylianou (2014) developed methods for extracting visual data from images that could be used for other forms of analysis. Kleber, et al. (2008) developed algorithms for generating missing text from digitized images of damaged manuscripts, and Stylianou (2014) extracted information from the visual content of photographs in order to generate geolocation data (via methods of triangulation) to find lost grave sites. This review of these research projects suggests that visual methodologies are having varied applications to the study of information.

3.1.3 Education and Socialization of Vision Considered in Information Studies

Visual analysis needs to be treated as mediated by social and institutionalized ways of seeing, as will be discussed in this section. Theories of *visuality*⁹ - the notion that human forms of visual interpretation are mediated by education, social categories and classifications, and other means of socializing vision - have seen some development in information studies around the concepts of *visual literacy* and *imaging literacy*. In the first case, visual literacy is defined by Elisabeth Kaplan and Jeffrey Mifflin (1999) as the ability to interpret images at multiple levels of analysis, including include content, context and the materiality of the visual medium. Kaplan and Mifflin (1999) suggest that developing visual literacy is important for archivists in arranging and describing visual documents in ways that will be useful for future users. This ability requires “a basic understanding of the history of the media of record, its technology, the conventions of visual communication, and the history of shifts in modes of literacy” (Kaplan and Mifflin, 1999, p. 94). Visual literacy is seen as an iterative process of “perception and

⁹ See Hal Foster (1988) for a full discussion of the intertwined nature of *vision* and *visuality*. Foster (1988) suggesting that the physical configuration of perception as embodied activity is intimately linked to discursive processes. Physical processes of perception (vision) are understood discursively, and socially-shaped regimes of seeing (visuality) are shaped by underlying physical processes.

translation” (Kaplan and Mifflin, 1999, p. 79) that integrates multiple forms of archival knowledge, rather than as a singular description of a single level of analysis. Visual documents are seen as anomalous types of documents compared to text-based documents that require additional layers of contextualization through descriptive practices in order to have meaning for future users of collections. Mifflin (2007) suggests that visual documents can become “orphaned” from their original meaning if taken out of context, and that an historical understanding of the imaging technology used to create the visual documents, the traditions of its production and the context of collecting is necessary for enabling fully contextualized use of visual documents (Mifflin, 2007). From this perspective, understanding the context of visual documents is tightly linked to considering the technical practices that created the documents and the interpretive conventions of users of collections.

While visual literacy for archivists is defined in terms of the skills necessary to describe and provide access to visual documents, *imaging literacy* is defined as the skills necessary for properly digitizing visual documents. Paul Conway and Don Williams (2011) define imaging literacy as a

form of applied knowledge [that] encompasses the abilities to read, interpret, and use generally accepted imaging results, to handle the corresponding performance information, to express ideas and opinions, and to make decisions and solve related problems. (p. 16)

This definition points to education as a key means of transmitting the visual knowledge related to the use and interpretation of digitization technology and its products. Imaging literacy can be seen to involve a training of the senses and use of digitization technology

in particular ways that are developed by a community of digitization experts.¹⁰ These concepts are useful for understanding the work of artisanal digital reformatting of analog video recordings because this also requires that preservationists learn to see in particular ways in order to produce and evaluate acceptable digital manifestations of analog originals.

These examples of research that engages with the concepts of visual literacy and imaging literacy show some of the ways in which researchers consider the interpretive dimensions of visual information. The concepts of visual literacy and imaging literacy, although directed at different pragmatic contexts (the former directed at archival description, and the latter directed at digitization), both draw attention to the embodied and educated aspects of vision and the interpretation of visual documents. Both approaches work to question the construction of vision as an unproblematic conduit of information, instead emphasizing that visual education and historical knowledge of the underlying technology and traditions of interpretation is required for proficiency in working with visual documents.¹¹

¹⁰ Puglia and Rhodes (2007) studied the current state of digitization practice in preservation institutions and found a lack of development between preservation practice and the systematic use of digitization technologies: “It is a little humbling to look back and admit that we are still asking many of the difficult questions that we were asking over a decade ago – particularly about the relationship of digitization to preservation and agreement on approaches that are appropriate for preservation reformatting using digitization” (p. 10).

¹¹ The training of vision implied by these two types of literacies can be conceptualized as an important part of developing expert knowledge. Findings from cognitive science applied to expertise in art criticism supports the existence of a relationship between learned expertise and observed perceptual behaviors of experts. By drawing on research in art, medicine and cognitive science, Robert L. Solso (1997) characterizes “expert viewing” in terms of greater efficiency and greater “diversive exploration” than non-expert viewing. Solso (1997) explains that “the pattern of eye movements produced by expert radiologists as they make a diagnosis from an X ray is far more parsimonious than that of novices” (p. 143) and Nodine, et al. (1993) found that “subjects who had had extensive art training tended to concentrate on finding thematic patterns among compositional elements, while the untrained subjects tended to concentrate on representational and semantic use of picture elements” (Solso, 1997, p. 147). These research projects give support to the idea that ways of seeing are the result of particular educational regimes and interpretive traditions.

The examples discussed in this section suggest that research in information studies that addresses visual information primarily focuses on technical and practical concerns, often considering the human body as part of the system of technical transmission. Christopher Peter Lueg (2014), for instance, suggests that taking the limitations of the human sensory system into account is necessary for conducting information behavior research that accurately captures participants' capacities to perceive information when it is available (under situations of multi-tasking or information overload). He focuses on the limitations of embodied perception, ignoring the ways in which vision may be educated and discursively constructed. There is a limited amount of literature in information studies - a few important exceptions being the *visual literacy* work of Kaplan and Mifflin (1999) and *imaging literacy* work of Conway and Williams (2011) - that explores the discursive construction of visual information, or the relationship between vision and visibility, a distinction developed by Hal Foster (1988), or the cultural production of "ways of seeing," as discussed by John Berger (1972). Christian Metz (1975) uses the term "scopic regimes" to describe the ways in which ways of seeing are learned and carried out within particular visual cultures. Following Michel Foucault (1977), our ways of seeing can be understood to be shaped by the way we talk about seeing and the ways in which particular techniques of seeing become institutionalized and hierarchized. Jonathan Crary (1992) points out that even the way we talk about vision as a physiological phenomenon has an historical dimension. By treating the perception of visual phenomena as taken for granted or as purely a problem only solvable by psychophysics, traditional information studies approaches typically overlook the discursive construction of visibility. Overlooking visibility limits investigations into

contexts of visual information by treating vision as universal and unchanging over time. Through the selection of methods for this dissertation research, I have strived to be sensitive to vision and visuality by applying methods of phenomenological inquiry and discourse analysis in order to understand how discourses and practices of artisanal digital reformatting shape and are shaped by visual technologies and socialized ways of seeing.

In the following section, I will review the major approaches to preservation research to begin to understand the epistemological assumptions that preservation research embeds within the techniques and technologies of preservation work. This will give further support to understanding artisanal digital reformatting as an emergent phenomenon, one that has emerged alongside ongoing research in preservation knowledge.

3.2 Approaches to Preservation Research

In order to begin to understand the epistemological assumptions that preservation research embeds within the techniques and technologies of preservation, I reviewed empirical research that seeks to contribute to practical and generalizable knowledge for the field of preservation professionals, and examined their epistemological assumptions and conceptualizations of *information* and *preservation*. By looking at the implicit assumptions about human knowledge of each project and the ways in which they define the nature and ethics of preservation, I was able to develop a three-part taxonomy of preservation research approaches, defined as: (1) Perceptual Approach; (2) User-centered Approach; and (3) Institutional Approach. I will now discuss each approach to preservation research, concluding with some remarks about what this taxonomy can tell

us about preservation research, and then move on to consider research that directly considers preservation knowledge as its object of study.

3.2.1 Perceptual Approach

The perceptual approach to preservation assumes that information is objective, i.e., that the informational content of a document can fully exist independently of its material manifestation or human interpretation. In terms of digital reformatting, this approach suggests that it is possible to capture all of the information contained by a document and represent it in another context or medium. Following the spirit of Shannon and Weaver's (1949) information transfer model, this approach to preservation assumes that preservation is a matter of transmitting signals of encoded symbols over space and time from a present sender to a future receiver.¹² Research that takes this approach addresses research problems related to the technical requirements for the high-quality transformation of analog documents into digital form and the technical storage, transmission and display of digitized manifestations, as in the work conducted by imaging scientists. This approach also tends to minimize the problems associated with the uncertain social and technical conditions of the future user of the digital manifestations of visual documents. The use of standards is one way in which preservationists have attempted to ensure that encoded documents are decodable by future receivers by adopting common, well-documented procedures and digital file formats.

To develop technical requirements for transforming analog documents into digital manifestations, the perceptual approach to preservation research makes assumptions about the nature of human perception based on work done in the field of psychophysics

¹² If preservation is understood in the Shannon and Weaver (1949) model as communication over time (rather than distance), then "noise" (p. 20) in the channel can be thought of in terms of the decay in the medium of inscription.

on color-matching and other “objective” measures of visual acuity. Research in this area constructs a *standard observer*, a model of human perception that responds to visual phenomena in a universal and predictable way, and uses this as a common model to which the “vision” of digitization technologies can be calibrated. In color-matching and other tests of visual acuity, the perceptual field is broken down into a discrete array of visual stimuli. If different stimuli produce the same perceptual response within the given model, indicating that human perception cannot discriminate between two given stimuli, then it is concluded that the sources of these stimuli may be treated as equivalent.¹³ For digital reformatting, this means that evaluating the transformation of an analog original into digital form as “successful” hinges on if the copy is indistinguishable from the original to a human subject.

The assumptions implicit in the perceptual approach can be seen to guide a variety of approaches in preservation research. For example, Marc Ebner (2012) used the perceptual approach to look at how the representations of movement in moving image scenes affected the perception of color constancy to viewers, with findings that suggest that preservationists need to take into account perceptual responses to motion when calibrating color in digitization systems. As another example, M. Chambah, et al. (2006) suggest an approach to objectively evaluating the image quality in digital restoration projects of motion picture film. This has implications for preservationists restoring deteriorated film, bringing up questions related to judging what something looked like

¹³ These models and measurements have laid the foundation for the development of digitization technology. To produce digital copies that can successfully emulate the appearance of analog objects, the technology must take into account the properties of human perception, and compensate for the differences in the way that the technology “perceives” the world. Human and machine vision are never precisely aligned: “Although instruments can measure color stimuli in terms of their spectral power distributions, the eye does not interpret color stimuli by analyzing them in a comparable wavelength-by-wavelength manner” (Giorgianni and Madden, 2008, p. 8).

when it was originally produced. By automating the process of restoration, Chambah, et al. (2006) assume that the automated algorithms not only can simulate human visual perception, but that they can predict what that visual experience was like in a previous historical era. The perceptual approach assumes that visual phenomenon can be objectively known and are predictable, and historical visual experiences can be reconstructed.

Another area of research that draws on a perceptual approach is research that studies the technical storage, transmission, and retrieval of digitized manifestations and follows a goal of efficiency for the use of information infrastructures, in this case the digitization systems and digital repositories used to produce and preserve digital manifestations of visual documents. Media historian Jonathan Sterne (2012) offers the example of the development of the MP3 audio compression format to provide insight into the infrastructural imperatives associated with the modeling of the limitations of the human sensory system to limit signal bandwidth in order to enable transmission over limited telecommunication infrastructures (such as telephone networks). Similarly, in order to optimize transmission within a limited bandwidth, digital preservation strategies working within the perceptual approach embrace reducing informational redundancy through compression algorithms, reducing pixel resolution and color depth (in the case of images) or restricting sampling rates (in the case of audio and video files) (Buonora and Liberati, 2008). Much of this research uses human subjects in order to test techniques and adjust objective metrics and models of human subjectivity to subjective responses of users,¹⁴ and many researchers in this area often work in engineering-related fields. For

¹⁴ Sterne (2012) points out that the models of human subjectivity used to develop compression algorithms can develop “universalist” worldviews about perception. Sterne (2012) outlines a critique of the

example, Takchito Kurihara, et al. (2011) studied how signal noise could be added to digitized images to improve perceived quality. Mohamed-Chaker Larabi and Louise Quoirin (2008) studied the relationship between bitrate, motion and frame rate in how users perceived the quality of digital moving images. Ludovic Quintard, et al. (2008) looked at the ways in which the image quality variables of hue, saturation, contrast and texture were perceived by participants in order to develop a statistically-derived perceptual model for use in automatic quality adjustment in digital display devices. Toshiyuki Fujine, et al. (2008) studied the relationship between the perception of luminance in video images and the size of the display, which suggests that preservationists need to take into account the size of the display that the digitized manifestations they produce may be displayed on when making decisions about calibrating image characteristics. These types of studies offer important contributions to the technological development of imaging equipment, and offer insights into relationships between variables of technologically-mediated vision, which are helpful for evaluating the performance of digital reformatting systems at the technical level. Empirically investigating the relationships between different variables of technologically-mediated vision (such as viewing distance, frame rate or ambient illumination) helps to identify the key technical factors that shape the variability of subjective visual experience. This type of research produces knowledge useful for preservationists involved in digital reformatting projects because it can be applied for establishing the recommended viewing conditions for the consistent evaluation of visual quality in

“objectivist” assumptions of the double-blind expert listening tests, in which audio engineers and other audio experts evaluated audible differences between compressed and uncompressed sound recordings, that were used to evaluate and refine the MP3 audio codec: The listening tests “do not distinguish between practical and formal knowledge; they do not account for subjectivity and positionality; and their aspirations to universalism only universalize an anaesthetized, objectivist worldview” (p. 180).

digitized copies. However, this approach neglects to address the cultural and historical dimensions of technologically mediated vision, and how those objective measuring techniques privilege certain ways of seeing and hearing. While understanding the ways in which various technical variables might affect viewing conditions is important knowledge for preservationists, these studies do not take into consideration how different types of viewers with different types of educated perception may interpret visual information differently. “Objective” and “universalist” models of perception risk overlooking the importance of considering the requirements of particular users, as well as the need to document the context of media creation or translation from one medium to another.

Looking further at research within the perceptual approach, we find that preservation research that employs objective measuring techniques to study the variables affecting digitization quality, and research that studies the transmission and storage of digitized information both share a common goal of balancing “total information capture” within the technical constraints of information infrastructures. This is due to the fact that the quality of the digital manifestations produced through digital reformatting depends on the infrastructures that support it, such as the systems of digital storage, transmission and retrieval, and the models of human perception that are used to optimize the use of those infrastructures. This suggests that research that follows the perceptual approach is dependent on the materiality of particular configurations of information systems, even as this research works to develop preservation techniques that can be universally applied in a variety of institutional contexts.

Research conducted within the perceptual approach assumes that the informational content of a document can be converted into signals by modeling how the human perceptual system will perceive the resulting digital manifestation. For instance, in the work done by Michael Ester (1991; 1994) on establishing digitization guidelines for digitized fine-art photographs, the goal was to find the threshold at which a user would no longer perceive further increases in image quality. By varying technical aspects such as image resolution and sampling depth, Ester (1991; 1994) was able to establish guidelines that would enable the highest quality file that would utilize the least amount of network resources. Other examples of the perceptual approach include Roy Berns (2001) who used models of the human visual system provided by the field of colorimetry to establish guidelines for producing color-accurate digitizations of paintings.

In the following section I will discuss another approach that takes the user and the uses of digitized collections into account but which focuses on the use of visual documents in meeting the needs of users' information tasks.

3.2.2 User-centered approach

The user-centered approach to reformatting develops models based on how users use documents. Cognitive approaches to indexing images (e.g., Greisdorf and O'Connor, 2002) emphasize the limitations of treating the problem of reformatting as an issue of information transmission, instead emphasizing how users use documents to facilitate particular information tasks. The big question for the user of a digital image then is a practical and individual one, "Can I use it?" (Greisdorf, 2000).

The user-centered approach uses models that are built around a subjective understanding of information that depends on the users and their uses of information.

Margaret Hedstrom, et al. (2006) showed how the perceived significance and usefulness of digital documents (text, as well as multimedia) depend on the techniques of reformatting. Conway (2011) developed a model of archival quality based on a definition of quality as the absence of errors in the digitization process relative to a base line of user-defined ideal copies. Translated to the digital reformatting of visual documents, these approaches suggest that decisions made about the selection and use of techniques and tools of digitization should be based on an understanding of the ways in which users will use the digital copies.

While the focus in these types of studies is in supporting particular users' information tasks, its major goal is to construct generalizable models for providing access for particular types of users (e.g., art historians, students, etc.) and types of uses (e.g., conducting historical analysis, writing a term paper, etc.). Thus, while the user-centered approach assumes that the informational content of documents is subjective, it also assumes that it is consistent across particular subsets of tasks and areas of domain knowledge. The user-centered approach views information as resulting from a process of individual cognition, downplaying other types of information and the influence of institutional dimensions.

Research that follows a user-centered approach adopts the assumptions of cognitive constructivism. In the cognitive constructivist paradigm, "an information user is not a passive information processing system but actively makes sense of the surrounding reality and attaches personal meanings to information" (Talja, et al., 2005, p. 83). Cognitive constructivism operates as a turn against information studies approaches based on the Shannon and Weaver (1949) transmission model, focusing instead on an

understanding of information as dependent on the changing cognitive structures of the user. While this approach moves beyond the limitations of the perceptual approach, which is based on an implicit information transfer model, the user-centered approach assumes that the informational content of a document depends on what is happening in an individual user's mind at a particular moment. For digital reformatting of visual documents, this approach suggests that decisions made about the application of the techniques and technologies of digitization need to be guided by considerations of what information tasks the various types of expected individual users might have and the ways in which they likely will use the digital manifestations. In the following section I will consider the institutional approach, which focuses on the role of cultural contexts in shaping the meanings of documents through processes of social construction and institutionalization.

3.2.3 Institutional approach

The institutional approach emphasizes the role played by institutions in symbolically and materially constructing the meanings and signifying properties of documents. Institutions are understood to provide conventions for interpretation and the establishment of the genres and traditions that promote particular ways of collecting, displaying and interpreting documents. For preservation knowledge, the assumptions of this approach suggest that the meanings of digital manifestations of documents will depend on the particular institutional contexts of display and the interpretive communities that encounter them. Michael Buckland (1997) suggests that systems of preservation both enable the storage of documents, but also shape the meanings of those documents, and that "information systems can be used not only in finding material that is already in

evidence, but also in arranging material so that someone may be able to make use of it as (new) evidence” (p. 808). The methods of storage and organization can produce the conditions for new knowledge claims. In addition, the ways in which digital manifestations are displayed shape how a particular interpretative tradition can make meaning from digital library collections. Marija Dalbello’s (2004) analysis of the contents of digital library projects produced from 1997 to 2002 found that many collections appeared as miscellaneous “cabinets of curiosities,” providing a miscellaneous assemblages of documents, rather enabling narrative coherence aligned through the institutional shaping of interpretations of the past. These types of studies suggest that institutionalized methods of collection and arrangement play important roles in shaping the meanings of documents.

In addition to the impact of storage and arrangement on the meaning of documents, the ontology of documents can also be linked back to institutional dimensions. The construction of key archival values, such as *evidence*, *authenticity* and *uniqueness* can be understood as the results of institutionalization. While the physical matter that gives a document its existence may be ontologically objective, we can only know it through its linguistic transformation and placement within institutionalized regimes of knowledge. Following John Searle’s (1995) philosophy, research within the institutional approach conceives of documents as social facts, rather than as objective matter. Searle (1995) distinguishes between the “brute” facts of objective matter, such as rocks and trees, and the mental facts of individual thoughts, feelings and experiences. Social facts are mental facts that have become generally agreed upon. In this case the objective matter of a document is the material that it is produced from and its

technologies of inscription, storage and display, which only become recognizable as a document only when placed in particular institutional contexts. Thus, from Searle's (1995) perspective, documents are ontologically subjective (they require a human subject to come into existence), but epistemologically objective (once they enter into social reality we can use them to make truth claims).¹⁵ Once the values of a document (such as its status as *evidence*) are institutionalized they become recognizable within the interpretive methods of specific disciplines. Devan Donaldson (2015a; 2015b) has developed a model for analyzing the ways in which visitors to websites containing digitized government records ascribe trustworthiness to those records. In Donaldson's (2015a; 2015b) work, the perceived trustworthiness of digital manifestations of documents was found to depend on the institutional context, the graphical layout of documents and visual elements on an institutional website, and the particular material characteristics of the digital manifestations. In addition, Devan Donaldson and Paul Conway (2015) studied the components of online documents at the Washington State Digital Archives to better understand what aspects of the materiality of documents affected perceptions of trust in users. Kathleen Fear and Devan Donaldson (2012) applied a framework of user credibility assessment to empirically measure perceptions about the *provenance* of records from the point of view of proteomics researchers. These approaches take into account the fact that the values ascribed to particular types of

¹⁵ Parallels can be seen with B.C. Brookes's (1980) use of Karl Popper's Three Worlds ontological scheme: "*World 1*: The physical world, the cosmos in which Earth, vital though it is to us, is but insignificant speck in the immensity of the universe of radiation matter. *World 2*: The world of subjective human knowledge or 'mental states.' *World 3*: The world of objective knowledge, the products of the human mind as recorded in languages, the arts, the sciences, the technologies – in all the artifacts humans have stored or scattered around the Earth" (p. 127). Brookes (1980) points out that the artifacts of World 3 are also "bits of the world," i.e. they have some material form, and thus are also part of World 1. Mapping Searle's (1995) terms onto the Three Worlds resolves this "hybrid" nature of World 3, i.e. objects of human knowledge are ontologically objective, but epistemologically subjective, since while they have a material form in the universe, their meaning is dependent on human subjectivity.

documents only become recognizable within the interpretive methods of specific disciplines (academic, legal, etc.) and within institutional contexts.

Preservation research that takes an institutional approach also draws attention to the role played by the materiality of documents in the context of society and how meaning is ascribed in the conventionalized methods of interpretation within specific disciplines. Historian Carlo Ginzburg (1979) relates the rise of the semiotic paradigm within the contexts of art history, medicine and crime detection, emphasizing the historical dimensions of the ways by which the materiality of documents may be interpreted. The materiality of digital documents has been analyzed in the digital forensics of Matthew Kirschenbaum (2008), the bibliographic analyses of digital texts by Alan Galey (2012), the logical-material approach to digital bits offered by Jean-Fran oise Blanchette (2011), as well as in the emergent methods for dealing with digitized texts in the digital humanities and in emergent media studies research areas, such as media archaeology (Ernst, 2013; Emerson, 2014; and Parikka, 2015), which have drawn attention to the rich interpretive possibilities of digital materiality. The institutional approach to preservation suggests that the process of digital reformatting necessarily privileges certain methods of interpretation over others, since the process of digitization itself is a technique of interpretation, acknowledging that certain attributes of the source documents must necessarily be excluded in the transformation from one system of encoded visual representation (e.g. analog video tape) to another system (e.g. digital RGB colorspace) in the production of a digital manifestation.

If the material form of an information artifact affects how it can be understood within traditions of interpretation, then the particular methods used and social

circumstances of copying can be seen to play a significant role in mediating the process of interpretation. Researchers in the field of textual studies suggest that the evidentiary traces of a text's copying or other significant events in a text's transmission, including typesetting, printing, binding, etc., can themselves be interpreted as evidence in order to gain insight into the intellectual, cultural, and historical factors that have shaped a text's present material form. Conceived by David Greetham (2013) as "the history of history" (p. 17), the field of textual studies is concerned with reconstructing the histories of the documents, books, and other information artifacts that may become the raw material for the writing of other histories. As inscription technologies historically emerge, a concern for judging the "authenticity" of those records and the role played by such "corrupting" forces as "errors" in shaping them begins to develop. Greetham (2013) explains: "at the very moment in each culture that documents begin to preserve the records of that culture, the issues familiar to textual scholars will appear: inscription, graphic representation, transmission, error/variant, authenticity, reception" (p. 17). This concern for interpreting the various events that shape the transmission of texts directs the analytic focus of textual scholars to the material traces that accumulate on extant copies. Thus, in the case of medieval manuscripts, textual scholars may be concerned with understanding the historical moment of their production, interpreting the traces of scribal production. The work of textual scholars can also involve enumerating scribal errors and other "corruptions" of the text in the various surviving copies. Similarly, in the context of producing digital copies of analog video recordings, preservationists must interpret the traces left behind by earlier events of copying. Book historians have pointed out that all points of textual transmission can be viewed as instants of *traduction* – moments of

translation that form new textual variants, readings, and ways of knowing – and that “changes in the arts of transmission affect what gets transmitted” (Chandler, Davidson, & Johns, 2004, p. 3). Thus, documenting and interpreting errors and the other traces that accumulate through each event of copying are transferable to all contexts of textual transmission.

The work of textual scholars was traditionally concerned with reconstructing an “ideal” version of the text, while later textual scholars became interested in identifying all of the variations in the text and their genealogical relations. Greetham (2013) defines the first approach with the term *analogy*, which describes attempting to reconstitute an ideal lost text, and the second approach with the term *anomaly*, which depends on “a Stoic acceptance of the unavoidable corruption of all worldly phenomena” (p. 22). Greetham (2010) points out that while “corruption” of texts has a negative connotation, for textual scholars that take a social-textual approach (such as Jerome McGann and D.F. McKenzie), the errors and other traces of the events of copying can provide important clues to reconstructing the historical events of a text’s transmission.

Relevant to this dissertation research, textual scholars have begun to apply this concern for documenting variants and errors (among other things) to types of texts beyond written texts, including visual forms of recorded knowledge, such as photographs and moving images. These approaches take up bibliographer, D.F. McKenzie’s (1999) “sociology of texts” that suggests the study of the transmission of texts should not be limited to written texts along, but can include “verbal, visual, oral, and numeric data, in the form of maps, prints, and music, of archives of recorded sound, of films, videos, and any computer-stored information, everything in fact from epigraphy to the latest forms of

discography” (p. 13). Thus, the concern of textual studies for the materiality of texts can be useful for understanding the work of digitizers of analog video recordings, since their work involves interpreting the traces of the transmission of these complex visual documents in order to make copies that are perceived to be “authentic” within their institutional contexts. The work of digitizers, and any errors they introduce, will leave traces in the resulting digital copies, which can be interpreted by future textual scholars.

However, it should be noted that there are some important differences that can be identified between the practices of traditional textual scholars working with linguistic texts (manuscript and print) and film and media scholars and media preservationists who work with moving image materials. While for critical editions of linguistic texts variants and errors are notated in the critical apparatus alongside the body of the text, for visual texts, conventions of documenting error and variation are not as precise or granular in their documentary capabilities. For a restored motion picture film, for instance, notes from the preservationists briefly discussing the techniques employed and the extant copies utilized are sometimes provided at a film screening or in the form of liner notes or as an audio commentary track on a DVD release;¹⁶ however, there are no precise conventions for documenting errors and variants within the visual texts themselves. In other words, there is currently no analogous critical apparatus for photographs, moving images, or other visual documents, which poses an interesting challenge to both textual scholars studying visual texts, as well as digitizers, as a special case of copyists, trying to

¹⁶ Some DVD releases of restored films will include mini-films about the restoration process of the film, as in the case of the 2004 DVD released by Kino Video of the Fritz Lang film *Metropolis* (1927), which contains a nine-minute documentary, which includes site-by-side comparisons of the restored and unrestored film frames and commentary from the film preservationists.

precisely document any errors in the visual image that they encounter in the process of digital reformatting.

Applying approaches from textual studies to visual documents is also made difficult by a lack of definition in the units of analysis within a visual image. While written texts can be precisely described at the level of individual alphanumeric symbols and within conventionalized languages for describing binding, paper, page layout, and paratextual elements, because there are a lack of guidelines for documenting similar granular elements within visual documents, it is not clear at what level of granularity (i.e., what is the most “primitive element” of a photograph?) is appropriate for describing errors and variants in images. While a single misprinted or miscopied letter can be precisely noted with a written text, it is not clear what the smallest significant unit in an image is. Kari Kraus (2013) points out that there are no precise, commonly-adopted conventions for describing the unit of analysis in analyzing the material form of images to enable precise description of errors and variants in the same way that there are conventions for describing written texts.¹⁷ The lack of clear guidelines in defining the basic unit of analysis for documenting errors and variants in visual texts makes it difficult for media preservationists to precisely document the errors that they encounter in the process of digital reformatting, and communicate effectively with media scholars about the present condition of media texts being analyzed.

In regards to preservation knowledge, the major implication of the institutional approach and these perspectives drawn from fields, such as textual studies, concerned

¹⁷ Kraus (2013) suggests one approach involving an analysis of topological distortions (i.e. deformations of an image along a geometric surface, as is used in creating flat map projections of the spherical form of the earth) that could be precisely enumerated over the course of an images transmission and events of copying. This offers one solution to the problem of conventions for describing errors and variants in terms of the spatial dimensions of images.

with interpreting the material traces that over time accumulate upon carriers of recorded knowledge, situates the central concern for the meaning of documents not in the transmission of signals and symbols, or in individual cognition and information tasks, but in cultural-cognitive dimensions, including “epistemic cultures” (Knorr-Cetina, 1999) with specific conventions for evaluating material evidence and supporting knowledge claims), as well as the conventions, forms of evidence, genres, and discipline-specific methods of interpretation related to the storage of documents, their presentation and interpretive conventions across institutional contexts. The process of placing an object within a particular institutional context and presenting it within associated codes, genres and forms, stabilizes its properties and gives it meaningful status within an institutionalized system of classification, display and understanding. For research into digital reformatting, this means that the production of digital manifestations of documents must take into account the institutional context in which the manifestations will be accessed and displayed. For instance, researchers in media archaeology have begun collecting “obsolete” media technologies in order to construct new institutional values around discarded technological artifacts, working to reactivate technologies that have long lain dormant, recovered from the dustbin of technological history (e.g., the media archaeology of Wolfgang Ernst, 2013). These emergent forms of media scholarship suggest that research in digital reformatting needs to consider the specific ways in which new institutional regimes of collecting may inscribe documents within new systems of values and methods of interpretation, since the processes of digital reformatting can be seen to bring collections of documents into new institutional contexts, as well as transform their materiality. Thus, understanding digital reformatting as an institutional

process requires taking into account a complex context that includes the necessary retrieval and display systems, the documentation and other aspects of an organizational website, and the materiality of the documents and how they may be interpreted within particular cultural contexts with conventions of interpretation.

3.2.4 Summary of Approaches to Preservation Knowledge

Establishing these three major research approaches to preservation knowledge - *perceptual*, *user-centered* and *institutional* approaches - is the starting point for identifying the epistemological assumptions that guide the production of preservation knowledge. Evaluating existing preservation research within the categories of *perceptual*, *user-centered* and *institutional* reveals that research on the preservation of visual documents is guided by disparate philosophical assumptions about the nature of information and human knowledge. In the following section, I will explore research that considers that different aspects of preservation knowledge, organizing my discussion around these different philosophical assumptions.

3.3 Preservation Knowledge as an Object of Study

Research that takes preservation knowledge as its object of study can be placed into five major areas, which I will describe in the following subsections: (3.3.1) studies that explore the objects being preserved, including their characteristics and values; (3.3.2) studies that look at the collections and objects produced through preservation practices, including the products of the work of digitization; (3.3.3) studies that look at the transmission and circulation of preservation knowledge through standards and standardization initiatives; (3.3.4) studies that look at the social practices of preservationists, including their roles in their organizations as social actors; and (3.3.5)

practitioner literature that offers first-hand case study accounts of preservation projects in order to develop best practices. Key trends and gaps in the literature will be identified at the conclusion of these subsections.

3.3.1 Objects of Preservation

Some research in information studies has tackled the problem of preservation by exploring the nature of documents, how they come to be meaningful for particular groups and how they are assigned certain values. Elizabeth Yakel's (1997) qualitative study of the documentary practices of radiographers shows how critical values of documents (in this case x-ray images), such as "trustworthiness" or "accountability," depend on efforts of radiologists to make radiographic images trustworthy through documentary practices. Michael Rossi (2010) studied the processes of legitimization by which a life-sized model of a whale could become an acceptable museum artifact at the American Museum of Natural History. This area of research on the objects of preservation considers how preservation practices enacted in institutional contexts construct the key values of documents as evidence, including such archival values as *authenticity*, *integrity* and *trustworthiness*. This suggests that archival values and the evidentiary value of documents are constructed through social practices of preservation professionals.

Another approach to objects of preservation looks to users to define what they see as the "significant properties" of documents. This research has become increasingly important for preservation work being done on born-digital documents which have to be migrated into new operating environments because ongoing cycles of rapid technological obsolescence make it necessary to periodically translate digital documents into new encoded formats in ensure ongoing accessibility. Margaret Hedstrom, et al. (2006)

developed techniques for identifying the perceived significant properties of digital artifacts based on interviews with a variety of user groups. Rather than looking at the institutional processes that ascribe values to documents, research in this area studies how users ascribe values to documents.

Existing research on preservation knowledge has considered the objects of preservation in terms of how they are constructed by institutional processes and by users, but little work has been conducted on the practices of preservationists as they reproduce digital manifestations.

3.3.2 Products of Preservation

Closely related to research that studies the objects of preservation is research that studies the resulting products produced through the work of preservation. Research in this area considers the products of preservation activities, including the construction of collections of records; the quality of digital manifestations produced; the uses and users of those manifestations; and the material traces left behind by the digitization process.

A few examples of research that look at how collections of records are constructed include Amelia Acker (2013) who has charted the process by which medical specimens become transformed into records in the context of biomedical tissue cultures; and Lorraine Daston (2004) who studied the role of type specimens as documents in the scientific work of botanists. In terms of the products of digitization work, Paul Conway (2010b) developed a research framework for evaluating the quality of digitized documents based on users' evaluations of the resulting texts. The incidence of human error in producing copies and its impact on legibility in terms of four different use-case scenarios were examined, "reading online, printing on demand, data mining, and print

collection management” (Conway, 2011, p. 293). Conway (2013) also assessed the quality of the digitized manifestations stored in the large collections of the HathiTrust digital archive and found that “one quarter of the volumes in the 1000-volume sample contain[ed] at least one page whose content is unreadable” (Conway, 2013, p. 26). Other research in this area includes: Thilo Bauer, et al. (2005) looked at users’ responses to digitally restored manifestations of analog video recordings; and Elsa F. Kramer (2005) observed how users from the general public interacted with a digitized collection hosted by the Indiana University – Purdue University Indianapolis image collection.

Other research has looked at how the processes of creating digitized manifestations inscribe traces of the cultural and historical context of their production. Bonnie Mak (2014) analyzed the digital manifestations of early English books stored in the database, *Early English Books Online* (EEBO), conducting an archaeology of the traces of the multiple acts of reformatting of the texts in the database, from microfilm to digital imaging to text encoding. In the process, Mak (2014) shows how studying the histories of databases of digital manifestations contributes to our understanding of the cultural and material dimensions of digital reformatting, suggesting “the images in EEBO offer a complex narrative about duplication technologies, as they chart moments in the history of printing, microfilm, and digital scanning and manipulation, and gesture towards the discursive practices of such work that involve human labor” (p. 1521). We can also see a concern for the materiality of the digital conversion process in Alan Galey’s (2012) bibliographic analysis that compared the print and digital editions of the 2009 book *The Sentimentalists* by Johanna Skibsrud. Galey (2012) suggests digital books can be studied in terms of their own particular materialities that are open to bibliographic

analysis. These research approaches suggest that the products of preservation may be analyzed at multiple levels of analysis, including the evaluation of the preservation work that produced them, their cultural context and their material attributes and traces of their creation and transmission. In the following section, I will consider studies that look at how knowledge about preservation is transmitted.

3.3.3 Transmission of Preservation Knowledge Through Standards

Research that studies the transmission of preservation knowledge has looked at how knowledge about digitization techniques flows through networks of experts and organizations in the form of standards that are created and disseminated in order to organize and scale up preservation activities across organizations. Lawrence Busch (2011) suggests that “standards are where language and the world meet,” suggesting that the texts that we call “standards” straddle the area between what can be linguistically specified and categorized and the properties of the physical world (p. 3). Standards also invoke categories and make distinctions about objects and actions in the world (Bowker and Star, 1999). In the case of formal technical standards, such as JPEG2000, they are represented in written documents developed through standardizing organizations (e.g. the International Organization for Standardization, or ISO), which are then interpreted by engineers who implement them as new technological objects and processes. Standards can also define digitization procedures, in which they are interpreted and put into practice by preservationists working in institutional contexts.

Research that looks at the construction of digitization standards has analyzed patterns of citations as evidence of the communication of ideas and as a way of mapping the flows of preservation knowledge through networks of preservation experts involved

standardization initiatives, mainly focusing on digitization guidelines of original formats that are less complex than analog video recordings, including text and still images (e.g. photographs). For instance, Conway (2008) mapped the networks of citations for the most common standards documents for still-image digitization, looking at publicly available digitization guidelines published between 1995 and 2008. During this period, the process of still-image digitization was still in a process of development and there remained uncertainty about the best methods of digitization in the preservation community. Conway (2008) found that while most standards documents he analyzed cited only a few key authors working within a small number of large organizations, including the Library of Congress, Cornell University's library and Harvard University's library, each standard still contained slightly different technical guidelines for digitization. This suggests that tensions may exist between the formation of a general consensus around standards and the needs of applying guidelines in the local setting of a particular organization's context. Understanding the flow of preservation knowledge through networks of experts through their citations provides insight into the role of expertise and influence on the diversity of ideas within the field and it produces a series of maps of those flows (see Figures 2 and 3 below) that can be used to identify sites for additional research into the circulation of preservation knowledge and the construction of digitization standards.

Research on standards has explored the interrelations between standards and the networks of influence between experts that are developing new standards. For instance, Figure 2 shows a citation map constructed by Conway (2008) by analyzing references between current standards and earlier standards, which are represented by single-headed

arrows pointing towards the cited text. Figure 3 from Conway (2008) shows the linkages between the standards and references to individual authors, either as authors involved in the writing of a particular standard or authors on other research being cited by the standards. In Figure 3, the labels for the standards have been excluded for clarity, but the presence of only six authors emerging as key nodes in the network suggests that a very small group of key experts are involved in the construction and transmission of knowledge around digitization standards for visual documents. These maps are useful for establishing the context of this dissertation research, which is concerned with understanding the construction of preservation knowledge and the social processes by which codified forms of knowledge are constructed and brought into local practice. Conway's (2008) work identifies standards and expert knowledge as key sources in the flow of preservation knowledge.

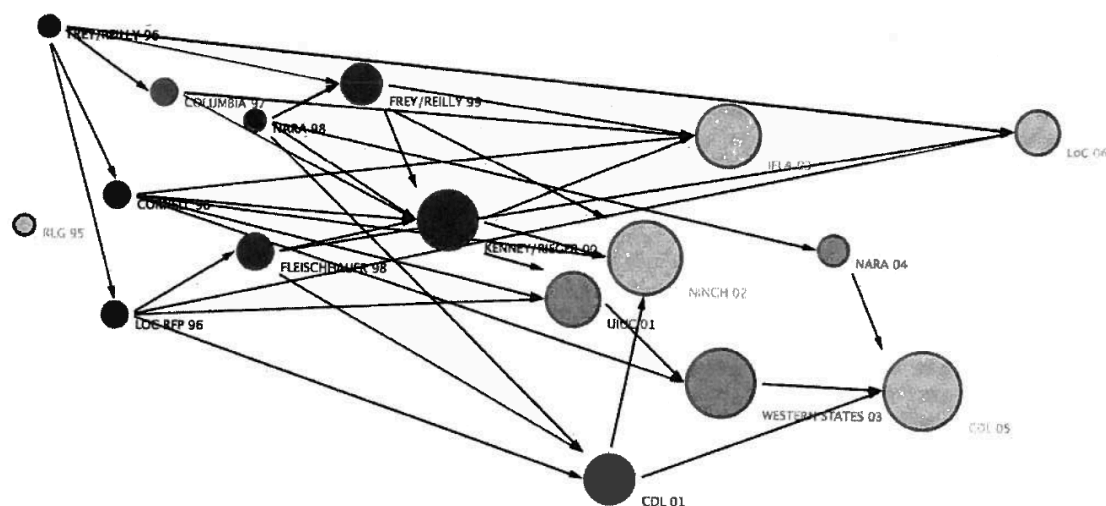


Figure 2 – Citation Analysis of Digitization Standards Documents (Conway, 2008)

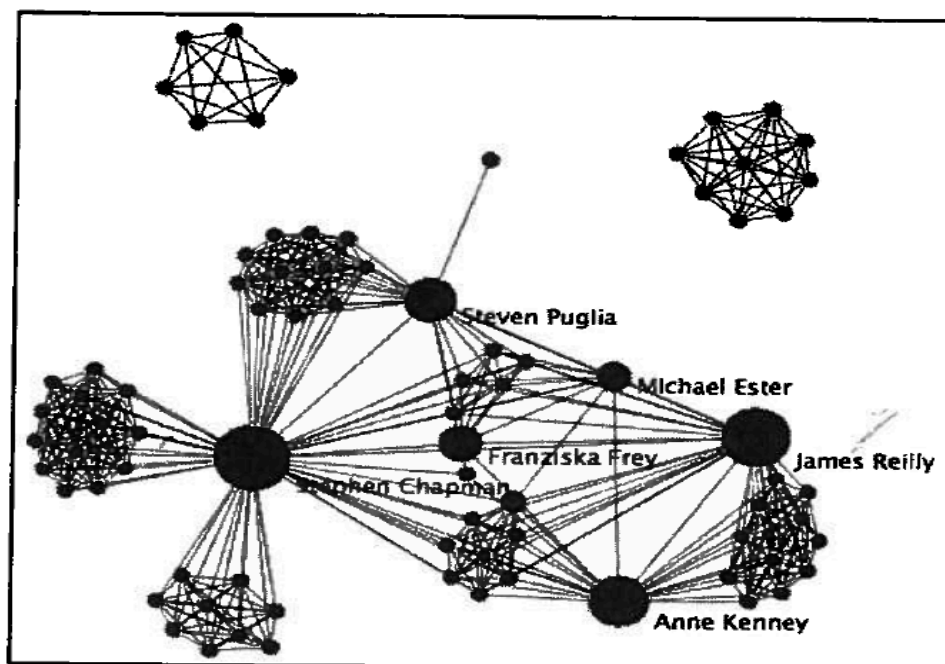


Figure 3 – Citation Analysis of Authors of Standards Documents (Conway, 2008)

In addition to studying how they flow and circulate along networks of expert communication, the standards documents themselves can be studied as texts since they play an important role in discursively constructing the forms that preservation knowledge can take. Standards are used across preservation contexts and “they reflect the most current knowledge about professional practices and increase interoperability, consistency, and the safety and security of collections” (Donaldson and Yakel, 2013, p. 55).

Standards considered at the level of a community define acceptable objects and practices for the carrying out of work activities.¹⁸ This is exemplified by the universal adoption of the International Organization of Standardization (ISO) standard for the production of preservation-quality book paper (ISO 9706 – 1994), however, most

¹⁸ Timmermans and Epstein (2010) point out that the process of standardization itself can be seen as a type of knowledge production, suggesting “standardization also raises questions about the role of science and expertise in regulation: What evidence is sufficient or necessary to implement standards?” (p. 70). These approaches demonstrate the close relationship between standards and knowledge.

“standard” preservation practices and technologies in the community, such as the use of the TIFF file format for preserving still images, have not been codified in formal standards documents, but can circulate as *de facto* standards (i.e. some technique or level of quality that becomes a standard because everyone in a community has decided to adopt that approach.) The documents developed by organizations to shape preservation practice are not formal standards either, but they reflect institutional efforts at standardizing preservation practice, in order to make it more consistent and controllable in the hopes of reducing the appearance of errors resulting in the digital copy.

Even though preservation institutions see standards as a means for promoting consistency and interoperability of archival documents across organizational sites, they may disrupt local practice. Although standards play a critical role in transmitting preservation knowledge, Donaldson and Yakei (2013) emphasize the potential disruptions posed to archival practice associated with the deluge of standards in archives:

For archivists working in the digital realm, the pace of standards introduction is swift and the decision to adopt a given standard can mean altering work processes and/or reconfiguring present technologies. (p. 56)

Research on the adoption of archival standards across institutions has also been conducted by Donaldson and Conway (2010), and Conway and Williams (2011) identify three impediments to the successful standardization of digitization practice of visual documents (photographic images, in this case) in preservation institutions: (1) existing guidelines “lack adequate attention to imaging science” (p. 16); (2) lack of a community that is systematically using digitization technologies; and (3) “current standards and guidelines are sometimes difficult to locate, compare, and interpret” (p. 16). While the critique offered by Conway and Williams (2011) is primarily directed at the current state

of the digitization of still images, elsewhere Conway (2010a) has noted that the guidelines for other, more complex visual documents, such as film and video, have also seen limited consensus on what digital reformatting standards should be adopted across the community of practitioners.

Analyzing the flow of preservation knowledge within expert communities and across organizations has also been conducted by looking at the circulation of particular ideas in the preservation literature and through educational programs. For instance, Trond Jacobsen, et al. (2013) traced the concept of “collective memory” throughout the discourse of preservation literature, looking at 165 articles from 1980 to 2010 within the archival studies literature and conducting a citation analysis. Additionally, Ann Russell (2007) evaluated the impact of the Northeast Document Conservation Center’s (NEDCC) annual *School for Scanning* conference, held between 1995 and 2005 to train information professionals on the proper techniques for scanning paper and photographic documents. Mapping the flow of ideas through scholarly literature and examining the impact of educational programs provides important means for understanding the flow of preservation knowledge between scholarly communities and organizations, and to new generations of practitioners potentially bringing new preservation knowledge into practice.

Preservation knowledge can also be studied as it flows within preservation organizations. It has been studied in terms of its flow between individuals and between departments in libraries, archives and museums, and through the social construction of ideas around innovative preservation technology by competing social groups. Paula De Stefano and Tyler Walters (2007) surveyed Association of Research Libraries (ARL)

member libraries to look at the prevalence of inter-organizational collaboration between the archives and preservation departments of member libraries; and Jeffrey Reed, et al. (2013) reported on their efforts at the National Archives and Records Administration (NARA) to develop standards for use across NARA. A key concern for Reed, et al. (2013) was how to package their specifications and effectively disseminate them to different parts of the organization: “An important part to ensure the success of developing agency-wide digitization standards is packaging the information so that it can be accessed and understood by NARA’s diverse community of content creators and product user’s” (p. 214). Successfully presenting the standards information in a form that will be understandable to social groups throughout the organization may be impeded by different conceptualizations of the digitization technology. Findings from Marija Dalbello’s (2005a; 2005b) study of institutional change through the reconstruction of phenomenological narratives by key personnel involved in the carrying out the National Digital Library Project (1995-2000) at the Library of Congress, draws attention to the tensions between the competing “ideological discourses” of whether the digital library technology was to be used for *preservation* or for *access*. Through analyzing participants’ retrospective accounts of technological and institutional change, it was found that competing “technological frames” were used by different social groups to discursively establish the purposes to which the digital library technology could (and should) be put (Dalbello, 2005a; 2005b). This suggests that within the discourses of preservation within organizations, social groups may view the same preservation technology very differently and have different ideas for how it should be used. Therefore, technologies need to be understood as discursively constructed as *preservation* technologies, i.e. technologies do

not emerge fully formed from the minds of inventors but their meaning must be socially negotiated through technological frames that may depend on the cultural backgrounds and incentives of different “relevant social groups.”¹⁹ In her study of five European national libraries that were conducting digital library projects in the era of first-wave digital library projects, Dalbello (2008; 2009) found similar tensions around conflicting meanings of the digital library technology within “arguments about the purpose of digital libraries—are they tools for access or a medium for preservation?” (2008, p. 68). Nathalie Heinich (2010) has analyzed the construction of the values of “cultural heritage” or “patrimoine” in French conservation culture, by applying ethnographic methods and interviews to studying the work of administrators and preservation specialists in the French heritage administration. These examples of research show how the flow of preservation knowledge within and between organizations can be studied in terms of the circulation of ideas, their implementation in practices and their social construction in institutional contexts. Within the context of artisanal digital reformatting of analog video recordings, these areas of research point to the importance of studying the social factors shaping the circulation of ideas about the “appropriate” technique to digitize a complex visual document and the role played by institutional discourses in shaping the concepts and values that preservationists use to gain self-understanding of their own preservation activities.

The discourses of preservationists have also been studied by looking at the debates around which file formats should be adopted as preservation formats in public

¹⁹ Different social groups may see the same technology in very different ways, and these differences may be traced to different professional backgrounds: “The issues of preservation, emerging reference practices, and control of access to information and collections represent controversies that originate from professional practice” (Dalbello, 2005b, p. e59).

forums, such as in online listserves (Lischer-Katz, 2014b). This research also reveals tensions within organizations and across preservation communities concerning the transmission of preservation knowledge and its social construction, including decisions around standardizing file formats and appropriate methods of evaluating the suitability of different file formats to preservation purposes. These research approaches reveal that the discourses of preservationists play an important role in how knowledge is transmitted within and between organizations and individuals. This suggests that the social construction of preservation knowledge, particularly in terms of establishing consensus around preservation standards is an important site of inquiry for understanding how knowledge is transmitted among preservationists.

Research into the transmission of preservation knowledge shows multiple levels open to analysis, from the level of discourse and arguments around the social construction of archival values and technological frames that shape the meaning of emergent preservation technologies, to networks of citations and educational forums that allow for the flow of preservation knowledge, to organizational structures and the development and circulation of standards. The following section will look at how preservation knowledge has also been studied in terms of its material actualization as a social practice, i.e. in the form of preservationists working in institutional contexts.

3.3.4 Preservation as a Social Practice

Preservation knowledge has also been studied in terms of how preservation practitioners act as creative agents to incorporate preservation knowledge into the contexts of institutional and professional practice. Adopting the perspective of social practice theory (Schatzki, 2001), research in this area is carried out under the assumption that knowledge

cannot be completely codified in standards, specifications and best practices, instead focusing on how knowledge emerges in socially-situated contexts of shared understanding and action. This area of research typically employs qualitative sociological research methods and has seen a limited but growing application to the context of preserving visual documents. Research in this area includes the ethnographic work conducted by Karen Gracy (2004; 2007a; 2007b) in film archives, which focused on the social practices of film preservationists. Film is another moving image medium that can also be considered as a complex visual document, since it requires specialized playback equipment for playback and contains multiple interrelated components (i.e., audio and image).²⁰ Gracy (2004; 2007a; 2007b) adopted Pierre Bourdieu's concept of *habitus* to examine how film preservationists construct professional identity in their work in preserving films, and examined how the institutional configuration of the film preservation community constructs hierarchies of value (with feature-length, Hollywood films at the top, and amateur and experimental films at the bottom) that determine the allocation of resources and define the meaning of preservation practices. Gracy's (2004) concept of "archival ethnography," defined as "a form of naturalistic inquiry which positions the researcher within an archival environment to gain the cultural perspective of those responsible for the creation, collection, care, and use of records" (p. 337), also offers a useful methodology for studying preservationists working with other types of complex visual materials, in the case of this dissertation research, analog video recordings. By positioning herself as a participant-observer in the archival context and

²⁰ Unlike video recordings, the human eye without mechanical mediation can view an individual frame of film by using only a light source shining through the transparent celluloid. Analog videotape, on the other hand, appears as a brown or black strip of magnetic tape that offers no clues to its encoded visual content until it is played back on a suitable video tape recorder.

observing the work of film preservationists *in situ*, Gracy (2004; 2007a; 2007b) was able to analyze preservationists' discourses in relation to their actual work place activities. This research stresses the importance of generating rich qualitative research data by applying ethnographic methods to the institutional contexts in which preservation work is being conducted, in order to understand how preservationist discourses construct the values and concepts of the preservation of complex visual documents and how those values and concepts are materialized in practice.

Research that treats preservation as a social practice also extends beyond preservation institutions to informal contexts of archiving and preservation. Lindsay Mattock (2014) applied qualitative research methods, including interviews and document analysis across multiple sites to study the archival practices of non-professional preservationists working to preserve video and film collections in small media arts organizations. Andrew Cox (2013) studied information practices related to the arrangement and preservation of photo albums inside the domestic spaces of the home. In these examples, the social and material dimensions of preservation practice are understood as inseparable. The handling of physical materials and embodied dimensions are intertwined as socially meaningful arrays of perceiving, knowing and acting. From this perspective, the study of digital reformatting practices must take into account the material properties of visual documents being handled by preservationists and their kinesthetic and visual activities of translating visual documents into a new medium. Thus, studying the social practices of preservationists conducting digital reformatting work requires a consideration of the technologically-mediated visual dimensions of their

practices as well as the kinesthetic conservation techniques required for handling original objects and manipulating equipment.

The main goal of studies that consider preservation as a social practice is to apply sociological analysis to contexts of preservation practices in order to gain insight into the construction of customs, values and identities associated with the materialization of preservation knowledge within different types of institutionalized sites of preservation. Most recently, scholarship has emerged that looks at digital reformatting as a social practice, including the work of Melissa Chalmers at the University of Michigan who is currently working on a dissertation project that looks at the labor practices and infrastructures of commercial mass digitization projects²¹ and the work of Asen Ivanov (2015) at the University of Toronto who is applying social practice theory to studying the construction of preservation values in preservation practice at the Canadian Broadcasting Corporation archives in his dissertation research. These established and emergent approaches to considering preservation as a social practice suggest that there is a growing interest in better understanding the social processes by which preservation knowledge becomes materialized through preservation work and put into practice within different scales of digital production and within different types of institutional contexts. In the following section I will discuss research that considers the pragmatics of preservation, i.e. how best to practically conduct the work of preservation in a variety of contexts.

3.3.5 Pragmatics of Preservation

In addition to research that takes a sociological perspective to analyze the circulation of preservation knowledge and its emergence as a social practice there is also a vast

²¹ According to doctoral candidate Melissa Chalmer's University of Michigan student homepage: <https://www.si.umich.edu/people/melissa-chalmers>

literature produced and consumed by preservation practitioners that works to establish “best practices” as guidance for others in the preservation community. This literature typically reports on the carrying out of projects by preservationists as exemplary case studies, or evaluates survey data about preservation projects across organizations in order to develop preservation knowledge in the form of practical solutions and best practices. I will briefly discuss two studies drawn from the practitioner literature to illustrate this type of research.

Laura Capell’s (2011) case study of a digitization project at the University of Southern Mississippi offers a pragmatic approach to the problem of digitization for preservation. The imminent destruction of a collection of acetate-based photographic negatives is the context analyzed, which is shown to structure the decision-making process of the archival staff. The case study concludes with the selection of digital reformatting as the most suitable preservation strategy to pursue to preserve the collection of photographic negatives. The decision to digitize the material rather than follow traditional analog preservation standards was also guided by the perceived lack of trained conservation staff and microfilming technology or other traditional reformatting techniques, and the apparent physical instability of the documents’ materiality (Capell, 2011). In this case, digital reformatting was seen as a substitute for traditional conservation work. In other cases, digital reformatting is used to complement conservation work, and there has been concern expressed by researchers in this area that digital reformatting is shifting resources away from traditional conservation activities, as noted in Karen Gracy and Miriam Kahn’s (2012) literature review of preservation research literature, 2009-2010. In their review, Gracy and Kahn (2012) also identified

mass digitization as a new preservation strategy that was forcing preservations to conceptualize the meaning of preservation work, and noted that an increased interest in the preservation community in digitally reformatting special collections was helping to drive research on more complex visual documents beyond text and still-image digitization.

Case studies such as the one provided by Capell (2011) are offered as advice for other practitioners in planning and executing their projects. They contribute to the establishment of preservation knowledge around common pragmatic solutions, offering best practices by illustrating what works and what does not work in preservation projects. Additional research from the practitioner literature that can help outline the scope of the field includes Marilyn Berger's (1999) case study of digitizing the entire run of the journal *The Canadian Architect and Builder*; Tom Evens and Laurence Hautekeete's (2011) case study of work done to digitize audiovisual collections at institutions in Flanders, Belgium; and Richard Wright's (2004) survey of the risk factors of several analog audiovisual collections and provides recommendations for efficiently digitizing these collections. In addition, Anne R. Kenney, et al. (1998) developed several model cases of digitization specifications for application to different types of book illustrations, ranging from 19th to 20th century sources. These practitioner approaches follow earlier projects that studied the digitization of print-based visual documents. For example, Kenney, et al. (1998) describe a project to automate the process of automatically detecting particular types of illustrations (e.g., half-tone printing) and applying recommended specifications for digitization. This type of research relies on an historical understanding of visual media technologies and requires adopting models of visual

perception from scientific fields of digital imaging and computer science. Reviewing these studies shows how earlier research to develop workflows and guidelines for technical decision-making in digitization projects have been focused on developing efficient and automated approaches that could be used by other organizations. This is relevant for understanding artisanal digital reformatting of visual documents as a social practice emerging within a research context that often focuses standardization and automation as means for making preservation processes more “efficient.”

Pragmatic research has also considered the administrative dimensions of digital reformatting projects, in particular focusing on the changing roles and responsibilities in library contexts due to technological change. This research includes such approaches as analyzing the organizational attributes that can be linked to the successful establishment and administration of digital reformatting initiatives (Greenstein and Thorin, 2002; Tennant, 2004); analyzing how the roles and responsibilities of staff members change in organizations when digital reformatting initiatives are introduced (Sutton, 2004; Boock & Vondracek, 2006); and the development of best practice guidelines for planning and managing digital reformatting projects (Kenney and Rieger, 2000; Sitts, 2000; Smith, 2001; D’Andrea and Martin, 2008; Besser, 2003; Hughes, 2004). Considering the roles and responsibilities of different social actors involved in the digital reformatting process gives insight into how responsibilities are distributed across different organizational roles. Research that studies the roles and responsibilities of practitioners within digital reformatting projects shows that organizational distinctions are made between administrators who plan and manage projects and the workers directly involved in the labor of digital reformatting. For example, Youngok Choi and Edie Rasmussen (2006)

surveyed library staff working on digitization projects at ARL libraries and found that their work responsibilities were primarily administrative, and that fewer than 16 percent of respondents reported that they were involved at all in the technical work of digitization projects. This suggests that the tasks of management and the tasks of digitization in digital reformatting projects may be the responsibility of separate organizational roles. In the case of the artisanal digital reformatting of complex documents, this suggests that the work of digitization is shaped both by digitizers physically engaged in the work and by administrators who may play a significant role in setting standards, workflows and policies for digitizers to follow. Thus, for a holistic understanding of preservation knowledge in the context of artisanal digital reformatting of visual documents depends on studying the work of individual digitizers but also the role of other key institutional actors (i.e. administrators) in shaping practice.

3.3.6 Summary of Approaches to Preservation Research and Research on Preservation

This review of the three major approaches to preservation research (Perceptual Approach; User-centered Approach; and Institutional Approach) and the five major areas of research (Objects of Preservation; Products of Preservation; Transmission of Preservation Knowledge and Standards; Preservation as Social Practice; and Pragmatics of Preservation) helps to establish preservation knowledge as a topic of inquiry that can be approached from a variety of perspectives, including focusing on the objects and products of preservation, studying its transmission between and within organizations and among preservationists, looking at the social practices of preservationists, as well as the pragmatics of preservation. In the following section I will identify the gaps in the

literature reviewed in this chapter and establish the need for the proposed dissertation research.

3.4 Gaps in the Literature

The preceding review of the literature on preservation research and applied knowledge has helped to identify key gaps in the existing research in this area and suggests several directions forward for addressing them. In particular, the literature review shows that there is a clear need for an holistic approach to studying the discursive construction of preservation knowledge in the context of artisanal digital reformatting of visual documents that considers the following dimensions of gaps: (3.4.1) the social construction of visibility; (3.4.2) the epistemic assumptions that guide the construction of preservation knowledge; (3.4.3) the connections between preservation knowledge and the construction of normative practice; and (3.4.4) an understanding of artisanal digital reformatting projects as an emergent context of digital production. These four gaps and research needs were identified through this review of the literature and will be explored further in the following subsections.

3.4.1 Studying the Discursive Construction of Visibility

As discussed in the literature review, research in information studies that involves visual forms of information tends to treat vision as a cognitive or technical problem that can be solved by utilizing approaches from other fields such as cognitive science, or as an entirely unproblematic conduit of information. A few studies have begun to emphasize the educated and embodied nature of vision, but they still do not fully address the cultural and historical ways in which ways of seeing and associated technologies are socially constructed within particular scopic regimes. This dissertation research addresses this gap

in the research by generating important insights into the discursive construction of
 visibility in the production of visual manifestations of visual documents in artisanal
 digital reformatting. Addressing this gap is important for understanding how preservation
 knowledge is constructed because this process relies on establishing particular ways of
 seeing that enable a preservationist to watch and evaluate visual representations of the
 process of translating from analog video tapes to digital files. The work of digital
 reformatting of visual documents requires preservationists to develop particular ways of
 seeing and technical expertise in order to adjust digital capture equipment, scopes,
 monitors, calibration devices and other technologies of imaging to translate visual
 documents into acceptable digital manifestations. This is not a strictly visual process, but
 relies on the mastery of necessary bodily movements, reading of technical manuals and
 documentary practices that are facilitated by the use of documents and forms, and
 codified preservation knowledge such as standards, specifications and guidelines. This
 research contributes to a better understanding of the discursive construction of visibility
 by incorporating analytic approaches that take into account the visual experiences of
 preservationists, their embodied activities and the role of documents and institutional
 practices in establishing normative practices of digital reformatting of complex visual
 documents, specifically analog video recordings.

3.4.2 Studying the Epistemic Assumptions that Guide the Construction of Preservation Knowledge

Due to its practical orientation, research on preservation knowledge has only recently
 begun to explore the cultural, historical or sociological dimensions of the field of
 preservation. The different approaches to preservation research identified earlier in
 section 3.2 show that preservation researchers and practitioners make different

assumptions about the nature of documents and the role that they play in the production of knowledge, yet these assumptions have seen little analysis in existing empirical research. In section 3.2 these approaches were classified as the *perceptual*, *user-centered*, and *institutional approaches*. Each defines information in different ways and is based on different epistemologies, establishing this taxonomy is useful for beginning to explore the epistemic and cultural assumptions shape knowledge production in this research context. This helps to identify the need to study the assumptions that preservationists make in carrying out the work of artisanal digital reformatting since those assumptions play a role in decision-making that shapes how the digital manifestations are produced and how they will appear into the future for users. In this dissertation research, analyzing the discourses and material practices of preservationists engaged in the artisanal digital reformatting of analog video recordings gives insight into their epistemological assumptions and the role that these assumptions play in shaping how they conduct their work. Studying what preservationists say and do gives insight into understanding how their epistemological assumptions are materialized and institutionalized in the work of artisanal digital reformatting of analog vide recordings, which is important for understanding how visual knowledge is constructed, the appearance of digital manifestations of analog originals, and the emergence of artisanal digital reformatting as a meaningful social practice for preservation professionals.

3.4.3 Studying the Connection between Preservation Knowledge and the Construction of Normative Practice at the Institutional Level

This review of preservation research has also shown that while there exists some research that considers the construction of preservation knowledge through institutionalized and codified forms (e.g., standards, guidelines and best practices) as well as research that

looks at the material practices of preservation professionals, little research has been conducted that integrates analysis of institutional discourses and the circulation of preservation knowledge with observations of the work of preservation professionals. This dissertation research incorporates an holistic approach that analyzes both preservationist discourses and their materialization in the practices of preservation professionals. Reiner Keller (2006) suggests that the cognitive and normative devices of a discourse “are produced, actualized, performed and transformed in social practices” (p.203), which can be material or language-based (and language has its own materiality as written texts and spoken statements). Studying artisanal digital reformatting as a site of digital production offers an ideal venue for studying how symbolic (standards, guidelines, documents) and material techniques, constructed technologies, and embedded infrastructures materialize preservation knowledge and establish normative practices within the work of artisanal digital reformatting of visual documents.

3.4.4 Considering Artisanal Digital Reformatting of Complex Visual Documents as Emergent Mode of Digital Production

The existing studies on digital reformatting typically consider case studies or technical descriptions of experimental projects, or analyze the products of large-scale digitization projects. What is missing in the literature is sociological, cultural and historical research that considers emergent small-scale digital reformatting projects in preservation institutions in an age when digital reformatting technology has become a stable and recognized technology, yet remains highly skilled and specialized. Studying the expertise of practitioners involved in these projects helps to explore the craft-based nature of this type of digital production. Considering digital reformatting in the artisanal mode draws

attention to the embodied forms of preservation knowledge and aesthetic judgments that are difficult to codify in documents.

In order to address these gaps in the research and address my main research objective of understanding knowledge construction and the underlying epistemic assumptions of preservationists who work in the artisanal mode of preservation to produce digital manifestations of visual documents, I employ an integrated research approach that takes into account institutional, practical and experiential dimensions of the construction of preservation knowledge in this context, which will be developed in Chapter 6, Research Methodology. In the following subsection, I will summarize the key findings of the literature review, before moving on to Chapter 4, in which I will define key conceptual terms and outline research objectives for this dissertation research.

3.5 Chapter Summary

In this chapter, I have outlined a comprehensive literature review of the research necessary for situating artisanal digital reformatting of analog video recordings as an area of study, and defining gaps that this dissertation research works to address. I reviewed research literature relevant to situating and justifying this dissertation research, which was categorized into three major areas. Within the first area, (3.1) *Approaches to Visual Information*, I reviewed research on (3.1.1) traditional information studies research that considers visual information; (3.1.2) visual methods of data collection and analysis applied in information studies; and (3.1.3) research in information studies that considers the education and socialization of vision.

In the second area of research reviewed, (3.2) *Approaches to Preservation Research*, I identified three main approaches to preservation research and their

epistemological assumptions about visual information: (3.2.1) *Perceptual Approach* defines information as physical and objective and bases its epistemology in psychophysics; (3.2.2) *User-centered Approach* defines information as individual-cognitive and bases its epistemology in cognitive constructivism; and (3.2.3) *Institutional Approach* defines information as cultural-cognitive and bases its epistemology in social constructionism.

In the third area of research reviewed, (3.3) *Research that Takes Preservation Knowledge as its Object*, I surveyed empirical research projects on preservation knowledge and its integration into practice, and grouped them into five main areas of research: (3.3.1) *Objects of Preservation*, which addresses how archival objects become constructed within preservation knowledge, including how values get ascribed to documents; (3.3.2) *Products of Preservation*, which focuses on the products of preservation processes, including digital objects produced through preservation activities; (3.3.3) *Transmission of Preservation Knowledge*, which considers the transmission of preservation within networks of experts and groups of preservationists; (3.3.4) *Preservation as Social Practice*, which adopts a range of sociological and cultural analytic approaches to studying the work of preservationists; and (3.3.5) *Pragmatics of Preservation*, which seeks to improve preservation techniques, primarily by presenting and analyzing case studies, surveys and literature reviews to assist preservation professionals.

From these three areas of relevant research literature, I was able to identify the range of epistemological assumptions within different areas of preservation research, and (3.4) define gaps in the literature in order to situate and justify a qualitative-interpretive

research approach to the construction of knowledge in the practice of artisanal digital reformatting of analog video recordings. In the following chapter I will outline the guiding research objectives and define key conceptual terms guiding this work.

CHAPTER 4: RESEARCH OBJECTIVES AND DEFINITIONS

4.0 Chapter Overview

The literature review in the previous chapter established the preservation field, with a focus on complex visual documents, and has identified perspectives not fully explored in that field. Studying the discourses and practices of preservationists as they engage in artisanal digital reformatting of visual documents requires a research approach that takes into account discourses and material practices, and is focused specifically on visual experience in that context and examines the underlying “moral order,” (i.e. the normative practices that comprise the set of moral commitments defined in the field of preservation as to what counts as legitimate preservation knowledge in regards to objects, documents and practices). In this chapter, I will (4.1) outline my research objectives and (4.2) define key concepts, and conclude with a (4.3) chapter summary.

4.1 Research Objectives

My main research objective is to gain understanding into the processes of knowledge construction and the underlying epistemic practices and assumptions of media preservationists who work in the artisanal mode of preservation to produce digital manifestations of complex visual documents, specifically analog video recordings. This main objective will be supported by the following subsidiary research objectives:

RO1: Understand the epistemic techniques and processes of knowledge construction of preservationists engaged in the work of artisanal digital reformatting.

RO2: Interpret the experiences of digitizers as they train their perceptions to carry out the work of producing digital copies perceived to be legitimate in their institutions.

RO3: Understand how preservation knowledge circulates and becomes integrated into the practice of artisanal digital reformatting.

RO4: Understand the moral commitments and real programs of preservationists within the “moral order” of the preservation field, particularly in terms of how the incorporation of standards and other forms of codified knowledge shapes and is shaped by institutional and professional values that in turn inform their work.

4.2 Definitions

In the following section I will define the key terms and concepts relevant to this research on the construction of preservation knowledge in the context of the artisanal digital reformatting of analog video recordings, including definitions of (4.2.1) *knowledge construction*; (4.2.2) *epistemic assumptions*; (4.2.3) *epistemic techniques*; (4.2.4) *practical knowledge*; (4.2.5) *complex visual documents*; (4.2.6) *constructions of visibility*; (4.2.7) *preservationists*; (4.2.8) *digital reformatting*, (4.2.9) *artisanal production*; (4.2.10) *standards*; and (4.2.11) *moral order of preservation*.

4.2.1 Knowledge Construction

Knowledge construction in the context of preservationists digitizing visual documents refers to the processes and structures by which preservationists form knowledge in the practices of digital reformatting and within the discourses that legitimize and structure preservation knowledge. In this research, knowledge construction is considered in terms of four modalities: (1) World-constructing: The processes and structures through which a particular socially-shared world-view is constructed and maintained, including accepted truths and ontological assumptions; (2) Practice-constructing: The training of participants’ bodies and the calibration of their senses in order to perceive and

legitimately act within the world of digital reformatting; (3) Document-constructing: The production of meaningful representations of purposeful action within conventionalized forms of documentation; and, (4) Identity-constructing: Knowledge as understanding of meaningful action, the construction and maintenance of professional identities through practice, the integration of educated perception, classificatory schemes, and ethical commitments in forming a coherent and knowing preservationist as subject. Together, these four modalities of knowledge construction may be seen to bring digital reformatting into view as a legitimated practice within the field of preservation knowledge. Knowledge construction plays a constitutive role in the professional identities and collective values of preservationists and preservation institutions, and operates individually and collectively as a shared practice with individual-perceptual and institutional dimensions.

4.2.2 Epistemic Assumptions

The concept of *epistemic assumptions* refers to taken for granted presuppositions held by preservationists about the nature of knowledge, including how it may be generated through the use of documents, and the range of genres and conventions in which legitimate knowledge and legitimate ways of knowing may take form. Epistemic assumptions shape the expectations of preservationists in terms of how documents may be used in the future, becoming embedded within the techniques of assessing and calibrating systems and in the standards, technologies and techniques used in digital reformatting.

4.2.3 Epistemic Techniques

The concept of *epistemic techniques* refers to repeatable clusters of micro-practices that combine perceptual activities and cognitive processes by using tools and documents to form knowledge claims about phenomena in the world. Epistemic techniques integrate discursive and material elements of visibility to aid decision-making in complex visual tasks, such as the artisanal digital reformatting of analog video recordings.

4.2.4 Practical Knowledge

In this research, *procedural knowledge* refers to the pragmatic forms of knowledge necessary for carrying out everyday tasks, including tacit and explicit forms of knowledge preservationists draw on in order to carry out tasks within the artisanal digital reformatting of preservation. Practical knowledge is materialized in practice and becomes embedded in institutional infrastructures and is often encoded within documents. Standards and other forms of codified knowledge are used to translate locally-produced practical knowledge into a durable and portable form that can circulate to other organizational contexts. *Practical knowledge* cannot be fully reduced to explicit instructions or routines, thus the standards and other forms of codified knowledge developed to transmit preservation knowledge can only capture a portion of the practical knowledge related to the complex work of artisanal digital reformatting of visual documents. Thus, practical knowledge incorporates codified forms of knowledge about routine practices with the embodied understandings and educated perception of skilled preservationists in their practices of artisanal digital reformatting of visual documents.

4.2.5 *Complex Visual Documents*

The concept of *complex visual documents* refers to representations of information valued primarily for their visual properties and encoded in dynamic or time-based medium that requires special playback equipment for viewing. Physical objects emerge as documents through inclusion within institutionalized regimes of collecting, classification and organization (Buckland, 1997), primarily in the context of libraries, archives and museums, but within other institutional contexts as well. Visual documents can range from two-dimensional printed or written forms, such as books, photographs, paintings and maps, to complex electromechanical forms such as photochemical motion picture film and analog video, and digitally-encoded forms such as video games, digital video, AutoCAD designs, etc. The concept of *complex visual documents* refers to visual documents with particular materialities that require advanced levels of preservation knowledge in order to properly digitally reformat them. “Complexity” is understood historically in terms of the knowledge required to preserve particular formats relative to the knowledge required to preserve other formats. For example, digitally reformatting analog video recordings is relatively more complex than digitally reformatting 8x10 photographic prints. This understanding of complexity is relational and historical, since the apparent complexity of a format will change as new preservation knowledge about other formats is developed over time. For instance, while digitization of photographs may have been “complex” in the first wave of digital library research (in the 1990s), today digitizing photographs is no longer a complex process.

While complex visual documents are *visual* in terms of their affordances and perceptual effects in regards to human vision, their status as visual documents, including

their conventions of representation, depends upon the particular values and epistemological assumptions of the institutional contexts and cultural traditions in which they appear.²²

In this dissertation research, analog video recordings of artistic and documentary works encoded on cassettes or open-reels of videotape constitute the particular type of complex visual document that is focused on in the digitization work of participants. Analog video recordings can be considered complex visual documents because to digitally reformat them requires an assemblage of video playback equipment, video processing components and digital converters, and because specialized scopes and video monitors are necessary to observe and adjust the video signals encoded within the continuously variable magnetic fields stored on the surface of the analog video tape. The image recorded on the analog videotape requires this specialized equipment to become visible. Unlike motion picture film, the visual image recorded in the analog videotape is not perceptible unaided by the human eye.²³

²² For instance, edited rolls of photochemical celluloid become meaningful as visual documents within the institutional context of film archives, which are embedded within the traditions of film collecting, curating, and scholarship. The institution of the film archive provides positions within classificatory orders in which commodities of mass culture are transformed into documents.

²³ Analog video recording technology is based on encoding video and audio signals onto a surface of magnetic “oxide” particles that is distributed across a long strip of plastic. This tape is coiled up onto plastic reels inside a cassette or is mounted on a single reel (“open-reel”) that requires manual threading of the tape onto the video tape recorder (VTR) for playback. In *Mastering Television Technology*, Coleman Cecil Smith (1988) explains how a video signal is recorded onto a tape: The “‘oxide’ coating is made up of tiny magnetic particles that are originally arranged with random magnetic orientation [...] During recording, the pattern of *magnetic orientation* of the particles in the coating is rearranged in response to the strength of an applied magnetic field” (p. 137). It is this pattern in the magnetic orientation of magnetic particles that when played back, re-produces a corresponding analog video signal via the tape head (a small electromagnet that runs along the surface of the tape and picks up these minute reversals in magnetic orientation).

4.2.6 Constructions of Visuality

In this dissertation research, *constructions of visuality* refers to the social practices by which “ways of seeing” (Berger, 1972) become institutionalized, embedded in visual technologies and adopted as part of embodied practice. The concept of *visuality* refers to the socially mediated ways in which the affordances of human visual perception are given meaning (Foster, 1988). Constructions of visuality emerge through the use of language (e.g. culturally and historically specific ways of describing colors have shaped how color is perceived), but they are also fundamentally material, relying on an embodied subject, and increasingly, on the mediation of visual technologies. As Foucault (1977) has pointed out, techniques and technologies of vision are intimately tied to epistemic-power regimes, and play an important role in the materialization of discursive power-effects. In the context of digital reformatting, the concept of *constructions of visuality* describes the ways in which the work of artisanal digital reformatting constructs particular ways of seeing through the calibration of digitization systems and visual displays, the use of classificatory schemas to describe the attributes of visual documents, and through the judgments of the educated perception of preservationists. Thus, the concept of *constructions of visuality* plays a significant role in understanding the production of legitimized digital manifestations of visual documents in the work of digital reformatting within the normative practices of preservation knowledge. Normative practice in this context is closely linked to the establishment by groups of preservationists of particular ways of seeing and interpreting video signals, as well as typifications of errors that may be documented and published as visual atlases.

4.2.7 Preservationists

Preservationists are the central social actors studied in this research. *Preservationists* are defined by their professional work and moral commitment to maintaining the values of the documents within their organizations through the use of technological and administrative procedures designed to extend the usability of those documents over time. The moral commitments of preservationists emerge within the “moral order” of preservation, which constructs normative preservation practice within institutional and professional contexts of archives, libraries and museums, and is observed through preservationists’ self-identification as preservation professionals. Official positions of preservationists can vary from such titles as preservation specialist, preservation technician, archivist, curator and conservator, each implying various configurations of education, skill and organizational affiliation. Michèle Cloonan (2007) suggests “Preservation has different meanings in different contexts; but one concept is common to all these definitions: the notion that it is possible to maintain collections, if not indefinitely, at least for as long as possible” (p. 136). Thus, in this dissertation research, while preservationists may have different titles within their organizations, they are referred to as preservationists if they are closely involved in preservation work (either the technical work of digital reformatting or the administrative work of managing projects), and express commitments to the values of preservation. As social actors, preservationists also have the power to materialize preservation knowledge through the execution of preservation plans within their work.

4.2.8 Digital Reformatting

In this project, *digital reformatting* is defined as the institutionally-sanctioned practice of copying information stored as documents from one medium to another using digital technology in order to extend the temporal and spatial availability of that information. The term *digitization* is commonly used in public life and in libraries, archives and museums to refer to any application of digital technology used for copying documents into a digitally-encoded form. However, this research chooses to use the term *digital reformatting* because it offers a narrower definition that better demarcates the phenomenon under analysis, emphasizing the institutionalized dimension of copying. Whereas digitization is used to refer to digital copying generally, digital reformatting refers to practices that have been given institutional and professional authority as acts of preservation. Preservation is a contested, yet important term for preservationists and preservation institutions. Digital reformatting has been seen by some preservationists as a complement to existing practices of conserving physical documents, while others suggest that digital reformatting is disruptive to traditional practices, shifting organizational resources away from conservation needs.

4.2.9 Artisanal Production

Artisanal production in relation to this research context refers to a mode of producing goods that is small in terms of its scale of production and requires skilled workers who are trained to perceive the unique properties of complex visual documents. This sense of “artisanal” follows film scholar, Gregory Zinman’s (2012) use of the term to describe the work of 20th-century, avant-garde filmmakers who directly apply their own hands to manipulate the film image. Zinman (2012) conceives of this work as an “oppositional

practice” (p. 9) in relation to mass-produced, mainstream film production techniques. Zinman (2012) explains how this type of “hand-made” filmmaking is “constructed with small budgets and preoccupied with formal innovation and abstract imagery” and that “handmade-film practices carry economic and even political valences with respect to mainstream film production” (p. 9). In this dissertation, “artisanal” is used similarly to describe modes of digital reformatting that are enacted in opposition to mass digitization modes of production. This use of the term differs in an crucial way from Zinman’s (2012) usage because digitizers are supposed to efface their presence in the final digital copy, whereas in the case of avant-garde filmmakers, their work gains value through the traces left behind by the author’s hand, what he calls “a corporeal cinema” (p. 12). Thus, artisanal production differs from mass-production both quantitatively and qualitatively, since it is more time consuming and produces less output than mass-production, but it also relies on the educated judgments of experienced and highly-skilled workers engaging deeply with the materials to hone the quality of their product with great skill and care. Sites of artisanal production in relation to digital reformatting should not be confused with sites of experimentation, which were common among early digitization projects in the late-1980s, throughout the 1990s and into the early 2000s within research universities and large national organizations such as the Library of Congress. Artisanal production implies a significant degree of institutionalization of practical knowledge and codification of activities into local policy documents and workflows, which gives stability and legitimacy to digital reformatting practice, while simultaneously giving the practitioner the freedom to exercise his or her judgment in shaping the final product.

4.2.10 Standards

Throughout this dissertation research, the concept of *standards* is understood to describe codified forms of knowledge that circulate as texts produced within the preservation community or within preservation organizations, and which play a role in shaping shared understandings of procedural knowledge in the preservation field. They are a form of *institutional carrier* (Scott, 2003) that transmits normative knowledge between institutions, allowing practitioners across organizations to share a common set of guidelines for normative practice. Standards embed classifications (Bowker and Star, 1999) and are not limited to formal, published and global standards. Rather, the various types of standards can be placed along a continuum (Busch, 2011) in terms of their degree of formalization (running from ad hoc to published), the extent of their influence (local to global), and the conditions of their production (grassroots to international committee work). The influence of standards can be analyzed across multiple levels, and it plays a role in institutional change, shapes professional identity and configures local practices and technical infrastructures. In the context of artisanal digital reformatting of analog video recordings, standards codify knowledge about appropriate analog techniques for getting the best video signal off of decaying and obsolete video tape formats, as well as the choice of digital tools and file formats for encoding digital files.

4.2.11 Moral Order of Preservation

The *moral order of preservation* refers to the constructions of normativity and the imperatives of preserving the key values of preservation within discourses of preservation knowledge, structured by the articulation of *moral codes*. Following Wuthnow (1987), *moral codes* refer to “a set of cultural elements that define the nature of commitment to a

particular course of behavior” (p. 66). The *moral order of preservation* is founded on the maintaining of key values ascribed to documents, such as “authenticity” and “integrity” which are articulated as *moral codes* within the work of preservationists. Understanding the structure of *moral codes* and how the *moral order of preservation* is replicated involves looking at preservationists’ stated *moral commitments* and how they are reflected in their *real projects* of carrying out the work of preservation for the purposes of archival stewardship. Following Wuthnow (1987), the concept of *moral commitments* refers to the symbolic activities of preservationists that articulate their devotion to the values of the preservation field and the carrying out of preservation tasks. *Moral commitments* are composed of symbolic expressions of commitment (*objects of commitment*), such as written or spoken statements. *Real projects* refers to the material practices used by preservationists to materially express their *moral commitments*. In the context of the artisanal digital reformatting of visual documents, such *moral commitments* may be seen within legitimizing activities such as following standards, documenting the application of conservation treatments, following policies governing the use of digital processing in the digital reformatting process, or practicing certain *rituals*, such as cleaning of equipment after every scan, which has both instrumental (e.g., producing high quality scans) and symbolic (e.g., acting methodical and careful for documents, as an expression of preservationist’s commitment to the *moral order of preservation*) dimensions.

The *moral order of preservation* is an important component of preservation knowledge that shapes preservation practice. On one hand, it is sustained by the active efforts of preservationists to legitimize their work and codify preservation knowledge,

and on the other hand it constrains their activities within a socially shared and legitimized practice. This dissertation looks at how normative dimensions of social practice are constructed through putting moral commitments to archival values into practice within the work of artisanal digital reformatting of analog video recordings, and how this contributes to shaping digitizers epistemic assumptions.

4.3 Chapter Summary

In this chapter I have outlined the (4.1) research objectives of this dissertation research and provided (4.2) definitions of key concepts related to these research objectives and the research context. In the following chapter I will outline the theoretical framework of this dissertation research.

CHAPTER 5: THEORETICAL FRAMEWORK

5.0 Chapter Overview

This research adopts a social constructionist perspective in the sociology of knowledge tradition of Peter L. Berger and Thomas Luckmann (1966), assuming that social reality is the result of discursive construction. A framework based on the intersubjective phenomenology of Alfred Schütz was developed further in *Structure of the Life World* (Schütz and Luckmann, 1973) to address individual and collective forms of knowledge in institutional contexts in society. From this theoretical perspective, the construction of the reality of preservationists engaged in the work of artisanal digital reformatting draws on multiple types of knowledge. These types of knowledge include the educated perception and practical knowledge necessary for carrying out and evaluating the work of digitizing complex visual documents; beliefs about the current state of accepted knowledge in the field and the nature of preservation objects and products; normative constructions of preservation practice; and the forms that legitimate preservation knowledge can take. Analyzing these multiple types of knowledge requires a holistic theoretical framework that can consider the institutional processes that construct preservation knowledge, as well as how preservation knowledge is constructed as social practice and through the education of perception in individual experiences of preservation work. The outcomes of these processes of construction are not just the theoretical and practical knowledge of preservation work, but constitute the taken for granted intersubjective yet personal “life-world” (Schütz and Luckmann, 1973) of the preservationist.

In the following section I will discuss the four main theoretical perspectives that form the theoretical framework for this dissertation research. They include: (5.1) The

sociology of knowledge approach to discourse (SKAD) developed by Reiner Keller (2005; 2006; 2011; 2012; 2013), which synthesizes the sociology of knowledge of Berger and Luckmann (1966) with the discourse analysis of Michel Foucault (1970; 1972); (5.2) interpretive phenomenological analysis (IPA), developed by Jonathan A. Smith, et al. (2009), which incorporates the analysis of social research data within the assumptions of hermeneutics and phenomenological analysis of Edmund Husserl, Martin Heidegger and Maurice Merleau-Ponty; (5.3) social practice theory, as conceptualized in the work of Theodore Schatzki (2001) and adopted in information practice research (e.g., Cox, 2013; Veinot, 2007; Lloyd, 2009, 2010, 2011, 2012); and (5.4) the cultural structuralism of Robert Wuthnow (1987), which can be used to interpret the work of preservationists within a culturalist framework, including the symbolic forms, social and material aspects of normative practice. Together these four theoretical perspectives allow for a conceptualization of the context of artisanal digital reformatting of visual documents that enables analysis of the institutionalization of preservation knowledge; the integration of preservation knowledge into local practices of artisanal digital reformatting of complex visual documents; the visual dimensions of artisanal digital reformatting of visual documents; and how normative dimensions of social practice are constructed through preservationists enacting their moral commitments to archival values within the work of artisanal digital reformatting of analog video recordings.

5.1 Sociology of Knowledge

Research in the sociology of knowledge is concerned with the social processes that shape human knowledge. The sociology of knowledge was initially concerned with studying the development of expert knowledge in scientific communities (e.g., Fleck, 1935), but the

field has expanded to include the study of all types of human knowledge in the social construction of reality (Berger and Luckmann, 1966). The sociology of knowledge tradition of Berger and Luckmann (1966) and the sociology of knowledge approach to discourse (SKAD) developed by Reiner Keller (2005; 2006; 2011; 2012; 2013) are the main and integrated frameworks for this research. These frameworks support this dissertation research by incorporating analysis of discourses and material practices in the construction of knowledge in the practices of artisanal digital reformatting with a consideration of classifications, and codified knowledge (i.e., standards and specifications) in order to analyze research participants' epistemic techniques, epistemological assumptions and embodied practices associated with their work of artisanal digital reformatting of analog video recordings.

5.1.1 Social Construction of Reality

Research in the sociology of knowledge tradition of Berger and Luckmann (1966) assumes an expansive notion of epistemology that considers the social dimensions of knowledge and its everyday processes of construction. In the case of media preservationists, this entails looking at how they develop both theoretical and practical knowledge in their work place practices. Berger and Luckmann's (1966) approach connects micro-level, individual acts of knowledge construction to the constitution of a shared social reality, which takes place through processes of objectivization, institutionalization and legitimization of knowledge. Through these processes the occupational community of preservationists builds up collectively shared "stocks of knowledge" (Schütz and Luckmann, 1979). Building from the social phenomenology of Alfred Schütz (Schütz and Luckmann, 1973), Berger and Luckmann's (1966) approach

considers the construction of social stocks of knowledge as taking place through the objectivating capacities of language and other institutions. The work of artisanal digital reformatting draws on stocks of preservation knowledge and assumptions about visual perception in order to produce new stocks of knowledge for society, which are composed of digital manifestations of complex visual documents. The epistemological assumptions of preservationists can be linked back to the dominant research approaches in preservation research discussed in the literature review: *Perceptual approach* (3.2.1) *user-centered approach* (3.2.2), and *institutional approach* (3.2.3). As shown in Chapter 3, each approach to preservation makes assumptions about the nature of information and is supported by different epistemologies, suggesting that the stocks of knowledge of practitioners in the preservation field may be multiple.

Language plays a central role in Berger and Luckmann's (1966) perspective, giving objectivized form to knowledge and sedimenting it into stocks of knowledge. In the case of media preservationists, this suggests that their use of language helps to build up and replicate knowledge for their occupational community over time. Berger and Luckmann (1966) explain "language is capable not only of constructing symbols that are highly abstracted from everyday experience, but also of 'bringing back' these symbols and appresenting them as objectively real elements in everyday life" (p. 38). By externalizing and objectivating human thought, language plays an essential role in constructing social reality and preserving human knowledge. In the context of the artisanal digital reformatting of visual documents, language-use for preservationists includes producing written texts that document their decision-making at various stages in the work of digital reformatting, reading reference books, visual atlases of errors and

other texts containing typified knowledge and codifying their practices in specifications and workflow documents.

Language plays a critical part in supporting other institutions, because it allows for human ideas to be given objective form and reproduced over time. Institutions work to materialize social knowledge and promote social order (Scott, 2003), and “control human conduct by setting up predefined patterns of conduct, which channel it in one direction” (Berger and Luckmann, 1966, p. 52). From this perspective, standards and other forms of codified knowledge can be seen as important agents in institutionalizing knowledge across space and time. This perspective is useful for conceptualizing the construction of preservation knowledge in the ways that it is institutionalized and legitimized through language and materialized in the work of preservation and in the shaping of institutional infrastructures. In the case of the artisanal digital reformatting of visual documents, preservation institutions work to institutionalize certain practices in order to maintain their legitimacy. For instance, the development of standards, guidelines, or other forms of codified knowledge is used to represent institutionalized practices of digital reformatting in recorded, linguistic form. Institutionalized practices, such as those relating to the artisanal digital reformatting of visual documents can be repeated and reproduced outside of their originary space and time of enactment, and language plays a crucial role in transmitting knowledge and institutionalizing practice.

Institutions are seen as repositories for preserving and transmitting knowledge over time, and as shapers of practice. Media preservationists can be seen as institutional actors that work to confer legitimacy on the digital copies that are produced through their preservation work. Institutions legitimize authority, confer identity, store (and destroy)

society's stocks of knowledge and maintain and enforce classification systems (Douglas, 1986). From this perspective, we can see that preservation institutions are institutions *par excellence*, since their social position stems from the explicit construction of identities, classification systems and the retention and disposal of documents. As sites where recorded knowledge becomes materially "sedimented" (Berger and Luckmann, 1966) into collections, preservation institutions can be seen to occupy the privileged social position of being responsible for organizing and preserving key stocks of social knowledge in objectivized form on behalf of the rest of society. Thus, the digital manifestations that preservationists create through the work of artisanal digital reformatting of analog video recordings emerge as "legitimate" copies in part through the legitimizing authority of the institutions in which are produced.

Studying the discourses of preservationists must take into account both the role that preservation institutions play in society as a legitimating force for knowledge construction as filtered in their work's imperatives, as well as how discursive practices within preservation institutions work to maintain the social legitimacy of the institutions and professional identities of preservationists. In the context of the artisanal digital reformatting of analog video recordings this suggests that fully understanding the discursive construction of preservation knowledge will require integrating the analysis of discursive and non-discursive practices with an assessment of how these shape and are shaped by normative forces within the preservation community. Selecting institutions within which this practice is emergent allows for the processes of institutionalization to be captured before knowledge is completely formalized and constructed into the "black box" (Latour, 1999) of routine and made invisible as infrastructure (Star and Ruhleder,

1996). The case of artisanal digital reformatting provides a site in which standards and infrastructures are still developing and thus are more visible.

In addition to its discursive construction and role in supporting the work of preservation institutions and preservationists, the shaping of preservation knowledge also has a crucial material dimension. This can be observed at moments when preservation knowledge becomes materialized in practice and embedded in institutional infrastructure (Keller, 2013) through the construction of practice knowledge for carrying out everyday tasks. Berger and Luckmann (1966) refer to this as “recipe knowledge” and define it as “limited to pragmatic competence in routine performances” (p. 40). Consideration of this form of knowledge has important implications for studying how preservationists and the preservation community construct practical knowledge, since the work of artisanal digital reformatting is founded on the successful development of pragmatic competence, yet also draws on the integration of professional values into expert decision-making. Standards and other codified forms of knowledge are used to transmit “recipe knowledge” across organizations. Recipe knowledge is given material durability in the shaping of institutional infrastructures, such as through the configuration of digital reformatting systems and digital repositories. As a form of recipe knowledge, standards and technical specifications play an important role in transmitting new knowledge about the latest developments in preservation techniques (Donaldson and Yakel, 2013), such as digital reformatting. Understanding the social construction of preservation knowledge requires consideration of how codified forms of knowledge, such as standards, specifications and guidelines, are integrated into practice, since they play a significant role in transmitting preservation knowledge about normative preservation practice. In the case of digital

reformatting standards, these documents codify technical specifications and procedures for handling documents, while at the same time offering exemplars of legitimized preservation knowledge (i.e., these documents offer models for practice and models of practice).

From the perspective of Berger and Luckmann's (1966) sociology of knowledge, the everyday work of preservationists can be seen to produce the material and symbolic realities of collections that are also used to support the work of other social institutions. The social status of the preservation field as a field of legitimate social activity can thus be linked to processes of legitimization related to the ways in which preservation practice is institutionalized and engaged in by preservationists through their adoption of normative practices. The development and the circulation of standards, the adoption of codes of ethics, and the documentation of preservation practices are a few examples of practices that legitimize the preservation field and its collective stocks of knowledge. In the following section I will discuss the sociology of knowledge approach to discourse (SKAD), its central theoretical assumptions and how it fits into my theoretical framework.

5.1.2 Sociology of Knowledge Approach to Discourse (SKAD)

Developed and implemented by sociologist Reiner Keller (2005; 2006; 2011; 2012; 2013), SKAD synthesizes the sociology of knowledge tradition of Berger and Luckmann (1966) and the discourse analysis of Michel Foucault (1970; 1972). Keller sees common ground between these two theoretical traditions, suggesting that "both traditions are based on the assumption that everything we perceive, experience, sense is mediated through socially constructed and typified knowledge (e.g. schemata of meanings, interpretations

and actions)” (Keller, 2013, p. 61). SKAD integrates the micro-level analysis of individuals’ drawing from social stocks of knowledge of Berger and Luckmann (1966) with Foucault’s (1970; 1972) macro-level analysis of the discursive shaping of historically inscribed regimes of knowledge (Keller, 2013). Since this proposed research seeks to gain integrated understanding into preservation knowledge at the levels of discourse and practice, SKAD will be useful for integrating the macro analysis of the discursive construction of preservation knowledge within codified forms of knowledge and the micro analysis of the practices of preservationists as they creatively adopt preservation knowledge into their work of artisanal digital reformatting.

SKAD expands Berger and Luckmann’s (1966) focus on individual processes of knowledge construction and language use to post-structuralist conceptions of discourses as “competing in the everlasting struggle over symbolic order [and emerging] out of historically situated practices and ‘problematizations’” (Keller, 2005, para. 11). This is important for understanding the construction of preservation knowledge related to visual documents because standards and specifications for the digital reformatting of these types of documents have been controversial and debated (e.g., see: Lischer-Katz, 2014b, for an analysis of the debates surrounding the JPEG2000 standard as a format for preserving analog video recordings). From the SKAD perspective, discourses are understood in terms of their capacities to structure and delimit what can be said and what can be known. The SKAD approach has implications for my research because it allows micro-level research data, such as standards documents specifying preservation practices to be understood as fragments of the discourse of preservation, useful for analyzing the epistemological assumptions and knowledge processes within preservation practice. This

understanding of discourse allows for inquiry into the structures in which preservation knowledge can take form, by analyzing enunciations in the form of interview transcripts, documents, practices and infrastructures and how institutional processes shape and are shaped by discursive practices of documenting and defining “legitimate” preservation practice) and embodied and technological practices in the calibration of digitization equipment and the work of producing and evaluating digital manifestations of visual documents in the context of artisanal digital reformatting.

The SKAD approach will support inquiry into preservation practices and discourses articulated within institutionalized forms of preservation knowledge, standards, locally produced guidelines and normative practices. SKAD provides the concepts of *subject positions*, *dispositifs* and *classifications*, which are used in this dissertation research to support inquiry into the discursive construction of preservation knowledge and its materialization in practices, artifacts and infrastructures, complementing analysis of the phenomenological, experiential dimensions of practice (discussed further in section 5.2).

5.1.2.1 Subject Positions

According to Keller (2013) social actors occupy “subject positions” within a discourse, defining who may speak and who should listen as part of a subjective positionality. In the discourse of preservation knowledge, technical experts and staff members at large preservation organizations (such as the Library of Congress) can be seen to occupy authoritative subject positions from within which to produce influential documents that shape preservation practice in the broader U.S., or even worldwide. In the case of digital reformatting some social actors (such as preservation experts and digitization systems

designers) maintain the authority to produce standards documents and other forms of knowledge that circulates throughout the preservation community in order to shape local practices in other preservation organizations, while other social actors (such as archivists, librarians and museum conservators) are responsible for planning and carrying out the work of preservation. The preservation knowledge of this second group of social actors is focused on executing plans and putting preservation knowledge into action. Keller (2013) notes “discourses are directed to potential addressees and configures these in a specific way” (p. 80). Thus, within the dominant discourse of preservation knowledge, the institutional field of preservationists can be seen as the addressees for the many reports, standards documents and other discourse-statements produced and disseminated by experts in dominant subject positions, and it is through this addressing, that preservationists are configured as particular types of subjects.

Preservationists can be seen as a class of social actors who have professional affiliations through membership and education in the fields of archives, libraries and/or museums and can be seen as constituting a heterogeneous community of practitioners. Official titles of preservationists can vary from such titles as preservation specialist, preservation technician, archivist, curator and conservator, each implying various configurations of education, skill and organizational affiliation. Preservationists may even hold different definitions of key concepts such as “preservation” itself (Gracy, 2007). This implies that preservationists, as a social group, cannot be treated as monolithic, but as a group that covers a range of social actors. In the context of the discursive construction of preservation knowledge, the subject position of a “preservationist” is defined in terms of how discourse-statements, such as standards

documents, address and configure preservationists as a particular audience. Thus, from the macro-level SKAD perspective, “preservationist” denotes a general subject position that social actors may fill within the discourse of preservation knowledge that is sustained within public documents, beyond the specific institutional context of their local practice. Since preservation knowledge is activated and given material form within preservation practice, it is also important to take into account the ways in which discourse becomes materialized in practice. SKAD uses the concept of *dispositif* to refer to human-created objects or systems that provide the means by which discourse may become materialized and enact power-effects in the world.

5.1.2.2 *Dispositifs*

In addition to the texts and utterances of preservationists, the SKAD approach can be used to analyze the practices, tools, technologies, etc. that preservationists use in their everyday work of digital reformatting. Discourses can be seen to have material effects through their shaping of infrastructures and practices, understood through the concept of *dispositif*. Keller (2013) elaborates on Foucault’s (1970; 1972) concept of *dispositif*, defining it as the material configuration of human agents, tools and discourses “that are the basis for the production of a specific discourse and/or for the production of a discourse’s power effects, its interventions into the world” (Keller, 2013, pp. 52-53). Dispositifs are objects through which discourses gain material reality through such things as architecture, technological configurations, filing systems, regulations, etc. Giorgio Agamben (2009) suggests that a *dispositif* can be “anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviors, opinions or discourses of living beings” (p. 14). The complex technological

configuration of digital reformatting fits into this definition. Considering digital reformatting technology—a sociotechnical amalgam of scanning technology, visual displays, visual documents, furniture, tools and the preservationist’s knowledgeable and trained body— as a *dispositif* allows the material dimensions of the work of artisanal digital reformatting to be analyzed as components of discourse. The education of perception and the training of bodies to engage in legitimate ways with digitization equipment, computer screens and archival video tapes, and the configuration of these technologies together work to give material form to discourses of preservation knowledge. *Dispositifs* can thus be seen as the totality of social and technical infrastructures by which a discourse is “(re)produced and achieves effects” (Keller, 2013, p. 73). Using concept of *dispositif* in this dissertation research is helpful for thinking about the role played by the visual technologies used in the artisanal digital reformatting of analog video recordings, in materializing discourses of preservation knowledge within practice.

Visual technologies can be understood as *dispositifs* in terms of how they discursively shape visual knowledge, which can be linked back to the social and material positioning of social actors within a discourse. The discursive construction of these *dispositifs* can be analyzed in the work of preservationists involved in artisanal digital reformatting and in the standards, guidelines and documents that shape these practices, in order to understand epistemological assumptions about visual perception and the truth claims about the nature of digital copies produced. John Tagg (1988) draws attention to the historical development around the discourses that have constructed the capacity of the photographic image to capture reality and have led to regimes of visual documentation

and constructions of evidence for social control. Focusing on visual *dispositifs* means looking at practices and material artifacts such as museum exhibits, classification systems, architectural configurations, and other institutional contexts that shape the appearance of visual phenomena (Rose, 2012). Incorporation of an analysis of visual dimensions into discourse analysis research has been used by Gabriele Christmann (2008) to explore the discursive construction of the visual terrain of Dresden as an historic urban space through books of pre and post bombing photographs. Iulian Vamanu (2014a; 2014b) incorporated visual analysis into his larger SKAD framework in order to understand how art exhibits produced by indigenous curators contributed to the structuring of indigenous knowledge. Similarly, preservationists can be understood to be reconstructing knowledge through *dispositifs*, as the re-production of visual manifestations of visual documents through artisanal digital reformatting methods. Preservationists rely on a range of visual imaging technologies, such as computer hardware, scanners, scopes, calibration targets, wiring diagrams, software interfaces, etc., to produce legitimate digital manifestations. These *dispositifs* enable the practices of preservationists to reproduce and actualize preservation knowledge, acting as the infrastructures that materialize discourse within artisanal digital reformatting and embedding epistemic assumptions about the nature of visual knowledge.

The concept of *dispositif* is thus useful for this dissertation research because it offers an analytic lens for considering the roles played by the full range of material objects and systems that become activated within the work of artisanal digital reformatting, drawing attention to the tools and infrastructures that support preservation knowledge and help to materialize it in the work of artisanal digital reformatting. In

addition to the concepts of *subject positions* and *dispositifs*, Keller (2013) also develops a conceptualization of *classifications* that is useful for exploring other dimensions of knowledge construction in the context of artisanal digital reformatting of analog video recordings.

5.1.2.3 Classifications

Keller (2011) defines classifications as “more or less elaborate, formalized, and institutionally fixed forms of social typification processes. Like every form of sign use, language usage within discourses classifies the world, separates it into particular categories which are the foundation for its experience, interpretation and way of being dealt with” (p. 57). For example, preservation knowledge relies on categories and classifications in the production and evaluation of the digital products of artisanal digital reformatting practices. Classifications may be hotly debated within a discourse because the construction and propagation of classifications can “have specific impacts for action (see Bowker and Star 1999 or e.g. Douglas 1966, 1986)” (Keller, 2011, p. 58). The adoption of certain classifications, such as those embedded in standards (Bowker and Star, 1999) may privilege one group of users over another group. In the case of preservation institutions, for instance, the adoption of a particular preservation standard could privilege larger organizations over smaller ones if the standard is very costly to implement. In addition, classifications play an important role in the work of preservationists. Preservationists classify different levels of preservation quality, different techniques, and different types of errors produced through the digitization process. Artisanal digital reformatting invokes a variety of classifications and standards that shape practice, from calibration tools (scopes, rulers and targets) to workflow diagrams and

organizational policy documents. These artifacts constitute local classification systems that aid preservationists in applying their educated visual perception in order to produce legitimate digital manifestations of analog originals.

Together, the concept of *classifications* along with the concepts of *subject positions* and *dispositifs* are useful for providing insight into how preservation knowledge is constructed within standards documents and articulated through the discursive and non-discursive practices of preservationists in their work of artisanal digital reformatting of visual documents. In the following section, I will discuss another major theoretical perspective that guides this dissertation research, Interpretive Phenomenological Analysis (IPA).

5.2 Interpretive Phenomenological Analysis (IPA)

Theorists of visuality point to both the difficulty in articulating visual experience in words and the role played by language and socialization in shaping our practices of seeing the world (Foster, 1988). The assumptions and analytic strategies of interpretive phenomenological analysis (IPA) assist in this dissertation research for studying visual dimensions of preservationists' experiences of digital reformatting, generating insight into their educated perception, embodied understanding and aesthetic judgment of preservation practice. IPA supports the interpretation of the lived experiences of preservationists as they carry out the work of artisanal digital reformatting. The visual artifacts - computer monitors, scopes, calibration targets, etc. – are also important elements of the technique of digitization, and analyzing preservationists' experiences of engaging with them as they carry out their work offers insights into the discursive construction of visuality in their work. These visual artifacts are analyzed in terms of how

preservationists experience them in their work because they embed particular assumptions about vision and visuality and shape visual experience. Including phenomenological inquiry alongside a discourse analytic approach seeks to offer a perspective that integrates an analysis of the material and discursive construction of knowledge systems with subjects' experiences of those knowledge systems.

Interpretive phenomenological analysis (IPA) adopts the program of phenomenology, as developed in various ways by such philosophers as Edmund Husserl (1982), Martin Heidegger (1962) and Maurice Merleau-Ponty (2002), each affirming the view that experience “should be examined in the way that it occurs, and in its own terms” (Smith, et al., 2009, p. 12). Taking a phenomenological perspective involves stepping out of our everyday lived experience, our *natural attitude*, and taking a *phenomenological attitude*, which directs the researcher's focus from “objects in the world... towards our perception of those objects” (Smith, et al., 2009, p. 12). IPA involves applying a phenomenological attitude to the generation of qualitative data, with the analysis of that data guided by the assumptions of hermeneutics. In this dissertation research, preservationists' reflections on their work are analyzed as interpretations of their own individual sensory and affective experiences associated with entering the preservation field and carrying out the work of artisanal digital reformatting. Hermeneutic analysis identifies a particular interpretive perspective on the analysis of generated data, indicating an iterative process of analysis at different levels of the text being analyzed, and at different levels of interpretation (Smith, et al., 2009). In studying preservationists this means considering their descriptions of their lived experiences at the level of each statement, how each statement fits into their descriptions, and how those descriptions fit

into the larger narrative of the practice of artisanal digital reformatting of analog video recordings. The hermeneutic circle is a method for integrating analysis of generated data at multiple scales of analysis, from words to paragraphs to entire oeuvres, to everything in between. The point is that the process of interpretation is iterative, cyclical and indeterminate. Building on Heidegger's (1962) interpretive phenomenology, Merleau-Ponty (2002) stresses the situatedness of human experience, and understands the body as playing a central role in experience. As a methodological approach for social inquiry, phenomenology is used to analyze the meaning of individual human experience²⁴ rather than focusing on the metaphysical concerns of philosophers. This distinction is important because the original program of phenomenology as developed by Husserl (1982) was concerned with transcendent understanding of the basis for human experience, whereas interpretive analysis as applied in qualitative research is focused on gaining insight into particular lived experiences. Like other interpretive methods, phenomenological inquiry assumes an idiographic rather than a nomothetic epistemology, focusing on the particulars of human experience rather than attempting to make generalizations. Even though they focus on small, purposefully-selected groups of participants, the findings of phenomenological studies can be generalized using alternative methods, such as "analytic induction and the quasi-judicial approach" (Smith, et al., 2009, p. 31), which are applicable to case study research.²⁵ In this dissertation research, IPA is used to look at the

²⁴ The status of the term "experience" has been contested in Western thought, garnering particular suspicion from late-20th century Marxist and feminist perspectives. In *Songs of Experience*, Martin Jay (2005) traces the historical understanding of experience from the ancient Greeks to early-21st Century thinkers.

Phenomenology has run up against critical theorists because of the assumption made by critical theorists that experience is always filtered through one's subjectivity, and one's subjectivity is shaped through the hidden machinations of ideology (or patriarchy, in the case of critical feminist thinkers).

²⁵ Smith, et al. (2009) explain that *analytic induction* involves testing tentative hypotheses on each case, revising the hypothesis as needed, until a hypothesis can account for most of the cases. The quasi-judicial

interpretive experiences of participants related to their visual practice as preservationists engaged in the work of artisanal digital reformatting, with commonalities and differences drawn across participants to gain insight into a common experience of digitization in similar contexts. This involves encouraging preservationists to verbalize their visual experiences, which means that their interpretations of their experiences, not the experiences themselves are captured as empirical data. IPA explicitly acknowledges the “double hermeneutic” of phenomenological inquiry, which requires an intensely self-reflective dimension on the part of the researcher. According to Smith, et al. (2009), “the researcher is making sense of the participant, who is making sense of x” (p. 35), thus, when interpreting data, the researcher must acknowledge that it constitutes a participant’s *interpretations* of lived experience, and not access to the experience in itself.

Using IPA in this research complements the discourse analytic view offered by SKAD, offering insight into how the lived experience of preservationists fits within ongoing discursive struggles at the institutional level. For instance, the meanings ascribed to visual phenomena presented on preservationists’ scopes or computer monitors may be in tension with the codified guidelines being circulated. From this perspective, looking at tensions that might develop between how preservationists interpret their visual experiences of artisanal digital reformatting and the legitimizing power of codified forms of preservation knowledge that circulate in their community gives insight into how visual regimes of knowledge are constructed and put into practice.

IPA supports the analysis of how individuals interpret their experiences, which opens up opportunities for studying how preservationists make sense of their visual

approach, on the other hand, follows the model of case law, with each case analyzed on its own and compared to each other (Smith, et al., 2009).

experience as they conduct digital reformatting work. From a phenomenological-hermeneutic point of view, this work in itself can be seen as interpretive. In the following section, I will discuss how the perspective of social practice theory complements these conceptualizations drawn from discourse analysis and phenomenology, and it is helpful for understanding the work of preservationists carrying artisanal digital reformatting of analog video recordings as an emergent social practice.

5.3 Social Practice Theory

Concepts drawn from social practice theory are helpful for addressing the embodied-perceptual and tacit modalities of knowledge construction that emerge in the articulations of meaningful practice and are difficult to articulate in discourse. Sociologist of science, Harry Collins argues “all types of knowledge, however pure, consist, in part, of tacit rules which may be impossible to formulate in principle” (p. 167). Tacit knowledge refers to knowledge that is not typically verbalized, including knowledge that is taken for granted or kept secret, as well as the knowledge that cannot be verbalized because it is “uncognized” or “uncognizable” (Collins, 2001).²⁶ The focus on the socially-meaningful material and embodied conditions of practice are relevant to the study of preservationists, helping to link the ways discourse (as classifications, standards, “best practices,” moral commitments etc.) brings phenomena (the signifying properties of visual documents, digital manifestations of visual documents, and practices of evaluation) into view, and

²⁶Collins (2001) identified five categories of tacit knowledge: *Concealed knowledge* (keeping “tricks of the trade” to oneself, or having limited space to fully present information in the space of a journal article); *mismatched salience* (two parties, A and B focus on different important variables such that “A does not realize that B needs to be told to do things in certain ways, and B doesn’t know the right questions to ask”); *ostensive knowledge* (“words, diagrams, or photographs cannot convey information that can be understood by direct pointing, or demonstrating, or feeling”); *unrecognized knowledge* (“A performs aspects of an experiment in a certain way without realizing their importance”); and *uncognized/uncognizable knowledge* (“such abilities can be passed on only through apprenticeship and unconscious emulation” (p. 72).

how the sociotechnical arrangement of infrastructures, tools and actions constitute legitimized ways of visualizing and representing visual documents.

Social practice theory takes practices as its unit of analysis and is primarily concerned with understanding socially-shared ways of doing. This complements the sociology of knowledge perspective that is focused on how knowledge is constructed through discourse across multiple social levels. Social practice theory focuses on types of knowledge that enable membership in social groups and shared understandings, including embodied forms of knowledge. Tiffany Veinot (2007) explains “practice theory contains a unique understanding of the body, which ‘highlight[s] embodied capacities such as know-how, skills, tacit understanding, and dispositions’ as the basis of activity (Schatzki, 2001)” (Veinot, 2007, p. 160). This embodied understanding of human practice coheres with two other frameworks in this research, the social construction of reality (5.1.1) and interpretive phenomenological inquiry (5.2).

Social practice theory constitutes a family of social science approaches (Nicolini, et al., 2003, p. 12) that place a phenomenological-based notion of practice at the center of analysis. Practice theory has helped to extend information literacy research from considering explicit and instrumental forms of knowledge to include the tacit and kinesthetic. These types of knowledge may be tied to individual bodies, but they become meaningful through their emergence within the context of particular practices.

Practice theory has also seen useful application to studying the information practices of blue-collar workers (Veinot, 2007), which is relevant for this study because artisanal digital reformatting work also involves visual and kinesthetic knowledge to be carried out successfully in a routine work setting. Studying practices emphasizes the

shared dimension of meaningful human activity, its embodied character, and the fact that the complexity of human activity is irreducible to explicit representations of instrumental knowledge (e.g. recorded in standards documents). Veinot (2007), following Etienne Wenger, offers the following definition of practice: “‘practice’ involves ‘doing in a historical and social context that gives structure and meaning to what we do’ [60, p. 47]” (p. 159). Research projects that adopt practice theory as a theoretical perspective take as their basic unit of analysis “sets of actions that are based on the interconnectedness of their various nonreducible elements” (Veinot, 2007, p. 159). Focusing on practice adds tacit forms of knowledge, such as situated judgment, embodied understanding and educated perception, as dimensions for analysis. Considering these types of knowledge are important to this dissertation research because the work of artisanal digital reformatting involves a range of visual and kinesthetic elements that SKAD and IPA do not fully address. Social practice theory also draws attention to the embodied knowledge required for even what is perceived to be routine work. In the context of organizational knowledge, Antonio Strati (2003) offers the concept of “aesthetic knowledge,” which links the individual mastery of perception and aesthetic judgment required by a practice to the social dimensions of shared understandings, norms and standards through which the practice may be mastered. Even though digital reformatting may appear to be a mundane, technical procedure, it requires skill, expert knowledge and visual education (Conway and Williams, 2010). Exploratory research on the information practices of digitization technicians working in a academic library setting (Lischer-Katz, 2014a) suggests that even digitization projects perceived to be routine and low-skilled, such as book scanning, may require some degree of aesthetic judgment in order to be carried out

successfully. Artisanal digital reformatting, on the other hand, is a form of digitization that requires considerable skill and educated perception to be carried out, in contrast to work carried out in current mass digitization projects that are designed to deskill and automate the digitization work as much as possible to enable fast and efficient digital output.

Conceptualizing artisanal digital reformatting as a social practice draws attention to aspects of knowledge construction within the work of digital labor that are *situated* (Suchman, 1987) and *embodied* (Merleau-Ponty, 2002), and thus, difficult to observe and formalize into automated routines. This approach is useful for understanding the limitations of standardization to fully define the knowledge necessary to carry out the work of artisanal digital reformatting. Lucy Suchman (1987) suggests that the goal of conceptualizing action as *situated* is “not to produce formal models of knowledge and action, but to explore the relation of knowledge and action to the particular circumstances in which knowing and acting invariably occur” (p. 178). The focus of social practice theory on situated and embodied forms of knowing helps practice theory to move information studies research away from cognitivist understandings of actions attributed to individuals, to individual actions enacted within socially-shared contexts of understanding that operate “within expectations or ‘the accountability of a shared way of doing’ (Corradi, et al., 2010, p. 277) set up in a practice” (Cox, 2012, p. 177).

Andrew Cox (2012) notes practice theory approaches have been applied to sociological studies that examine a variety of bounded, skilled contexts, such as “hammering, flute making, roof tiling, and cooking in an haute cuisine restaurant” (p. 183). Practice theory has also seen ongoing use in information literacy research,

particularly in the work of Annemaree Lloyd (2009, 2010, 2011, 2012) and others (e.g., Sundin and Francke, 2009; Tuominen, Savolainen and Talja, 2005). Practice theory extends the range of information-related phenomena to include information practices related to the physical manipulation of tools and documents in digital and physical spaces, and it emphasizes the specificity of interactions with particular interfaces, textual genres and standards in particular contexts, and how they shape information-related activities. In reviewing the literature on practice-based research in information studies, Cox (2012) found that one limitation of existing social practice theory research is its overemphasis on “non-cognitive forms of knowing,” and its failure to integrate an understanding of “abstract knowledge and local knowing” (p. 183) through its reliance on ethnographic methods. Cox (2012) acknowledges that non-cognitive forms of knowledge are central to many professions, suggesting “skilled professional and expert performance leverages tacit understandings and sensory experience to adjust to the contingencies of a particular situation [33]” (p. 183). However, Cox (2012) suggests this focus tends to ignore abstract knowledge and the extent to which “knowledge in many forms of work is able to be made explicit and be generalized” (p. 183). In the context of artisanal digital reformatting, taking into account both types of knowledge is essential for a full understanding of knowledge construction in this context. Routine, specifiable knowledge, which standards and other codified forms of knowledge seek to encode and transmit, can be seen to be in tension with the embodied and situated aspects of digital reformatting work that emerge within local practices. In this research, integrating social practice theory with the SKAD and IPA approaches helps to bridge this analytic gap between abstract and practical forms of knowledge, connecting the discursive construction of

preservation knowledge with its embodied and situated enactment in unique local practice.

Adopting a phenomenological perspective to research draws attention to the uniqueness of human actions and experiences, rather than their predictability and ability to be formalized into routines. This is particularly relevant for studying artisanal digital reformatting, since this work relies heavily on educated visual perception, which is difficult to fully put into words and unfolds within dynamic contexts of complex visual technologies that interact and behave in unpredictable ways. Lucy Suchman (1987) suggests that human “actions, while systematic, are never planned in the strong sense that cognitive science would have it. Rather, plans are best viewed as a weak resource for what is primarily *ad hoc* activity” (p. ix). In this sense, our engagement with the world is best understood as “situated” (Suchman, 1987) in the particularities of changing conditions of human experience. Thus, from the perspective of social practice theory, the work of preservationists can be seen as always situated, resistant to being completely broken down into discrete steps and codified. This work relies on preservationists to make judgments that involve negotiating between visual and haptic engagement in the context of a complex and evolving system composed of their bodies, the digital and analog technologies they use to make the digital manifestations, and representations of those digital manifestations displayed as visual images, charts and scopes on screens that provide feedback for evaluating the outputs of their work. Thus, even though the work of artisanal digital reformatting relies on “routine knowledge,” as defined in the earlier section on Berger and Luckmann (1966) and the social construction of reality, this

routine knowledge cannot be completely articulated in discourse. That is, certain forms of knowledge – particularly, haptic and visual – are often difficult to put into words.

Social practice theory is thus primarily concerned with embodied knowledge and socially-shared ways of doing, which are difficult to capture entirely in language. In terms of the other approaches incorporated into this larger theoretical framework, SKAD is more focused on how knowledge is constructed through discourse, and phenomenological analysis is more focused on analyzing individual experiences. Social practice theory complements these other perspectives by encouraging the researcher to pay close attention to those types of knowledge that shape practice, perception and institutional infrastructures, but that are not easily expressed through language or formalized in plans. Social practice theory allows for analysis to move between individual, embodied experiences of artisanal digital reformatting and the emergence of socially shared meanings and normative practices that can be understood across a community of practitioners. Understanding these constructions of normativity are important for connecting analysis at the level of codified knowledge, in the form standards and codified knowledge encoded in documents, with the level of material practice and constructions of normative action. Social practice theory establishes the foundation for beginning to understand individual practices as socially-shared and shaped in part by normative pressures of a community of practitioners. The construction of normativity plays an important role in the construction of preservation knowledge and practice, and is also a focus of research in cultural structuralism, which will be described in the following section.

5.4 Cultural Structuralism

The perspective of cultural structuralism, as defined by Robert Wuthnow (1987) will be useful for understanding how discourses and practices of artisanal digital reformatting contribute to the construction of normativity in the practice of artisanal digital reformatting of analog audio recordings, by relating preservationists' expressed moral commitments to their enactment in local practice. The cultural structuralism of Wuthnow (1987) offers a unified theoretical framework for integrating the analyses of the construction of preservation knowledge in terms of discourse, practice and experience, into an understanding of the production and maintenance of the "moral order" of preservation, i.e., how preservation values, such as *trustworthiness* and *authenticity* are constructed and sustained through discourse and practice. While social practice theory cautions us against reducing human activity to cultural determinants, Wuthnow's (1987) approach allows for some connections to be made between different levels of analysis without reducing them to causal relationships. In particular, the concept of *moral order* is important for understanding how the practice of artisanal digital reformatting is embedded in a larger framework of institutional and professional moral commitments, by relating actions and discourses to cultural values. Wuthnow (1987) defines *moral order* generally as "a set of definitions about what is proper to do and what is reasonable to expect" (p. 14). The articulation and maintenance of values ascribed to documents such as *authenticity* and *integrity*, among many others, are integral to constructing and maintaining the moral order of preservation in the institutional and professional contexts of archives, libraries and museums. It is through constructions of normative work that local practices of preservationists put values into practice. Moral order is shaped by

ideological and symbolic dimensions, which express particular beliefs about how the world should be. Adding this analytic lens helps conceptualize practices, discourses and experiences of preservationists within the normative structures of the preservation field.

Disagreements in the preservation community over key archival concepts, such as the meaning of “preservation” itself (Gracy, 2007), suggests that basic symbolic elements of the moral order of preservation knowledge may be contested by competing social groups. Moral order is thus not monolithic but operates at points of tension, such as in debates within a community over the definition of normative activity. For instance, the staff of an academic library may operate under certain normative expectations for how they should treat the materials held in its collections, what initiatives they should engage in, and how they should document and report on their activities. Similarly, a person who identifies as a preservationist, and is digitizing collections, gives meaning to their practice through ethical considerations about how best to maintain the significant properties or archival values (such as uniqueness, authenticity, provenance, etc.) of the documents in being cared for. In this manner, normative expectations about “appropriate” actions shape a practice and make it meaningful. As an emergent practice, artisanal digital reformatting of analog video recordings can be analyzed as a site in which practice is being actively shaped to conform to the normative expectations of the preservation community.

Of central interest in Wuthnow’s approach is understanding how people “maintain the moral commitment” to particular courses of action within social organizations (Wuthnow, et al., 1984, p. 2), a program of research that he defines as studying the structure of *moral codes*. Jonathan Turner (1998) summarizes Wuthnow’s (1987) approach, defining moral codes in terms of how the expression of commitments to

principles is enacted in practices. Turner (1998) breaks down Wuthnow's (1987) conceptualization of moral codes into three structural elements: Objects of commitment (e.g. statements of moral commitment, policy documents, codes of ethics, etc.) and real programs, i.e., material activities that put those commitments into action; the construction of identities, which articulate tensions between self and the roles that people must take on in a cultural context; and the distinction between inevitable and intentional activities (Turner, 1998), i.e. what are the limits of an individual's locus of control. For instance, in the case of preservationists, we might inquire into how much control they have over which standards they may be able to adopt into their work. Wuthnow identifies institutional context and ideology as key dimensions of cultural analysis (Turner, 1998). For Wuthnow, institutional context includes all "material goods, money, leadership, communication networks, and organizational capacity" (Turner, 1998, p. 507) that support the moral order. In the case of the practices around artisanal digital reformatting, they are carried out within cultural institutions that work to conform to particular codes of ethics and articulate certain values at different scales and levels of an interconnected ecosystem of preservation.

The concept of ritual is also important to maintaining the symbolic order of the institutional contexts of preservation institutions. Wuthnow (1987) defines ritual as social practices that "communicate meanings rather than being performed for purely practical or instrumental purposes" (p. 99). In the context of artisanal digital reformatting of analog video recordings, rituals include the methodical cleaning of equipment and tapes before every tape transfer, as well as other repetitive tasks that go above and beyond practical considerations. These rituals have an instrumental dimension, i.e. there is a practical

rationale for them, but at the same time they express a preservationist's commitment to archival values of care and the integrity of archival documents. Wuthnow (1987) notes that this distinction between instrumentality and expressiveness in human activity is analytic, since all human activity can be seen to have both dimensions to some degree. In the case of this dissertation research, focusing on those micropractices of media preservationists that have strong expressive dimensions, such as repetitive cleaning, offers insight into how practical and expressiveness dimensions are intertwined within the construction of normative practice in the practice of artisanal digital reformatting of analog video recordings. Understanding the "rituals" of preservation, such as the systematic and repetitive cleaning of equipment, the use of white gloves and the verifying of proper video signals by using multiple video monitors, above and beyond their pragmatic value in carrying out the work of digitization, offers insight into what preservation practices communicate about the work of the preservationists and the symbolic codes that are being used to construct artisanal digital reformatting of visual documents as a normative practice. The example of "cleaning" equipment is ritualistic in the sense that it is a structured and repetitive activity that always precedes the start of a new digitization session. Cleaning also has practical motivations, too, as a means of preventing dirt to cause errors in the video signal and disrupt the digitization process.

The approach to cultural structuralism developed by Robert Wuthnow (1987) offers a perspective that allows for an integrated analysis that combines the embodied, visual and institutional forms of knowledge construction and evaluates them in terms of the roles played by institutional agents, professional activities and moral commitments. It is useful for gaining insight into how knowledge is constructed in the context of artisanal

digital reformatting in order to bring legitimacy and establish normative actions for an emergent preservation practice.

This approach connects the discursive structuring of knowledge, subjects and moral order to considering the specific mechanisms by which cultural practices are articulated, shared commitments to values and understandings about their professional practice. This has important implications for understanding the relation between processes of knowledge construction, the integration of external standards into practice and the construction of professional identities. By highlighting the processes by which preservationists articulate commitments to the moral order through their practice, Wuthnow's (1987) framework offers insight into how the knowledge construction of preservationists shapes and is shaped by discourses of preservation principles and constructions of normative preservation practice(s). Adding this analytic lens helps focus on the cultural practices of preservationists that link them together into a shared discursive community that includes tensions and straddles multiple professional identities (libraries, archives, museums and other organizational types). Connecting institutionalized and practice-based knowledge construction to the moral order of preservation aids in evaluating the discourses and practices of preservationists in terms of how they negotiate institutional and professional principles and moral obligations within the discursive space of preservation knowledge. Because it is an emergent preservation practice, analyzing the structure of moral codes articulated within the work of artisanal digital reformatting of analog video recordings offers a useful context in which to observe tensions between the normative pressures of codified preservation knowledge and institutional and professional organizations, and the creative and embodied practices

of preservationists carrying out this work. For example, if generally accepted standards for digitizing a particular type of visual document were not yet established, a preservationist might extensively document the techniques and tools were settled on in order to legitimize his practice. In this case, the construction of moral codes around a documentary regime are necessary for conforming the practice to the normative constraints of preservation knowledge, even if there is uncertainty or ambiguity about the knowledge of a particular practice. Furthermore, since some aspects of the artisanal digital reformatting resist routinization, the articulation of moral codes by preservationists engaged in this work offers insights into how this emergent practice becomes established as normative in the context of preservation knowledge. Considering the structure of moral codes, how moral commitments are put into practice, offers another dimension for considering processes of knowledge construction in the context of artisanal digital reformatting of analog video recordings. In following section I will summarize the sections of this chapter and transition to the next chapter.

5.5 Chapter Summary

This chapter has outlined the theoretical framework for this dissertation research. This framework enables analysis of knowledge construction in the context of artisanal digital reformatting at the levels of practice, discourse, and experiences of preservationists, and how these levels relate to constructions of normative action. These different levels of analysis are necessary for looking at the interplay between material practices, discourses, normative expectations and principles in the construction of visual knowledge. Adopting a sociology of knowledge perspective (5.1) gives insight into the discursive construction of preservation knowledge and its shaping of discursive and non-discursive practices of

preservationists. The interpretive phenomenological analysis (IPA) approach (5.2) provides insight into the ways in which preservationists interpret their visual experiences of digital reformatting. Social practice theory (5.3) complements the IPA perspective and provides concepts for understanding the embodied knowledge and educated perception that preservationists draw on when carrying out the work of artisanal digital reformatting. The cultural constructionism (5.4) of Robert Wuthnow (1987) is used to understand how these dimensions of knowledge construction together contribute to maintaining the moral order of preservation knowledge and can be seen to articulate and sustain moral codes. Together, these four theoretical perspectives support a research methodology that supports the research objectives outlined in Chapter 4. The following figure (Figure 4 – Theoretical Model) provides a visual model that summarizes and relates the theoretical perspectives (“frameworks”) to “foci of analysis” and “data sources” within the overall dissertation project. In the following chapter, Chapter 6, I will describe my research methodology and how these forms of data were collected and analyzed.



Figure 4 – Theoretical Model with Data Sources

CHAPTER 6: METHODOLOGY

6.0 Chapter Overview

The following chapter describes the research methodology for this dissertation. The following parts will be outlined: (6.1) the selection of research sites and participants; and (6.2) the overall research process, including (6.2.1) the generation of research data (6.2.2) a summary of the overall research plan; (6.2.3) procedures for data analysis; and (6.2.4) validation strategies and theoretical saturation.

6.1 Selection of Sites and Recruitment of Participants

The selection of sites and recruitment of participants was guided by the theoretical concerns of this research and by my own familiarity of the field of preservation. Having been involved in the preservation field from 2005-2012, I have first-hand knowledge about ongoing projects, familiarity with the types of locations in which digitization is typically carried out and professional contacts at a range of potential research organizations carrying out digitization projects. This familiarity with the field afforded me the ability to easily gain access to sites and understand the context of work. One drawback of this insider knowledge was the risk of becoming too familiar with the context and overlooking salient details that might have stood out to someone less familiar with the work of digital reformatting. In carrying out this research I discovered that there was not a significant risk of being too familiar with this context since I had not been working in the field since 2012 and I had not kept up with the latest developments in digitization techniques. In the following section I will outline the process of selecting research sites and participants.

6.1.1 Research Sites

Andrew Cox's (2012) review of practice-based approaches in information studies research emphasizes the importance of examining practices in context. The practices of artisanal digital reformatting have to be studied in the spaces where these practices are carried out on a daily basis. The micro activities, experiences and discourses of artisanal digital reformatting practices are observable in the institutional contexts of libraries, archives and museums where artisanal digital reformatting projects are planned and carried out. In order to facilitate comparison of practices across sites, sites were selected that were currently involved in digitizing analog videotapes. Narrowing the focus to the digital reformatting of this particular subset of visual document formats is useful because standards for these types of visual document formats are still emergent and the discourses around them are likely to be more visible than for other types of visual documents, such as still-image collections, where knowledge about them has become stabilized, systematically codified in guidelines and standards.²⁷

The following selection criteria were used to identify sites of artisanal digital reformatting of visual materials for this research: The digital reformatting of complex visual materials, i.e. analog video tapes, is currently being conducted; the mode of digital reformatting is characterized by highly skilled and relatively low output; and the institutional context is an organization committed to preserving the informational and aesthetic values of visual documents.

Identification of sites of artisanal digital reformatting based on these criteria

²⁷ Digitization experts Paul Conway and Don Williams (2011) suggest "after fifteen years of systematic effort, it appears that the cultural heritage community now has access to imaging expertise and a variety of sophisticated guidelines for digitization that accomplishes preservation purposes" (p. 66).

followed a three-step process:

1. Organizations that preserve film and video collections were identified by consulting the organizational member directory for the Association of Moving Image Archivists (AMIA), which is the largest North American professional organization for preservationists working with film, video and digital media collections in libraries, archives and museums. This process was aided by my existing knowledge of this network of preservationists and institutions, which I developed through my earlier involvement with AMIA. I have been a member of AMIA since 2006 and attended its annual conference from 2006-2012.
2. Organizations were identified that are presently conducting digital reformatting projects involving film and/or analog video. This involved searching the websites of potential organizations to find any information indicating that they were conducting these types of projects. The mission statements of each organization were also found on their official websites and were examined to establish the commitments of organizations to preserving the informational and aesthetic values of visual documents.
3. Organizations were identified that are currently engaging in artisanal digital reformatting projects and would be willing to allow data to be conducted on site.

Through this selection process and criteria corresponding to my research objectives, the potential list of sites was initially narrowed down to three sites (two in the Northeast and one on the West Coast) that would be well suited for observing the practices of artisanal

digital reformatting and among those, would be willing to allow research to be conducted at their location, and would be practically accessible for conducting the research in a timely manner. Between the time of writing the dissertation proposal and the start of research, one of the three sites initially selected for conducting research indicated that they were no longer able to host research activities. It also became apparent that the sites had fewer potential participants than expected (one site only had one participant that was currently engaged in any digital reformatting projects). Consequently, I put out a second call for participation, which yielded six additional sites. Introductory emails (See Appendix A – Email to Site Administrators) were sent to administrators at the institutions deemed to be open to research in order to gain permission to conduct research on site. Of these six sites, one of these sites was deemed unsuitable due to lack of access and to the lack of archival professionals doing digitization work, and was thus excluded from the research. Along with the one site in the Northeast still able to participate that was identified through the initial call for participation, this brought the total number of research sites up to six (two on the West Coast, two in the Midwest, and two in the Northeast). The initial difficulty of locating suitable sites in one locality thus pushed the research into a more diverse array of contexts in which to study the emergent practice of artisanal digital reformatting of analog video recordings.

The following final set of six organizations (all are non-profit organizations) was identified that matched the criteria above for identifying sites where artisanal digital reformatting of analog video recordings:²⁸ Site L1: a large art museum (Northeast); Site

²⁸ Names of organizations and their specific locations have been omitted to better preserve participants' confidentiality. While this was not a requirement of IRB approval for conducting this research, I felt that given how small the community of video preservationists is and the fact that each organization has only

L2: a small community video production and preservation center (West Coast); Site L3: a small video and media art distributor and archive (Midwest); Site L5: an audiovisual media preservation project (West Coast); Site L6: an audiovisual preservation lab at an academic library (Northeast); and Site L7: a small community media and video art archive (Midwest).²⁹ Before research began, letters of permission to conduct research at these sites were acquired through contacting site managers and submitted to the Rutgers Institutional Review Board for approval. The project received exempt status on 7/10/15 and received IRB Protocol # E15-834 (See Appendix F – IRB Exemption Letter). As specified in the IRB-approved protocol, research data and related documents will be retained for three years before being disposed. In order to ensure the confidentiality of participants, the letters of permission were excluded from the IRB documents presented in the appendix.

In each site, research was conducted within the lab spaces in which preservationists conduct the work of artisanal digital reformatting of visual documents. At each site, I conducted semi-structured interviews with the preservationists who carry out digital reformatting projects (I will refer to these participants as “digitizers,” as they are directly engaged in the process of digitization), following the interview protocol (See: Appendix D – Interview Protocol). I observed them as they carried out their work and used a video camera to record their physical activities throughout the workflow of digital reformatting. I also analyzed the built-environment and infrastructural elements of the

between 1-3 workers in it, connecting organization names with participants’ positions would make it easy to guess participants’ identities for other members of the community.

²⁹ As discussed earlier, one of the sites identified in the second call for participation, site L4, was excluded from this study, thus the inconsistency in the numbering. Site L4 is a small stock footage company and archive, and while I visited them briefly, but the rigid constraints placed on my access to the site and participants prevented me from collecting the necessary data and including this site in the research.

digitization labs including the types of equipment, tools, and visual displays that participants use in their work of digital reformatting.

At Sites L3, L5, L6, L7 I interviewed administrators who were involved in developing standards and protocols for digital reformatting activities in these sites of artisanal digital reformatting and were overseeing the work of digitizers (I will refer to these participants as “administrators” throughout this dissertation). The administrators whom I talked to were involved in the initial setting up of the preservation labs being studied, so that their perspectives were important to understanding artisanal digital reformatting in these contexts. Sites L1 and L2 had higher rank administrators in the organizational chart, but they were neither involved in the digital reformatting work, nor responsible for the initial configurations of the system.

In the following section I give brief profiles of each site in order to establish the size of each organization, their histories, institutional missions, access to resources and their current digital reformatting projects, as well as outline the particular spaces and people I will be studying. Each site was selected for this dissertation project because it fits the criteria of an organization that is currently engaged in “artisanal digital reformatting.” Observation sessions and video recording were conducted in the media conservation lab space where videotapes and other media are digitally reformatted. Access to each site was accomplished through contacting the head of the preservation department via a media conservator (See: Appendix A for the email that was submitted to department administrators) and distributing the IRB-approved recruitment letter (See: Appendix B – Participant Recruitment Letter).

6.1.1.1 Site L1: Conservation department in a large art museum (Northeast)

Site L1 has a large collection of analog and digital videotapes that they have been digitizing in order to produce digital copies for preservation purposes and for exhibiting in their galleries. The mode of production used at Site L1 is small scale and highly skilled and it has an institutional mission to preserve the informational and aesthetic aspects of documents. Its mission statement expresses a commitment to “establishing, preserving, and documenting a permanent collection of the highest order that reflects the vitality, complexity and unfolding patterns of modern and contemporary art.” Site L1 had only one media conservator who is tasked with digitizing tapes.

Founded in 1929, Site L1’s organization collects and exhibits works of modern and contemporary art. It is a large and well-funded arts organization. It currently maintains a collection of approximately 25,000 film titles in its off-site storage and also maintains film, video and digital works in its collection, which it may exhibit in its screening theaters or install in its galleries. Since 2011, Site L1 has employed a mixture of onsite digitization and some outsourcing to outside contractors.³⁰

6.1.1.2 Site L2: Small community video production and preservation center (West Coast)

Site L2 is currently digitally reformatting visual documents recorded on analog video formats. This work is conducted in a small-scale and high-skilled mode, and Site L2 has expressed commitments to the preservation of the informational and aesthetic dimensions of visual documents. Its mission statement expresses its commitment “to preserve and digitize precious works of media art and other cultural artifacts.”

³⁰ Personal communication with staff member (December 19, 2014).

Founded in 1976, Site L2 provides media arts education and preservation resources. Site L2 is a small arts organization. Since 1994, Site L2 has been offering analog video preservation services to the arts community, digitizing over 7,000 hours of tape.³¹ While it does not maintain its own collection, according to its website Site L2 partners with other arts organizations to help them “preserve and digitize precious works of media art and other cultural artifacts.” Site L2 carries out all digital reformatting activities on-site by two full time and one part time staff member.

6.1.1.3 Site L3: Small video and media art and archive (Midwest)

Site L3 is a small video and media art distributor currently working to digitally reformat its collection of video art recorded on analog videotape. This work is being carried out through a small-scale, high-skilled mode of production, and Site L3 is committed to preserving the informational and aesthetic dimensions of visual documents. Site L3’s mission statement expresses its commitment to “fostering awareness and scholarship of the history and contemporary practice of video and media art through its distribution, education, and preservation programs.”

Founded in 1976, Site L3 is a small, modestly funded media arts organization housed within a large arts education institution in the Midwest. While Site L3 receives some support and space from its parent educational organization, it is primarily funded through state and national grants. According to its website, Site L3 has assembled a large collection of historical and recent video art, totally approximately 6,000 video art titles by over 600 artists. Since 2009, Site L3 has been digitally reformatting videotapes from its collections and made these digital manifestations available through digital media rentals,

³¹ According to institutional website.

sales, and an on-site screening room. Two participants were recruited from this site: One staff member conducts the digital reformatting of this collection on-site, while the other, the administrator who initially set up the digitization lab, manages the digitizer's work.

6.1.1.4 Site L5: Audiovisual media preservation project (West Coast)

Site L5³² is a preservation project located at a large state university on the West Coast. It partners with libraries and archives throughout the state of California to digitally reformat their collections of film, video and audio collections. According to an administrator at Site L5 (P1_L5), as of 2016, L5 was collaborating with 108 “partner” institutions throughout the state (including “museums, libraries, historical societies, [and] independent producers”) and had been involved in digitization projects that covered a range of media formats, including analog videotapes, as well as audiotape and motion picture film. Site L5 carries out small-scale, high-skilled work, and has a small staff of three employees. Two participants were recruited from Site L5, one administrator (P1_L5) and one quality control specialist (P3_L5). Site L5 is committed to preserving the informational and aesthetic dimensions of visual documents. According to its website, Site L5 is “undertaking an urgently needed project to digitize, provide online access, and preserve historic California audiovisual recordings.” Site L5 was formed as a project in early 2011, after producing a report in 2007 that surveyed the need for audiovisual preservation services for state-wide archives, libraries and museums. It began digitizing in May 2011.³³ While physically located in the basement of the academic library of a large state university, Site L5 is independent of its host university, instead receiving the

³² Site L4 was visited, but was eventually excluded from this research because it was found to be an unsuitable site (i.e., the work of digitization was carried out by non-professionals and thus did not fit the definition of artisanal digital reformatting).

³³ From email correspondence (3/8/17) with, participant P1_L5, the administrator who setup and designed the workflows at Site L5.

funding necessary for carrying out its work from external state and national grants from such organizations as the California State Library and the Institute for Museum and Library Services, according to the project website.

The work conducted at Site L5 stretches the definition of “artisanal digital reformatting,” since the preservationists working there are not involved directly in the work that translates analog originals into digital copies. While Site L5 outsources all of its digitization work, it carries out inspection of original media artifacts, as well as careful quality control of the resulting digital copies. Thus, while studying Site L5 does not give a complete picture of the practice of artisanal digital reformatting, it provides some insight into the inspection, handling and quality control components. This provides additional points of comparison and analysis. The quality control process at L5 also involves many of the same competencies for visual analysis involved in digitization. Thus, it was determined that including Site L5 in this study would contribute data that would be relevant to understanding artisanal digital reformatting. Including L5 in this research also helps to clarify the boundaries of artisanal practices of digital reformatting, by considering how the meaning of the practice changes as central components are removed from the work of preservationists.

At Site L5, preservationists inspect analog originals (video, film, and audio), before packing and shipping them to an external contractor for the actual digitization work. Then, the digital files are sent back, at which point the quality control staff at Site L5 conducts quality control procedures using video monitors and video scopes to look for video errors or mistakes made by the off-site digitizers. While I was not able to directly observe the components of the work of digital reformatting that were conducted off-site,

examining how the staff evaluated the digital manifestations produced by off-site contractors was an important source of research data. Observation sessions and video recordings took place in the lab space at Site L5 location where analog originals were inspected and documented, and where the digital files were evaluated on a workstation with computer systems and video monitoring equipment.

6.1.1.5 Site L6: an audiovisual preservation lab at an academic library (Northeast)

Site L6 is an audiovisual preservation lab at an academic library at a large research university in the Northeast. They are responsible for digitally reformatting collections of analog video and audio recordings that are stored in the library's collections, or from faculty collections. This work is being done at a small-scale, high-skilled mode of production, and Site L6 is committed to preserving the informational and aesthetic dimensions of visual documents. Site L6 operates both under the Department of Preservation and Conservation Services, responsible for working with the libraries own collections, and according to the department's website, fully committed to "the American Institute for Conservation (AIC) Code of Ethics and Guidelines for Practice."

Founded in 1865, Site L5's host institution is an established research university. Formed in 1986, the Department of Preservation and Conservation Services developed its audiovisual preservation and began digital reformatting work in 2012. According to the administrator who designed and administers the digitization lab (Participant P2_L6), digitization work for video began in 2012, and they digitize a wide-range of audiovisual materials including motion picture film and audiotape, in addition to analog videotape, which are drawn from collections stored at libraries, academic departments, and faculty members across the university. P2_L5 explained "we're sitting on about 1,700 items

having been digitized. Our new pipelines in our new lab estimate ~2,000 items a year.”³⁴

The 2000 items per year noted by P2_L5 is just an estimate, since at the time of the interview, L5 was still surveying the university campus to get a clearer sense of how much material they would be responsible for digitizing. Through my email communications with P2_L5, I found out that the audiovisual preservation lab has a staff consisting of two digitizers (P1_L6 and P3_L6) and one administrator (P2_L6) who also designed the digitization systems and set the technical guidelines. According to staff members, most of the digital reformatting of the library collection is conducted on-site by full-time staff in the audiovisual preservation lab, while some media formats that they lack play-back equipment for are sent out to off-site contractors for digitization.

6.1.1.6 Site L7: a small community media and video art archive (Midwest)

Site L7 is currently working to digitally reformat its collection of video art and documentaries recorded on analog video tape, through a small-scale, high-skilled method of production. Site L7 also offers its services for hire to digitize the collections of outside archives for a fee. Site L7 is committed to preserving the informational and aesthetic dimensions of visual documents. According to its website, the mission of Site L7 “is to preserve audiovisual records of history and culture and to engage audiences with their creative reuse,” and it has over 7,000 analog videotapes in its collection and has made digital copies of 1,500 of them freely available for online streaming on L7’s institutional website.

³⁴ According to an email from P2_L5, dated 3/24/17, Site L5 has the capabilities to digitize the following formats: “1/4” audio tape, cassette, DAT, LP, VHS/SVHS, Umatic, Beta, DV/MiniDV. P2_L5 also notes that.”

Founded in 2003, Site L7 is a non-profit archive of independently produced artistic and documentary video recordings. It has been digitally reformatting its collections since 2006. The digital reformatting of this collection is conducted on-site by Site L7 staff, as well as off-site by contractors for media formats that they do not have the equipment necessary to play back (such as ½” open-reel video tape). Digitization staff consists of one full-time digitizer (P1_L7), one part-time digitizer (not included in this study because this person was not currently working on any digitization projects during the timeframe of data collection), and one manager who designed and configured the original digitization system (the executive director, P2_L7).

Observations and video recording of the work of digital reformatting took place in the space of the digitization lab where the work of artisanal digital reformatting is enacted. Gaining access to the site was accomplished through contacting the executive director of Site L7 (See: Appendix A for the email that was submitted to department administrators) and the participants were recruited by having the Executive Director distribute the IRB-approved recruitment letter (See: Appendix B – Participant Recruitment Letter).

6.1.1.7 Comparison of Sites

The six sites selected for this dissertation research all share some common characteristics and are also distinctive in several significant ways. In terms of similarities, they all express a commitment to preserving analog video recordings in terms of their aesthetic and/or documentary values, as evidenced by their institutional missions statements (See Table 1 – Profiles of Research Sites); they each operate at a small scale of digital reformatting, as demonstrated by their low output and labor-intensive production

practices; and each employs highly-skilled labor, as evidenced by the fact that all of the participants have advanced academic degrees.

Beyond common characteristics of sites in which the work of artisanal digital reformatting is carried out, the six sites selected differ in terms of their geographic location; institutional characteristics; and their histories of carrying out digitization initiatives. In terms of geographic location, Sites L1 and L6 are both in the Northeast region of the United States. L1 is located in a large city, while L6 is in a rural town. Sites L2 and L5 are both located in the West Coast of the United States. Sites L2 and L7 are located in the Midwest region of the United States,. This diversity in locations provides insight into how the practice of artisanal digital reformatting is geographically oriented. Information about each site is provided in Table 1, below.

	Location	Commitments to preservation from Mission Statements	Year Institution Founded	Digitization Initiatives Started	Collections Being Digitized	Formats Observed Being Digitized
Site L1	Northeast	“establishing, preserving, and documenting a permanent collection...” “Recognizes all forms of visual expression, including painting and sculpture, drawings, prints and illustrated books, photography, architecture and design, and film and video...”	1929	~2011	~1,600 video tapes were digitized	Digibeta Tape Copied from 1/2” Open Reel, to Digital File
Site L2	West Coast	“works to preserve and digitize precious works of media art and other cultural artifacts”	1976	1994 for video tape; File-based digitization workflow: ~2008.	Preserves documents from collections of other organizations	Analog Video formats: ½” open reel, Umatic, Hi-8
Site L3	Midwest	“dedicated to fostering awareness and scholarship of the history and contemporary practice of video and media art through its distribution, education, and preservation programs.”	1976	2009	6,000 tapes, “video art”	½” Open Reel Analog Videotape

(cont.)	Location	Commitments to preservation from Mission Statements	Year Institution Founded	Digitization Initiatives Started	Collections Being Digitized	Formats Observed Being Digitized
Site L5 ³⁵	West Coast	“undertaking an urgently needed project to digitize, provide online access, and preserve historic California audiovisual recordings.”	2010	2011	Tapes and films sent to them through partnerships with 127 archives and libraries	Quality Control: VHS video, 16mm film
Site L6	Northeast	“the American Institute for Conservation (AIC) Code of Ethics and Guidelines for Practice.”	1986	2012	Have digitized ~1700 items; expect to digitize ~2000 per year when at full capacity. Formats: ¼” audio tape; cassette; DAT; LP; VHS/SVHS; Umatic ¾”;	VHS Video, Umatic ¾”
Site L7	Midwest	“to preserve audiovisual records of history and culture and to engage audiences with their creative reuse”	2003	2006	7,000 analog video tapes of video art and local documentaries	VHS Video

Table 1 – Profiles of Research Sites³⁶

Each site has a different institutional identity that is shaped in part by its particular focus on the preservation on certain types of visual materials (as articulated in mission statements) and how it conceptualizes the types of materials it preserves. Site L1 collects any and all materials that are considered “modern art”; Site L2 preserves “media art,” primarily analog videotape; Site L3 preserves “media art” and distributes copies to educational institutions; Site L5 preserves all audiovisual formats that are sent to it by partner organizations; Site L6 preserves all audiovisual formats that are owned by the library that it is housed in or any faculty that bring in materials from across the

³⁵ Site L4 was visited, but was eventually excluded from this research because it was found to be an unsuitable site (i.e., the work of digitization was carried out by non-professionals and thus did not fit the definition of artisanal digital reformatting).

³⁶ Institutional commitments were identified by examining the mission statements provided on the official websites of each organization. Quantities and types of formats being digitized were determined by referring to sites’ official websites and by conferring with research participants.

university; and Site L7 preserves “media art” and community-produced documentary footage. Site L1 is a large art museum; Site L2 is a small hybrid media education and preservation organization that digitizes media art produced by the local, national and global arts communities; Site L3 is a small distributor of media art to educational institutions and it preserves analog video tapes and makes digital copies to support those efforts; Site L5 is a small grant-funded preservation project that works with over a hundred different archives across the state of California and helps them digitize their collections with the assistance of outside vendors; Site L6 is a small audiovisual digitization lab in the preservation department at a large research university; and Site L7 is a small media archive that preserves its own collection of media art and community documentary footage, while also offering its services for hire to other organizations.

Site L1 is a significantly larger organization than all of the others, has a longer history, and is better equipped with the resources necessary to deal with a complex array of media art works (See: Table 1). At the same time, Sites L2, L3 and L7 have been conducting digital reformatting projects longer than Sites L1, L5 and L6 (See: Table 1), which suggests that they have had more time to develop codified knowledge around artisanal digital reformatting techniques. The timeline below (Figure 5) visualizes the sequence in which each organization began its digital reformatting work. These dates were established by referring to the organizational websites of each site and were confirmed with the managers of each site. There are some definitional problems with precisely establishing Site L2’s history of digitization because their website specifies that they have been preserving analog videotape in 1994, but this predates current digitization

technology.³⁷ Information provided on Site L2’s institutional website established that the organization had been digitizing analog videotapes since the early 1990s by copying them onto digital videotape formats, such as Sony’s Digital Betacam (“Digibeta”) format, and current digitization work employs direct transfer to digital files.

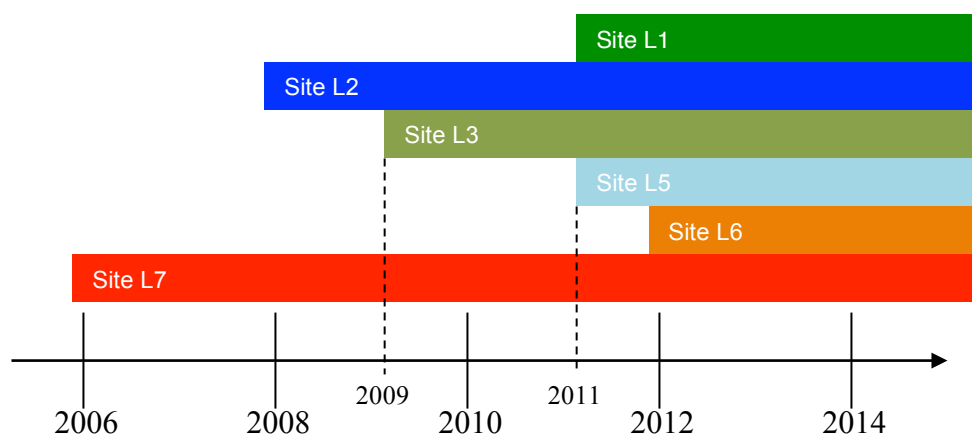


Figure 5 – Timeline of Digitization Initiatives in Research Sites³⁸

Each of these sites can be seen as a unique setting in which preservationists must negotiate tensions between the techniques of copying with the institutional complexities of maintaining the aesthetic values of the work. Each site engages in artisanal digital reformatting while their institutional identities differ, which offers the opportunity to examine the same emergent social phenomenon within organizations with different

³⁷ Examining archived copies of Site L2’s website available on the Internet Archive’s Wayback Machine suggest that Site L2 was using digital technology to produce digital manifestations of analog video tape at least as early as 1998, when their website lists “Digibeta” as a digital destination format.

³⁸ These dates mark the approximate years in which each site began digitizing videotapes using a file-based workflow. Some of the sites, such as L2 acknowledged that they had transferred tapes earlier to Digital Betacam, which is another magnetic tape-based format, but is encoded as digital bits. This chart marks when they started converted tapes directly to digital files, rather than to another video tape format, even it happened to be digital. This information was gathered through email follow-ups with participants at each site. In the case of Site L2, no one currently working there new exactly when the digital file-based workflows started, because this had happened before they started working there. Instead they referred me to a former employee who explained that 2008 was a likely starting point: “It was offered on a case by case basis to clients who did not own Digibeta machines. Often clients would preserve to a tape format and also to hard drive. I think it was only really within the last two or three years that I was there [he left Site L2 in 2010, zlk] that we had ongoing projects that went to hard drive.”

organizational characteristics. This supports the goals of this dissertation by enabling the comparison of activities across different sites in order to identify the common epistemic techniques that are common to sites of artisanal digital reformatting of analog video.

Within each of these organizations, this dissertation research studies the particular spaces in which the physical work of digital reformatting is carried out and the particular social actors directly engaged in the work of digital reformatting, either directly carrying out the work or planning and managing the daily operations of artisanal digital reformatting.

Table 1, above, summarizes attributes of the three organizations selected for this research project. It compares the locations, mission statements, institutional attributes, years of founding and years of digitization project initiation, and the size and types of visual document collections being digitized. Table 1 makes it clear that each institution is unique, but is similar in that each employs small teams of highly skilled preservation professionals to digitally reformat visual documents. In the following section I will discuss how research participants were recruited for this research.

6.1.2 Research Participants

Participants were recruited from employees currently working on artisanal digital reformatting projects by consulting with the department administrators in charge of the spaces in which digital reformatting projects are conducted.

Once permission to conduct research on site at each organization was acquired, a recruitment email was sent to site administrators for them to distribute to potential participants in the preservation departments that they manage (See: Appendix B – Participant Recruitment Letter). This recruitment letter explained the research project and

the time commitments associated with the interview and observation sessions, as well as my email address so they could contact me if they are interested.

The total number of research participants recruited for this study totaled 9 participants who were actively involved in the work of digital reformatting (whom will be referred to as “digitizers” from now on); 3 participants who were administrators or managers who actively shaped the workings of the digitization lab and its equipment (whom will be referred to as “administrators” from now on); and 1 participant who was only involved in quality control activities (whom will be referred to as “quality control specialist” from now on).

Participants who agreed to participate were emailed the consent form (See: Appendix C – Participant Informed Consent Form) and interview questions (See: Appendix D – Interview Protocol) a week before the scheduled interview date. Once they signed and return the consent form, a mutually convenient time was scheduled for conducting the observation and interview sessions. The sessions for reviewing the video recordings with participants were scheduled after analysis of the video recordings was carried out.

The concept of “artisanal” was used to distinguish the high-skill work of trained preservationists in small-scale projects to work being conducted in mass digitization projects, such as the Google books scanning project. It points to the mixture of technical know-how and formal education necessary to legitimately produce digital copies within preservation institutions. Participants present some variations and commonalities in terms of educational backgrounds and professional identities (i.e. as conservationists, preservationists, etc.) but there are some clear similarities (see Table 2 below).

Participant ID	Digitizer?	Location	Institution Type	Job Title ³⁹	Professional Identity ⁴⁰	Educational Background	Time at Current Job	Time in the field
P1_L1	Yes	Northeast	Conservation Dept. of Large Art Museum	Assistant media conservator	Media Conservator	NYU-MIAP (2009)	5 years	7 years
P1_L2	Yes	West Coast	Small community video production and preservation center	Preservationist	Video Preservationist	NYU-MIAP (2014)	1 year	2 years
P2_L2	Yes	West Coast	Small community video production and preservation center	Preservation Project Manager	Preservationist	MA Film Studies; NYU-MIAP (2016)	2 years	2 years
P3_L2	Yes	West Coast	Small community video production and preservation center	Preservation Technician	Moving Image Archivist	Fine Arts Degree; Selznick School Certificate Program (2014)	1 year	4 years
P1_L3	Yes	Midwest	Small video and media art distributor and archive	Digitization Specialist	"Doesn't think about it."	MIAP (2013)	2 years	3 years
P2_L3	No	Midwest	Small video and media art distributor and archive	Archive and collection manager	Moving Image Archivist	Fine Arts Degree, MLIS (Ullinois, Champaign-Urbana)	17 years	14 years
P1_L5	Designed System, Some Quality Control	West Coast	Audiovisual media preservation project (outsources digitization)	Project Manager	Audiovisual Preservation specialist	MIAP (2005)	6 years	11 years
P3_L5	Quality Control Only	West Coast	Audiovisual media preservation project (outsources digitization)	Project Assistant	Moving Image Archivist	Film studies degree; MLIS (San Jose State Library Science Program)	3 years	3 years
P1_L6	Yes	Northeast	Audiovisual preservation lab at an academic library of Large Northeastern Research University	Collections Analysis Assistant	Archivist	Art History, MLIS (SUNY-Albany)	3 Years	5 years
P2_L6	No	Northeast	Audiovisual preservation lab at an academic library of Large Northeastern Research University	Director of Digitization and conservation services	"Administrator of a preservation department that has a strong audiovisual component"	Journalism, Audio Production	4 Years	8 years
P3_L6	Yes	Northeast	Audiovisual preservation lab at an academic library of Large Northeastern Research University	Lab Manager	Audio Engineer	BS, Electrical Engineering (Rutgers University)	1 year	6 years
P1_L7	Yes	Midwest	Small community media and video art archive	Video Technician	Video Archivist /AV Archivist	MIAP (2013)	1 year	6 years
P2_L7	No	Midwest	Small community media and video art archive	Executive Director of Archive	Media Producer and Archivist	University of Chicago (BA), Researches Video Collectives	12 years	13 years

Table 2 – Characteristics of Participants

³⁹ Participants' job positions were defined through participants' responses to interview question IQ2 (See Appendix D).

⁴⁰ Participants' professional identities were defined through participants' responses to interview question IQ1a (See Appendix D).

Table 2 summarizes the key characteristics about the participants and information on the sites in which they work. In terms of educational background, seven participants have degrees from professional moving image archiving programs, with six participants having a Master of Arts Degree in Moving Image Archiving and Preservation from New York University, and one participant holding a certificate from the L. Jeffrey Selznick School of Film Preservation at George Eastman Museum (Rochester, NY). Three participants have Master of Library and Information Science degrees from a range of accredited programs including the University of Illinois, Champaign-Urbana; San Jose State University; and the State University of New York, Buffalo. Of the remaining participants, one had a journalism degree, one had a degree in electrical engineering, and the final one was a researcher with a bachelor's degree who studied video art collectives. All participants have advanced degrees of some kind that would prepare them for "white-collar labor."

6.2 Overall Research Process and Steps

In the following section I will describe the overall research plan: (6.2.1) methods of generating of research data; (6.2.2) summary of overall research plan; (6.2.3) procedures for data analysis; and (6.2.4) validation strategies and theoretical saturation.

6.2.1 Methods for Generating Research Data

The selection of methods for generating research data was determined by the research objectives of this research, which is centered on the discursive construction of visual knowledge. To study participants' practices of seeing, observation and video recording were identified as suitable tools for generating data on visual practices. Crucially, visual practices are also constructed through discourse, so the use of interviews, think aloud and

review sessions with participants were identified as effective tools for generating statements from participants that articulated fragments of the discourse shaping their visual practice. These statements could then be linked back to the data generated through observations of participants' practices of seeing. The research design of this dissertation enabled the holistic generation and analysis of data that captured both the discourses and material practices of digitizers. Interviews and review sessions were found to be effective means of gathering fragments of the discourse alongside analysis of the material practices and technological dispositifs that give discourse its material instantiation (Keller, 2013).

At each site, a period of 2-3 hours was spent upon arrival becoming familiar with each location and just passively observing what was happening and taking notes. After this initial period of orientation to the site, one-on-one observation sessions with each digitizer as they engaged in artisanal digital reformatting work were conducted. Observation sessions were video recorded and attentional moments in which digitizers reflected on their practice were transcribed. Review sessions were conducted over the phone using the resulting video files to cue participants to reflect on their digital reformatting practices during the review sessions. Participants were emailed the video files, and then were asked to watch them and respond over the phone. Review sessions were audio recorded and transcribed.

The table below (Table 3) shows the total types and quantities of data that were collected and the time period in which that type of data was collected. Observation sessions were conducted between May 2016 and June 2016. Video recordings of observation sessions captured the range of tasks that made up the digitization process, with the shortest observation session lasting 45 minutes and the longest lasting 2 hours,

with the average being 1 hour and 19 minutes. Interviews for Site L2 were conducted before the observation sessions due to scheduling requirements, but all other interviews were conducted after the observation sessions. Interviews were conducted during the period between October 2015 and June 2016. The shortest interview was 43 minutes and the longest interview was 2 hours in length, with the average being 1 hour and 15 minutes. Review sessions were conducted between August 2016 and December 2016, during the time the interview data was being analyzed. The shortest review session was 16 minutes, the longest review session was 42 minutes, and the average was 33 minutes.

Type of Data	Dates Collected	Quantity	Total Time (hours:minutes)
Semi-structured Interviews: Audio Recordings	October 2015 - June 2016	13	16:21
Observation / Think Aloud: Video Recordings	May 2016 – June 2016	9	11:57
Review Sessions: Audio Recordings	August 2016 – December 2016	9	4:59
Total:			32:17

Table 3 – Types and Quantities of Data Collected

Collecting multiple forms of data, and using the review sessions as a means of bringing participants into the process of interpreting the research data provided an important means of addressing my research questions and strengthening the validity of the analysis. Each form of data supports one or more research objective. The following table (Table 4) relates the forms of data collected and the elements of my theoretical framework to the research questions that they address.

Research Objectives	Theoretical Perspectives	Data Collection
RO1: Understand the epistemic techniques and processes of knowledge construction of preservationists engaged in the work of artisanal digital reformatting.	Sociology of Knowledge Approach to Discourse	Observation of process of digital reformatting and think aloud; interviews with digitizers and administrators; Review sessions; Documents collected from sites

(cont.) Research Objectives	Theoretical Perspectives	Data Collection
RO2: Interpret the experiences of digitizers as they train their perceptions to carry out the work of producing digital copies perceived to be legitimate in their institutions.	Sociology of Knowledge Approach to Discourse; Phenomenology	Interviews with digitizers and administrators, Review Sessions
RO3: Understand how preservation knowledge circulates and becomes integrated into the practice of artisanal digital reformatting.	Sociology of Knowledge Approach to Discourse	Interviews with digitizers; Review Sessions; Documents collected from sites
RO4: Understand the moral commitments and real programs of preservationists within the “moral order” of preservation, particularly in terms of how the incorporation of standards and other forms of codified knowledge shapes and is shaped by institutional and professional values.	Moral Order and Structures of Moral Codes; Sociology of Knowledge Approach to Discourse	Interview data; Review Sessions; observation of work of digital reformatting; Documents collected from sites.

Table 4 – Research Objectives and Forms of Data Collected

In the following section, I further explain the following aspects of my data collection procedures: (6.2.1.1) the process by which the observation sessions were carried out; (6.2.1.2) the process by which review sessions were carried out; (6.2.1.3) the interview protocol and how each cluster of interview questions relates to the dissertation research objectives; and (6.2.1.4) the collection of documents.

6.2.1.1 Observations

Observations of preservation practices related to artisanal digital reformatting were conducted over a period of 1-2 days at each site. The first 2-3 hours of observations were non-interactive, involving tours of the spaces where preservation work is conducted and passive observation of the various work tasks related to digital reformatting. The purpose of this first period of observation was to orient the researcher within the spaces and to observe the work of digital reformatting without intervening in the process. The second period of observation involved observing each participant as he or she carried out the work of digital reformatting, asking participants to “think aloud” through the process of carrying out the full range of tasks (prep, adjustment, monitoring, evaluation) within the process of digitization, following the procedures of concurrent protocol analysis

(Ericsson and Simon, 1993). The “think aloud” technique of protocol analysis (Ericsson and Simon, 1993) is a methodology utilized in psychology and cognitive science - to generate rich data about participants’ processes of knowledge construction while carrying out digitization tasks, and post hoc reflection cued by recordings of their activities to encourage deeper reflection on the part of participants.

These “think aloud” sessions were recorded with a small handheld video camera so that participants’ statements and bodily motions as they carried out the work of digital reformatting could be analyzed during the data analysis stage. Adopting the think aloud technique helps combat the difficulty of getting participants to reflect on kinesthetic and visual practices that may have become habituated and are no longer consciously thought about by participants. Ericsson and Simon (1993) explain: “as processes become automated, less and less information becomes available about them. This is particularly true of many motor activities. [...] Even though this may be the usual case, still the subject can change his processing [i.e., through the think aloud process] and describe the activity in detail from his perception of his own visual, kinesthetic or tactile input” (Ericsson and Simon, 1993, p. 243). Thus, techniques of think aloud will be useful for generating data on the habituated aspects of practice that may be otherwise difficult to observe.

While some of the techniques of protocol analysis are adopted in this research, this research still maintains a social constructionist perspective, even though protocol analysis is typically applied within a cognitivist perspective. K. Anders Ericsson (2002) has defined protocol analysis as “a rigorous methodology for eliciting verbal reports of thought sequences as a valid source of data on thinking.” This methodology relies on

cognitivist assumptions that conceptualize human thinking as a form of information processing and it analyzes task completion as a rational process of decision-making. Some key assumptions of protocol analysis are that verbalizing thoughts during the carrying out of a task does not change the underlying thinking, which has been supported by empirical research in cognitive science (Ericsson and Simon, 1993). This research uses the data generated through the think aloud technique to gain insight into preservationists' interpretations of their visual experience and the ways in which preservation knowledge and legitimate practices are discursively constructed, rather than analyzing the underlying cognitive processes of preservationists, as would be the focus if following the protocol analysis methodology.

It is also important to draw attention to the distinction made in protocol analysis between “explaining” and “thinking aloud.” In the case of “explaining,” the verbalizations produced by participants are intended to communicate to the researcher what the participant is doing. The goal of “thinking aloud” on the other hand is to generate verbalizations that are representative of the participant’s process of thinking and are often incoherent and idiosyncratic (Ericsson and Simon, 1993). As Ericsson and Simon (1993) suggest “Think aloud protocols leave unanswered how the solution was generated in detail and why a given method was adopted among many possible methods” (p. xv). The benefit of encouraging “thinking aloud” from preservationists for this research is that it helps to generate rich data about tacit dimensions of knowledge construction that may be difficult to fully explain on the part of the participants. Additional data about participants’ interpretations of their activities was generated after the observation sessions when the video recordings were presented to participants during

the second half of the interview sessions and they were asked to reflect on these recordings of their activities.

In order to structure the think aloud observation sessions, the Observation Guide (Appendix E) was used in order to organize observations and cue participants to think aloud as they carry out digitization procedures. I encouraged participants to think aloud throughout the process, and asked them to reflect on how they are incorporating visual information into each stage of digital reformatting. As noted earlier, participants' statements and activities were recorded using a digital video camera.

6.2.1.2 Review Sessions

The videorecordings from participants' think aloud sessions were presented to the participants during review sessions in which participants were asked to reflect on their experiences and thought-process behind their actions recorded in the video. The recordings from the observation sessions were used to "cue" and structure their reflections on their digital reformatting activities. Using cues from the earlier observation session follows the suggestions of Ericsson and Simon (1993): "For investigators who are committed to post-experimental assessment of thinking, more valid information is attained by cuing subjects with specific items from the experiment (Cantor, Andreassen, & Waters, 1985; Richardson, 1985) than by asking general questions" (Ericsson and Simon, 1993, p. xlix).

Review sessions were conducted over the phone, after the data generated from participants' interview and observation sessions had started to be analyzed. This sequencing enabled me to use these phone calls as a time to conduct a brief "member check" (Creswell, 2014, p. 201) to give participants a chance to comment on the accuracy

of my interpretation of their practice as I was in the middle of my data analysis. After each participant reflected on his or her activities recorded in the video, I briefly discussed what I thought was happening and gave them a chance to correct any false conclusions that I was making.

Before each review session, I assembled a series of video clips (each 2-10 minutes in length) taken from the longer videos recorded during the observation session to make a 30-minute video file for each participant. Clips were selected to cover the full range of activities from each stage in the process of digital reformatting, as well as key moments when participants were required to make complex decisions in the process of digital reformatting. Showing video clips rather than the full length of unedited footage for the review sessions served two purposes: first, participants had limited availability, so this enabled more efficient use of their time in order to get them to reflect on all stages of the digital reformatting process; and, second it enabled more directed reflection on the those activities of visual evaluation and decision-making that this research is focused on. Significant portions of the tapes included repetitive activities (such as cleaning a piece of equipment, or monitoring a video transfer an hour), which made it possible to provide clips that were able to capture representative samples of each stage of the process.

The digital video files were sent to participants via a file transfer service before the scheduled review session so that they could review the videos beforehand. During the review session for each participant, the participant and the researcher reviewed the videos simultaneously from each other's laptops and communicated using cellphones. These conversations were audio recorded and transcribed by the researcher.

6.2.1.3 Interviews

Interview sessions followed observation sessions (except for site L2, in which case they preceded the observation sessions, due to scheduling logistics). Interviews were semi-structured and followed the IRB-approved interview protocol included in Appendix D. When possible, interview sessions were conducted face-to-face away from the digitization lab so that participants could provide more candid responses to the interview questions. Due to time-constraints during my site visit, interview sessions for Site L5 had to be conducted over the phone.

The suitability of the interview protocol (Appendix D) was evaluated through a pilot study conducted on October 22, 2015 at the Barbara Goldsmith Conservation Center at Bobst Library at New York University in order to evaluate the interview protocol. Three participants were interviewed using the initial interview protocol and were observed as they conducted the work of digital reformatting. Data from the pilot were used to improve the final version of the Interview Protocol (Appendix D), and to develop the Initial Coding Schema (Appendix G). The pilot and initial coding schema will be discussed further in sections 7.2 and 7.3, respectively. Interviews were conducted over a period of eight months (from October 2015 for the pilot and continuing to June 2016). Interviews were recorded with a digital audio recorder and transcribed. A transcriber was hired to transcribe the interviews. The researcher reviewed the transcripts for errors before proceeding with the analysis.

In the following sections, I will discuss how each cluster of interview questions was used to address the dissertation research objectives (see Table 4, above). Interviews were conducted to elicit participants' accounts around three clusters of questions.

6.2.1.3.1 Cluster 1: Constructing Preservation Knowledge

Interview questions in Cluster 1 (IQs 13, 14 & 15) ask participants to reflect on their experiences of constructing knowledge, both in terms of how they construct knowledge when carrying out the work of artisanal digital reformatting, and in terms of integrating knowledge from their occupational community into their work. In conjunction with observational data, the data generated with these questions provided insights into the following Research Objectives: (RO1) understand the epistemic techniques and processes of knowledge construction; and (RO3) understand how preservation knowledge circulates and becomes integrated into the practice of artisanal digital reformatting. Specifically, these interview questions ask participants to reflect on the role of standards and specifications in shaping their digital reformatting practices (IQ13 & IQ14); their experiences of using standards and specifications in their practice and how this contributes to shaping their professional identities and constructions of normative practice (IQ13 & IQ14); their experiences of the institutional consequences of using standards and specifications in the shaping of their organizations' access to resources and institutional legitimacy (IQ15). Other questions ask participants to discuss their understandings of the assumptions guiding their processes of creating local standards and their experiences of disagreements in their organizations about how best to shape digital reformatting practice (IQ16); and reflect on their experiences using different sources of information in evaluating the outcomes of their decisions concerning the shaping of digital reformatting practice (IQ14 & IQ17).

6.2.1.3.2 Cluster 2: Experiences of Constructing Visual Knowledge

Interview questions in Cluster 2 (questions IQ1-IQ12 & IQ15) help to investigate the experiences of digitizers as they train their perceptions to carry out the work of producing digital copies perceived to be legitimate in their institutions (RO2), with particular attention paid to their use of different forms of visual information and their interactions with infrastructural elements of digital reformatting technology and reflections on their visual experiences. Questions pertaining to participants' background and professional self-understanding were used to elicit responses that give insight into how participants integrate their conceptualizations of professional identity and institutional role into understanding workplace practices. Table 5 (below) summarizes how these interview questions help generate data to address research questions and identifies the relevant theoretical frameworks within the overall research plan of this dissertation project.

Questions in Cluster 2 ask participants to reflect on their background, their role in their organization and how they conceptualize their professional practice (IQ1 & IQ2). Questions in Cluster 2 explore participants' perceptions about their roles in digital reformatting projects within their organizations (IQ3); participants' reflections on and understanding of the process of training that they were required to go through in order to be able to work on digitization projects, drawing attention to habituated activities, which once learned may be typically unnoticed in everyday practices (IQ4); participants' interpretations of the nature of the visual documents that they work with, their expectations about how the digital copies they produce will be used in the future, who might use them, and how these expectations and assumptions shape their practice (IQ5); and participants' interpretations of each stage of digital reformatting and their reflections

on and differentiating between the elements of their practice that have become habituated and aspects that may require close attention and aesthetic judgment (IQ6, IQ7 & IQ10). Questions in Cluster 2 ask participants to reflect on how they engage with visual information in their work when calibrating equipment and producing and evaluating the products of digitization (IQ4, IQ5, IQ9 & IQ11) and how their local practices and digitization initiatives are influenced by work conducted at other organizations (IQ9 & IQ12).

6.2.1.3.3 Cluster 3: Constructing Normative Preservation Work

Interview questions in Cluster 3 (questions: IQ3, IQ8 & IQ13-IQ15) address the role that standards play in constructing normative practice within preservation discourse. This contributes to the following research objectives: (RO3) understand how preservation knowledge circulates and becomes integrated into the practice of artisanal digital reformatting; and (RO4) understand the moral commitments and real programs of preservationists within the “moral order” of preservation. Questions 14-17 ask participants to reflect on how knowledge about normative practice is constructed in relation to standards and specifications produced inside and outside the organization. Particular emphasis is placed on understanding the processes by which normative knowledge around the practices of digital reformatting are legitimized and institutionalized. These questions are concerned with understanding the structure of moral codes of preservationists, i.e. the ways in which they form moral commitments and put them into practice in their work as “real projects” (Wuthnow, 1987). Questions in Cluster 3 ask participants about their interpretations of the role played by codified forms of knowledge and how they circulate across their community and inform their local

practice (IQ3, IQ13, & IQ14); participants' understandings of how other organizations in the preservation field influence the adoption of standards and use of publicly available documents within their own organizations (IQ15); and asks participants to reflect on how digitization projects and the establishment of normative practices in the preservation field shape their professional identities (IQ8).

These three clusters of interview questions ask participants to discuss their background and reflect on the various aspects of the practices and institutional processes related to digital reformatting in their organization. Data generated from these interviews is complemented by observational data and review sessions that will give a richer understanding of the practices of artisanal digital reformatting and the visual tools used within their work.

6.2.1.4 Documents

The documents collected for this research included guidelines, standards and any other documents that were found in the research sites and were indicated by the participants to be guiding their work of digital reformatting. A complete list of documents collected can be found in Appendix J.

Before entering field and collecting data at the research sites, a corpus of publically available digitization standards documents, published between the years 2004 and 2015, was assembled (See: References – Primary Sources: Public Documents) and a selection of six documents was analyzed in order to develop an initial coding schema (See: Appendix G – Initial Coding Schema).⁴¹ This time period was selected because it

⁴¹ This initial corpus of documents was assembled using several collection strategies. Some documents were found by searching for standards documents using web searches (via Google's search engine) using the terms "digitization guidelines," OR "digitization standards," OR "digitization practices." Additional documents were found by referring to a comprehensive bibliography of digitization standards published by

spans a decade in which digital reformatting was becoming widely accepted, and it follows the first wave of digital library projects (1995-2002) (Dalbello, 2005a; 2005b) characterized by experimentation and innovation in digital reformatting technologies.

6.2.2 Summary of Overall Research Plan

The following table (Table 5) summarizes my overall research plan, linking research objectives to the types of data collected, interview questions asked and the theoretical frameworks used to structure data analysis.

Research Objectives	Data Types	Interview Questions	Data Analysis	Relevant Theoretical Perspectives
RO1: Understand the epistemic techniques and processes of knowledge construction of preservationists engaged in the work of artisanal digital reformatting.	Observations, interviews, and review sessions with digitizers; documents collected from sites	IQ2, IQ3, IQ6, IQ7, IQ9, IQ10, IQ11 IQ13, IQ14, IQ18	Discourse analysis	Sociology of Knowledge Approach to Discourse (Berger and Luckmann; Keller, Foucault)
RO2: Interpret the experiences of digitizers as they train their perceptions to carry out the work of producing digital copies perceived to be legitimate in their institutions.	Interviews and review sessions with digitizers and administrators.	IQ3, IQ4, IQ5, IQ6, IQ7, IQ9, IQ10, IQ11, IQ18	Discourse analysis; Phenomenology	Sociology of Knowledge Approach to Discourse (Berger and Luckmann; Keller, Foucault)
RO3: Understand how preservation knowledge circulates and becomes integrated into the practice of artisanal digital reformatting.	Interviews and review sessions with digitizers; documents collected from sites.	IQ6, IQ7, IQ9, IQ11, IQ12, IQ13, IQ14, IQ15, IQ16, IQ17 IQ18	Interpretive Phenomenological Analysis; Discourse Analysis	Phenomenology; Sociology of Knowledge Approach to Discourse (Berger and Luckmann; Keller, Foucault)

the Library of Congress in 2009; by referring to a 2008 article published by Paul Conway in which he analyzed the impact of the most influential digital imaging specification documents; and by following citations found in academic journal articles about digitization projects. This corpus of documents constitutes key publicly available texts produced by influential organizations in the field of preservation.

(cont.) Research Objectives	Data Types	Interview Questions	Data Analysis	Relevant Theoretical Perspectives
RO4: Understand the moral commitments and real programs of preservationists within the “moral order” of preservation, particularly in terms of how the incorporation of standards and other forms of codified knowledge shapes and is shaped by institutional and professional values.	Observations, Interviews and review sessions with digitizers; interviews with administrators; documents collected from sites.	IQ1, IQ4, IQ5, IQ7, IQ8, IQ9, IQ11, IQ12, IQ13, IQ15, IQ17	Cultural Analysis, Discourse Analysis	Moral Order and Structures of Moral Codes (Wuthnow) Sociology of Knowledge Approach to Discourse (Berger and Luckmann; Keller, Foucault)

Table 5 – Overall Research Plan

6.2.3 Procedures for Data Analysis

Data were generated through semi-structured interviews with participants, observations and video recordings of digitizers as they carry out their work of artisanal digital reformatting, and review sessions in which participants were asked to reflect on their work while they watched the video recordings taken of their workplace activities.

Within the theoretical framework outlined in Chapter 5, the qualitative data generated through this research - interview transcripts, observation videos, and review transcripts - were analyzed at the levels of institutional knowledge, individual practice, the experience of preservationists, and the “moral order” of preservation. The institutional level was examined within Keller’s (2005; 2013) sociology of knowledge approach to discourse (SKAD), with the analytic goal being to identify processes of the legitimization and institutionalization of knowledge (Berger and Luckmann, 1966; Foucault, 1971; 1972; Keller, 2012; 2013); the practice level was examined using concepts drawn from social practice theory and interpretive phenomenological analysis (Smith, et al., 2009) with the goal being to identify and describe practices of situated judgment, embodiment, educated

perception and tacit understanding (Schatzki, 2001; Veinot, 2007); and the analysis of institutional and practice levels was analyzed using Robert Wuthnow's (1987) approach to cultural structuralism to understand the structure of moral codes that shape institutional and practice-based processes of knowledge construction.

6.2.3.1 Observational Data

Two types of observational data were collected from each site. The first type of observational data consisted of impressionistic notes generated during the first hour of entering each site and becoming oriented to the various spaces of each digitization lab. These data were used to produce descriptions of the overall operations of the site, the participants involved, and the technological configurations of workspaces.

The second type of observational data consists of videorecordings from the second period of observation in which "think aloud" sessions with each digitizer were conducted. Digitizers were observed carrying out the digital reformatting stages of a project that they were currently working on. The videorecordings captured each participant reformatting one complete videotape from beginning to end, recording their actions and vocalizations through the full range of steps involved. The videotapes being digitized by the participants varied in length from forty-five minutes to two hours, which determined the length of the videorecording sessions. The video camera (a small, high-definition digital camera that recorded to flash memory) was hand-held by the researcher and was repositioned frequently throughout the observation session in order to track the participant as he or she moved around the space of the lab. The camera was positioned so that it captured both the screens and scopes that the participants watched during the digitization process and the participant's hands and bodily gestures as they manipulated

the equipment. The camera was held below the eye line between the researcher and the participant so that it would not distract the participant when the researcher was verbally prompting the participant to “think-aloud” throughout the digital reformatting process (to enable this, the flatscreen viewfinder on the camera was rotated to an angle that enabled the researcher to easily glance down and reframe the image being captured by the camera as needed). Video was recorded in a continuous take with breaks in the recording to change the battery every hour. Audio was captured using the small on-board microphone mounted on the camera.

The visual component of the video recordings produced from these observation sessions was analyzed in terms of how digitizers coordinated their bodily movements, including head, hand and eyes, in carrying out the work of digital reformatting. The key moments of digitizers’ activities captured in the audio component of these videorecordings were transcribed by the researcher and analyzed using techniques of interpretive phenomenological analysis (Smith, et al., 2009) to gain insight into participants’ experience of their work (RO2). Observational data were also analyzed in order to develop understanding of how visual information is constructed through producing manifestations of visual documents and describe the roles played by visual information in digitization practice (RO1).

Techniques of visual analysis (Rose, 2013) were used to gain insight into the way in which visual displays construct visual knowledge and provide means of knowledge production and ways of seeing in the practices of artisanal digital reformatting. For example, Vamanu (2011) effectively used visual analysis to examine the practices of indigenous curators by examining the visual dimensions of their curated exhibits,

integrating this approach into his larger inquiry into the construction of indigenous knowledge, using the SKAD (Keller, 2013) framework. Similarly, preservationists can be seen to be shaping how knowledge artifacts will appear through their material labor.

6.2.3.2 Review Sessions

Each participant was presented with the videorecording from his or her earlier “think aloud” observation session, and will be asked to reflect on what he or she was thinking at each stage in the process of digital reformatting. The participants were prompted to reflect on each stage of the recordings and discuss their kinesthetic and visual practices. The audio files of these review sessions were transcribed and coded. Analysis focused on how participants described the experience of digitization, treated as phenomenological accounts (Smith, et al., 2009), and how they made sense of their own actions recorded in the videos. Analyzing how digitizers interpret their own actions gives insight into how they construct their individual activities as elements of meaningful social practice (Schatzki, 2001).

6.2.3.3 Interview Data

Semi-structured interview sessions were conducted following the IRB-approved interview protocol (Appendix D). Data generated through interviews offers insight into the ways in which knowledge is constructed through language use and how participants’ understand the meaning of their work. These data were analyzed in order to gain insight into the ways in which preservation knowledge is constructed and legitimized in practice and within the institutional context of each research site.

Analyzing the interview data using interpretive phenomenological analysis (Smith, et al., 2009) gives insight into the experiential dimensions of the use of visual

information and the construction of visual knowledge around digital reformatting practices. Encouraging participants to reflect on the development of visual skills and their experiences of entering the field gives insight into the processes by which the vision of digitizers is shaped in order to see in socially sanctioned ways. Understanding how they learn to see and interpret visual phenomena in particular ways gives insight into how participants calibrate their senses and coordinate their bodily motions in order to construct meaningful practice.

6.2.3.4 Documents

The documents collected from each site consisted of standards and specifications that were identified by participants as guiding their work (see Appendix J for a complete list of documents identified and collected at each site). These documents were not analyzed in-depth (i.e. following the steps of data analysis presented in 6.2.3.5 below) but rather served as technical guides for grounding the descriptions of digitization technology and for better understanding the technical underpinnings of participants' actions in the analysis of the observational data.

6.2.3.5 Steps of Data Analysis

In the following section I describe the practical steps of data analysis. Computer-based, qualitative analysis software, MAXQDA was used to organize and code all collected documents, interview transcripts, and video recordings from the observation sessions. Data coding began by establishing *a priori* codes based on the initial coding scheme (Appendix G), the theoretical frameworks and by employing grounded theory procedures to draw out emergent codes from the data. Keller (2013) recommends the use of

grounded theory⁴² tools to give structure to discourse analytic projects, such as using open-coding procedures and axial coding (Charmaz, 2006). Preliminary document analysis of a selection of six collected standards documents (See Table 6 – Documents Analyzed for Initial Coding) was used to develop the initial coding schema (See: Appendix G). This helped establish *a priori* codes to help guide the process of coding interview transcripts. The coding of data generated from interviews and observations was also informed by insights drawn from earlier research that was conducted on preservation practice (Lischer-Katz, 2014a) and discourses of preservationists (Lischer-Katz, 2014b), and the pilot study (See Section 7.2).

Because of the emergent nature of a qualitative research design, data analysis went hand-in-hand with data collection (Creswell, 2014, p. 195). Review sessions with digitizers were scheduled after interviews had been transcribed and coding had begun, so that the coding process could be shaped by new data generated by participants’ reflections on their actions captured in the observation videos. Otherwise, the following

⁴² Creswell (2014) defines grounded theory as “a design of inquiry from sociology in which the researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants. This process involves using multiple stages of data collection and the refinement and interrelationship of categories of information (Charmaz, 2006; Corbin and Strauss, 2007)” (p. 14). Grounded theory analysis offers techniques for analyzing data following an inductive approach that allows theory-building to emerge from the data through the process of analysis. Adopting the complete grounded theory methodology as an overall research approach involves a very time-consuming research process that requires that the researcher refrain from approaching the research phenomenon with a theoretical framework already in place. Instead, all theoretical constructs should emerge inductively from the data, with a literature review ideally conducted at the end of the project in order to compare the theory developed via the independent analysis with existing research. Employing some of the tools of grounded theory (such as open coding, axial coding, and memo-writing) enables for a systemic approach to inductively analyzing the data without committing to the full grounded theory regime. Instead, these tools can be employed within an existing theoretical framework to generate emergent themes alongside *a priori* codes. Kathy Carmaz (2006) suggests “grounded theory methods can complement other approaches to qualitative data analysis, rather than stand in opposition to them” (p. 9).

“general process of analysis” follows the basic structure outlined in Creswell (2014, pp. 196-201).

Step 1: Organize and prepare data: Interviews were transcribed, checked for mistakes and organized. Researcher notes from visits to each site were organized.

Step 2: Look over the data: All of the interview transcripts and observation videos were quickly looked over, with emergent codes being applied. Emergent codes were integrated into the initial coding schema. Looking through all of the data at this stage was also useful for evaluating the data for “overall depth, credibility and use of information” (Creswell, 2014, p. 197).

Step 3: Line by line coding of data: Interview transcripts and observation videos were coded based on the *a priori* codes established through initial coding and the initial coding schema, still being sensitive to emergent codes.

Step 4: Organizing codes: I looked across codes for relationships to common high-level themes and began grouping codes into higher-level themes and relating them to concepts from my theoretical framework. By defining codes, I was able to identify codes that referred to the same themes and carefully collapsed them together.

Drawing on concepts from my theoretical framework helped to shape the organization of codes. The sociology of knowledge approach to discourse (SKAD) was useful for grouping themes related to the circulation and legitimization of practice in institutional and community levels of analysis. Interpretive phenomenological analysis (Smith, et al., 2009) was useful for understanding descriptions of participants’ experiences of digital reformatting. Concepts from social practice theory were helpful for examining the embodied and aesthetic dimensions of participants’ practices and how they

emerge as legitimate and socially meaningful. Through the process, codes applied to later transcripts were compared with codes on transcripts coded earlier to ensure that the meaning of codes was not shifting significantly by “constantly comparing data with the codes” (Creswell, 2014, p. 203).

Step 5: Representation of themes. The higher-level themes formed by organizing codes were used to begin to outline the four analysis sections. (The initial and final coding schemas can be found in Appendix G and Appendix H, respectively.) This outline was used to develop a commentary based on the structure of the themes and subthemes, with illustrative quotes used to support analysis with presentations of data. The results of this process of organizing codes, forming them into groups organized under high-level themes within my theoretical framework are presented in the first three analysis chapters of this dissertation (Chapters 8-10).

Step 6: Discussion of findings. The earlier analyses were integrated into a cultural structuralist framework developed by Wuthnow (1987). Wuthnow’s (1987) approach to studying cultural practices in terms of how empirical data (statements and actions) gives insight into the structure of the moral codes that construct normative practice. Wuthnow’s (1987) approach helps to integrate the analyses of the epistemic techniques, experiences, and processes of knowledge construction into an integrated understanding of the construction of visual knowledge and the emergence of normative practice in artisanal digital reformatting of analog video recordings.

In the following section I will discuss validation strategies I use for ensuring that my analysis is being true to the research context I am studying and my participants’ experiences.

6.2.4 Validation Strategies and Theoretical Saturation

The epistemological assumptions of interpretive qualitative research methods - particularly the assumption that reality is constituted through intersubjective, conventionalized uses of language - make it problematic to assess the validity and quality of the “findings” of interpretive research with quantitative techniques. Even the concept of “findings” is fraught since it suggests that the truths of an external world are out there waiting to be found. Social constructionist researchers’ approaches suggest that there is no verifiable world to begin with, only socially accepted “life-worlds” of particular groups (Phillips and Hardy, 2002, pp. 79-80). In this sense, “language constructs, rather than reveals” phenomena (Phillips and Hardy, 2002, p. 83). Maureen Jane Angen (2000) suggests the use of the word validation, rather than validity to “deliberately emphasize the way in which a judgment of the trustworthiness or goodness of a piece of research is a continuous process occurring within a community of researchers” (p. 387). Angen (2000) argues, “interpretive research is a chain of interpretations that must be documented in order for others to judge the trustworthiness of the meanings arrived at in the end (Nielsen, 1995)” (p. 390). In this sense, being clear about research procedures, the interpretive nature of analysis, and developing multiple perspectives on research phenomena is essential for encouraging trustworthiness for this scholarly community.

To that end, this dissertation research employs several validation strategies. First it generates multiple forms of data – interviews, video recordings of observation sessions, review sessions – in order to understand the practice of artisanal digital reformatting from multiple perspectives. The review sessions in particular allow participants to engage directly with the observational data and provide their own perspectives on what is

happening in the video recordings. Second this research includes “member checking” (Creswell, 2014) as strategy for bringing major themes from the analysis back to the participants and encouraging them to respond and let me know how closely my interpretations fit with their lived experience. Review sessions functioned as member checks. In addition, I shared an early draft of Chapter 8, which covers the main aspects of the overall digitization workflow, with my participants and encouraged them to give me their feedback. I received feedback from two participants, P1_L2 and P3_L6, which helped me make minor adjustments to the text.⁴³ Both expressed concern about participants’ identifying information being included in the dissertation. I subsequently removed from the images that I included in this dissertation (I blacked out the names of the institution, which had been visible on the barcodes on the equipment in the photos). Third, I included “negative or discrepant information that runs counter to the themes” (Creswell, 2014, p. 202) in my discussion, in an effort to account for aspects of the reality I was trying to capture that did not fit within the categories of the themes I was constructing. Fourth, I included extensive quotes from participants and rich descriptions of their work activities in order to provide a complete picture of the social context and the actions and statements of participants. By providing representative extracts of the data

⁴³ I received feedback on an early draft of Chapter 8 from participants P1_L2 and P3_L6. P1_L2 said that they had not had time to look it over very closely but suggested that I black-out the “barcodes in the photos to keep it anonymous.” P3_L6 had more notes on my chapter: “If it is important to mask who is who, you'd have to take the locations of the organizations out of your tables. As soon as you do that, we all know the colleagues you likely visited. [...] The beginning of the paper uses the word ‘epistemic’ and other words based on the same root a lot. I understand this is a[n] academic paper, but use of big words seemed a bit forced, more in service of sounding fancy than communicating as clearly as it could. [...] I appreciated hearing about ‘Historization.’ [sic] [...] I want to read some stuff more closely and think more about your use of the word ‘artisanal’[sic]. Stay tuned. [...] Interested in reading the beginning of the whole dissertation, so I understand what you are really aimed at. [...] Is this focused on the nuts and bolts of a particular human endeavor and/or the sociological unfolding of the human endeavor itself?! [...] Need to review, but I'm not sure how useful the last chart about idiosyncratic workflows is. I want to pay more attention to the words there though before I pass judgement [sic] on that section. By itself though, the table seems incomplete in conveying what any of us may really emphasize at any stage of workflow.”

upon which I based my claims, readers are encouraged to make their own interpretations of the data and see how it fits with those offered here.

In order to approach theoretical saturation⁴⁴ and adequately address the research objectives of this dissertation, the following three strategies were incorporated into the research design: (1) the generation of rich data through methodological and theoretical triangulation; (2) the use of an emergent approach that enabled the research design to evolve as it progressed in order to ensure saturation of themes; and (3) the recruitment of sites from different regions of the United States (Northeast, Midwest, and West Coast).

First, in order to produce a rich picture of the knowledge construction of “artisanal digitizers,” it was initially determined in planning this research that the emphasis should be on collecting “rich” data from a relatively small number of participants. Patricia Fusch and Lawrence Ness (2015) define “rich data” as “many-layered, intricate, detailed, nuanced” (p. 1409) and they emphasize the importance of “triangulation” both in terms of using multiple research methods and multiple theoretical perspectives to support the generation of rich data and multi-faceted analysis of the data. The research design employed multiple methods of data generation (interviews, think aloud, observations, and review sessions in which participants reflect on the video images of their practices recorded earlier), as well as multiple theoretical perspectives (sociology of knowledge, phenomenology, social practice theory, and cultural structuralism), which act as different lenses for viewing different facets of the same phenomenon. Norman Denzin (2006) encourages qualitative researchers to “learn to employ multiple external

⁴⁴ Corbin and Strauss (2008) expand the notion of saturation from the traditional notion of “no new data” to include the convergence of categories and themes: “saturation is usually explained in terms of ‘when no new data are emerging.’ But saturation is more than a matter of no new data. It also denotes the development of categories in terms of their properties and dimensions, including variation, and if theory building, the delineating of relationships from concepts” (p. 143).

methods in the analysis of the same empirical events” (p. 13). Employing deep, multi-perspectival analysis of data generated from material and discursive dimensions of participants practice helped to ensure that a rich picture of the processes of knowledge construction of artisanal digital reformatting would be developed, supporting this dissertation’s research objectives.

Second, this research employed an emergent design that was shaped by the emergent themes from the data. The concept of theoretical sampling in qualitative research specifies that the research process and selection of participants should follow an emergent design, suggesting that the design of a qualitative study will often change as it is carried out. Juliet Corbin and Anselm Strauss (2008) explain, “unlike statistical sampling, theoretical sampling cannot be planned before embarking on a study. The specific sampling decisions evolve during the research process.” (p. 157). In the case of this dissertation research, after initially generating data at Sites L1, L2, L3, L5, and L7,⁴⁵ a cursory analysis of the data suggested that additional participants would be necessary to fill out key themes that were emerging. Furthermore, it was deemed important in regards to exploring variation in the practices of participants to generate data at another site in the Northeast in order to compare it to another Northeastern site (L1). Thus it was decided to collect data from Site L6 (Northeast location), which had not initially been considered in the research design. Generating data with participants at Site L6 helped to begin to clarify some of the nascent themes developed in the initial stages of analysis and lead to a convergence in common patterns of practice across sites. After generating data at Site L6, there was sufficient data to begin to construct a complete picture of each stage of the

⁴⁵ Site L4 was also visited briefly, but was eventually excluded from this research due to problems gaining access to the site and a lack of professional preservationists working there.

digitization process and had enough data to explore variation and commonalities across sites. As Corbin and Strauss (2008) explain, “a researcher knows when sufficient sampling has occurred when the major categories show depth and variation in terms of their development” (p. 149). It was found that adding Site L6 to the study provided rich data that contributed to developing depth and variation in the major themes as the data analysis progressed.

Third, sites were selected in multiple regions of the United States (Northeast, Midwest, and West Coast) in order to maximize the variation in data generated from practices and discourses of participants across sites. This enabled converging themes to be established from across disparate sites, allowing for understanding of the common elements of the practice of artisanal digital reformatting of analog video recordings that were across geographical dispersed sites of practice.

These three strategies enabled this research to approach theoretical saturation with a sample size of $N=13$ by generating rich data through a research design that used triangulation to explore material and discursive aspects of visual knowledge construction, selecting participants through an emergent research design that was sensitive to the changing needs of the research objectives as data was generated, and selecting sites across the country enabled common themes to emerge that could be understood as common elements and patterns of activity related to the practice within a national context, rather than limited to one particular site or one particular region. The convergence of common themes across geographically dispersed sites and the development of a rich picture of the micropractices and discourses of artisanal digital

reformatting of analog video recordings helped to develop trust that the research was approaching theoretical saturation.

6.3 Limitations

There are five salient limitations related to studying the construction of preservation knowledge by studying the digitizers engaged in the artisanal digital reformatting of analog video recordings. First, this research is limited to studying the discourses and practices of preservationists within their work, while there are clearly other social actors influencing the discursive construction of preservation knowledge (e.g., scientists and engineers are involved in the design of digitization equipment and other information professionals and scholars are involved in developing best practice guidelines).

Second, this research focuses primarily on knowledge construction around digital production. For a complete picture of knowledge construction around artisanal digital reformatting, future research will be required to take into account the consumption side of artisanal digital reformatting, studying how users form knowledge around these digital products.

Third, this research is partially limited in its applicability to other contexts because it focuses on only one particular set of source documents being digitized, complex visual documents, and more specifically, analog videotape. This research sets out to study the digital reformatting of a particular format of visual document in order to gain insight into how knowledge of visual documents are constructed within preservation knowledge, which limits this research in terms of the insights it can provide into understanding the particular practices of digital reformatting for other visual document formats in other contexts.

Fourth, this research is limited to understanding the artisanal mode of digital reformatting as conducted in the particular selection of organizations for this research. Using the concept of “artisanal” limits the focus of this research to digital reformatting projects of a certain scale and mode of labor. Future research could study knowledge construction in other modes of digital production, such as in mass digitization projects that rely on higher output and lower skilled labor to product their digital products. The sites studied each place significant value on the documentary and artistic attributes of visual documents, while other organizations that collect complex visual documents, such as large film and television archives may focus more on their value as entertainment or as documents of cultural heritage. This limits the implications of this research to those types of organizations that share similar institutional commitments to the enacting of preservation values.

Fifth, another limitation faced by this dissertation research is the inherent difficulty in studying the visual aspects of artisanal digital reformatting. Studying “the visual” is fundamentally problematic because the generation of data that captures the visual experience of participants must always be mediated by language. This is addressed by documenting the visual technologies using a digital camera to aid in analysis, but there appear to be clear limitations to studying visual experiences that limits how deeply I can understand this aspect of knowledge construction in this research context. Second, this research only studies the construction of the visual in terms of one type of activity, artisanal digital reformatting, but vision is clearly involved in many other productive tasks, and plays a role in preservation practices outside of the digitization lab. The focus

of this research is thus limited to considering the discursive construction of the visual, and not in studying seeing in everyday life.

6.4 Chapter Summary

In this chapter I have described the essential aspects of the research methodology of this dissertation. I have described (6.1) the selection of research sites and participants; and (6.2) the overall research process, including (6.2.1) the generation of research data (6.2.2) a summary of the overall research plan; (6.2.3) procedures for data analysis; and (6.2.4) validation strategies and theoretical saturation. In the following chapter I will reflect on preliminary research conducted in preparation for this dissertation and discuss how it has informed the plan and execution of this dissertation research. In section (6.3) I identified several limitations related to the context and methodology of this dissertation research.

CHAPTER 7: PRELIMINARY RESEARCH

7.0 Chapter Outline

In the following chapter I describe preliminary research conducted in preparation for this dissertation research. I will describe (7.1) two exploratory research projects that I conducted that examined the discourses and practices of preservation knowledge in contexts of digital reformatting; (7.2) a pilot study that was conducted on October 22, 2015 in the preservation lab of an academic library to evaluate and refine the initial interview protocol for this dissertation research; and (7.3) discuss the development of the initial coding schema developed for analyzing the data generated in the course of this dissertation research.

7.1 Exploratory Research

Two exploratory research projects have been conducted and they have provided insights into the utility of the interpretive methods and theoretical perspectives selected for this dissertation research. The first study (Lischer-Katz, 2014b) used SKAD to identify the epistemic assumptions and discursive strategies utilized in the debates on the professional listserve of the Association of Moving Image Archivists (AMIA) concerning the JPEG2000 file format as an archival format for digitized analog video. This research collected and analyzed 433 messages posted to the AMIA-L listserv between 2000 and 2013. This project found that over the course of the debate around the JPEG2000 file format, different social groups debated both the suitability of the format and the epistemic grounds (i.e., particular constructions of legitimate arguments, types of evidence warranted, and methods of measurement) upon which the suitability of the format should be evaluated. These findings suggest the usefulness of the SKAD approach for examining

processes of knowledge construction within contexts of emergent preservation practices and technologies because of its ability to consider competing epistemological assumptions and descriptions of technical practices.

The second exploratory study (Lischer-Katz, 2014a) used a theoretical framework based in social practice theory and used grounded theory to examine the information practices of three library staff members conducting digitization work at an academic library at a large public research university. In this project, data were generated through in-depth, semi-structured interviews (using a modified version of the interview guide developed in Veinot, 2007) conducted by the researchers and through participant-observation sessions that lasted 1-2 hours, in which I observed each participant going through each stage of their digitization processes and had them reflect on what they were doing at each stage. This methodology was used to examine the embodied and perceptual modalities of information practices of digitizers. This research found that while library staff who were engaged in digitization projects relied on standardized calibration tools and strict guidelines for carrying out their work, key decision points in their practices required them to employ “aesthetic judgment,” which involved them integrating “educated perceptual abilities and situated knowledge to come to a decision about the acceptable visual quality of digitized copies” (Lischer-Katz, 2014a, p. 1103). The findings from this research suggested the usefulness of a social practice theory approach for researching embodied dimensions of knowledge construction in digital reformatting practice. Additionally, this research also found that even seemingly simple book scanning projects in academic libraries involve aesthetic judgment (Lischer-Katz, 2014a), which suggests that practices of digitization, even when they appear on the surface as routine,

offer rich contexts for studying the construction of visuality. The concept of aesthetic judgment can be linked to Antonio Strati's (2003) concept of "aesthetic knowledge," which he uses to link the individual mastery of perception and aesthetic judgment required by a practice to the social dimensions of shared understandings by which the mastery of the practice may be evaluated.

These two research projects offer evidence of the suitability of integrating SKAD and social practice theory perspectives into studying processes of knowledge construction around digital reformatting that takes into account institutional and practice-based dimensions, and indicates the central role played by discourses and constructions of visuality in contexts of digitization.

7.2 Pilot Study

In addition to the above-mentioned exploratory studies, a pilot study was conducted on October 22, 2015 at the Barbara Goldsmith Conservation Center at Bobst Library at New York University in order to evaluate the suitability of the interview protocol. Three participants were interviewed using the first draft of the interview protocol and were observed as they conducted the work of digital reformatting, using the observation guide (Appendix E). The first participant interviewed was actively involved in a project digitizing analog videotapes and was observed carrying out the work. The interview protocol was found to be quite suitable for this participant. The second participant was at the stage of planning a preservation project but had not yet started it. The interview questions appeared to be less suitable for this participant, as the participant seemed to have difficulty answering many of them, likely because the participant was not involved in any digitization projects at the time of the interview and had only within the last two

months started working in this current position at the library. The third participant was working on a project digitizing analog audio recordings. While many of the questions in the interview protocol were useful for encouraging the participant to reflect on the integration of preservation knowledge into the participant's practice, because the material being digitized consisted primarily of sound recordings, there was little reflection on how visual information was being integrated into preservation knowledge. From these three interviews it is apparent that the interview guide is best used in this research project with participants who are currently engaged in digital reformatting projects involving visual documents. The questions are less suitable for participants who are not presently engaged in digital reformatting projects, and when applied to participants working with non-visual materials (such as audio recordings) they generate data that is less directly applicable to the research objectives of this dissertation research, which are focused on the construction of visibility. This supports the suitability of the criteria of site and participant selection of this dissertation (i.e., preservationists currently involved in artisanal digital reformatting of visual documents) outlined in the research methodology outlined in Chapter 6.

It is also important to note that within each of these three interviews I ran out of time and was not able to ask all of the questions, suggesting that the interview protocol may be too long to be practically administered in a reasonable amount of time. To address this, I examined the first draft of interview protocol and noted questions that seemed to cover similar topics or that could be collapsed into one another to make the use of the interview time more efficient. Through this process I identified three questions that I subsequently omitted from the interview protocol, reducing the total number of

questions for digitizers from 20 to 17.⁴⁶ Thus, the process of interviewing participants for this pilot was very useful for assessing the suitability of the original interview protocol and for improving upon it in order to create the final Interview Protocol (Appendix D).

7.3 Initial Coding Schema

To provide insight into the suitability of using the SKAD framework analyze the discursive construction of preservation knowledge, a selection of six digitization standards documents for visual materials were analyzed using this framework. An initial coding schema was developed, which can be found in Appendix G. This coding schema established the initial codes used to begin analysis of interview data and observational data generated through the data collection phase of this research.

The digitization standards documents analyzed specify in detail how the digitization of visual documents (images, video and film) should be carried out, methods of evaluating quality, and the types of digital files that should be produced. The documents that were analyzed to develop this initial coding schema each contain a mixture of textual explanations of processes and technical specifications for digital products. Considered in terms of their instrumental dimension, standards can be seen to transmit preservation knowledge by offering models for practice, in the sense that they prescribe particular formalized procedures for conducting the work of digitization. By looking at how these standards are structured as representations of preservation practices, the ways in which standards construct legitimate forms of preservation knowledge can be

⁴⁶ The omitted interview questions from the original version of the interview protocol were as follows: “Please describe the role standards and guidelines play in digitization projects at your organization”; “Who is involved in the development of digitization standards and guidelines at your organization? Probes: What are their official roles and responsibilities (job titles, etc.)?” and “How do you make decisions in your organization about procedures, standards and technology to use? Probes: How do you evaluate the effects of your decisions? Please describe the process of decision making.”

analyzed. At the same time that the structure of standards can be analyzed as instrumental transmitters of preservation, they can also be considered in terms of their performative dimensions. Standards communicate certain things about the organizations that produce and distribute them. Thus, when analyzing these documents, I tried to look at both the ways in which these documents construct the forms in which preservation knowledge can take, and the symbolic work that these standards do in constructing their legitimacy and the legitimacy of the organizations that produce them. Keller (2013) suggests analyzing the formal structure of texts in terms of their features as “documents of a particular communicative or textual genre,” in order to gain insight into types of content acceptable under the formal rules of these types of document that “shape the ‘allowed’ ways of (re) presenting such content” (pp. 111-112). Analyzing the performativity of standards documents gives insight into the way they structure preservation knowledge and community understanding. Taking both the formal and performative aspects of documents into account is important for understanding the knowledge construction in the context of the artisanal digital reformatting of complex visual documents because even if they are not adopted, they shape the taken-for-granted knowledge available in the community of preservationists by the fact that they were published and circulate.

Six documents were selected for the process of initial coding. These documents were selected because their publication dates were distributed evenly across the time period of the emergence of artisanal digital reformatting of complex visual documents (2004-2015), giving insight into the early, middle and later parts of this period, and were produced by a range of different organizations, which provides insight into the range of styles that standards documents may be produced in. The length of the documents was

quite variable, ranging from 15 pages to 111 pages, with an average length of 102 pages. Only select portions of these documents were coded, since many of these documents contain large sections pertaining to topics not directly related to the practices of digitization, such as concerns over copyright or the data encoding standards of metadata records. The following table (Table 6) lists the standards documents that were analyzed.

Year	Organization	Document Title
2004	National Archives and Records Administration (NARA)	<i>Technical Guidelines for Digitizing Archival Materials for Electronic Access</i> (106 pages)
2007	Library of Congress (LC)	<i>LC Technical Standards for Digital Conversion of Text and Graphic Materials</i> (28 pages)
2008	Collaborative Digitization Program (CDP)	<i>CDP Digital Imaging Best Practices, Version 2.0</i> (71 pages)
2010	Federal Agencies Digitization Guidelines Initiative (FADGI)	<i>Technical Guidelines for Digitizing Cultural Heritage Materials</i> (101 pages)
2013	Association for Library Collections and Technical Services (ALCTS)	<i>Minimum Digitization Capture Recommendations</i> (70 pages)
2015	Federal Agencies Digitization Guidelines Initiative (FADGI)	<i>Technical Guidelines for Digitizing Cultural Heritage Materials</i> (93 pages)

Table 6 – Documents Analyzed for Initial Coding

The process of developing this initial coding schema (Appendix G) followed three steps, drawing on the data analysis techniques of grounded theory:⁴⁷ (1) Through the process of initial coding (Charmaz, 2006), I read through each document and looked for emergent themes, applying codes line by line and at the paragraph level; (2) I looked back over this initial set of codes and began to introduce more codes guided by analytic strategies of SKAD (Keller, 2013), looking for elements of interpretive frames, narrative structure, phenomenal structure and classifications, in order to identify the ways in which

⁴⁷ Keller (2013) suggests the use of grounded theory techniques, but with some methodological modification in terms of expectations around the types of data to be generated and the phenomena being studied. While grounded theory researchers are primarily concerned with social interaction, discourse analysis is concerned with “analyzing social production and the structuring of discourses on the basis of (primarily) textual data” (Keller, 2013, p. 117). Keller suggests using the tools of grounded theory to analyze documents in terms of their contribution to discursive construction of aspects of social reality, rather than as data resulting from processes of social interaction.

these documents construct preservation knowledge; and finally, (3) I put the codes from each document into tabular display that allowed for the codes generated from steps (2) and (3) to be compared and contrasted (comparing codes within each document and between documents), in order to identify commonalities and differences, merging codes that seemed to be referring to the same concept, and subsuming lower level codes under higher-level codes. The resulting initial coding schema is presented in Appendix G.

The process of initial coding also produced insight into the structure of preservation documents, which is important for understanding the different ways that knowledge is being constructed within the documents. For instance, standards documents typically contain two distinct categories of elements, those that situate the document within preservation knowledge and establish its legitimacy, and those that offer models for shaping preservation practice. Through the process of forming these initial codes, the following six formal elements of preservation standards documents were identified (they are not always presented in this order nor are they always differentiated by clearly demarcated sections of the document): (1) Introductory statement or preamble used to establish attribution and authority of document; (2) scoping of document, defining its use for particular contexts and materials, and identifying limitations; (3) narratives of document creation and processes of production and revision; (4) the “model,” which defines practices and technical configurations, using a combination of text, charts, tables and diagrams; (5) identification of sources of supporting evidence and supplemental resources; and (6) documentation of the document’s lifecycle (e.g., version history, authorship, changes, errata, addenda, etc.). Elements (1), (2), and (3) help to establish the legitimacy of the document and the moral commitments of the institutions that published

it, and define the agency of the document (the range of contexts and materials of application); element (4) provides a model for practice, defining normative conventions, constructing visibility and embedding epistemic assumptions into technical recommendations; and elements (5) and (6) offer evidence to support the legitimacy and agency of the document and the validity of its recommendations for shaping preservation practice. The process of analysis needs to be sensitive to these distinctions in order to understand the role played by these documents in the construction of preservation knowledge. For instance, analyzing preambles (section 1) requires a consideration of the narratives that position the standards document within a constellation of earlier and contemporary standards documents, while analyzing the “model” (section 4) requires an analysis of how it defines particular ways of controlling vision, visual processes at the practitioner level. These six elements work together to integrate the standard document within the discourse of preservation knowledge, establishing its authority and helping to define the forms in which preservation knowledge can take.

Carrying out this initial analysis of digitization documents from the period of the emergence of artisanal digital reformatting (2004-2015) helped to establish an initial coding schema (Appendix G) that helped to sensitize my analysis to the forms in which preservation knowledge might be presented. Analyzing digitization standards documents in advance of beginning to analyze my interview and observational data helped to provide an important introduction to the ways in which codified forms of preservation knowledge could appear, which prepared me for interpreting participants’ statements and actions within the wider discourses of preservation knowledge.

7.4 Chapter Summary

In this chapter I have described preliminary research conducted as preparation for conducting this dissertation research. In section (7.1) I described two exploratory research projects that I conducted that examined the discourses and practices of preservation knowledge in contexts of digital reformatting, the findings of which offered insights about the suitability of two theoretical perspectives included in the theoretical framework for this dissertation research, sociology of knowledge approach to discourse (SKAD) and social practice theory. In section (7.2) I described how I used a pilot study that was conducted on October 22, 2015 in the preservation lab of an academic library to refine the initial interview protocol for this dissertation research. In section (7.3) I discussed the development of the initial coding schema developed for analyzing the data generated in the course of this dissertation research. This preliminary research was helpful for assessing the suitability of the theoretical framework and research methodology for this dissertation research, and for familiarizing me with the forms of knowledge and elements of preservation discourse that I would be encountering in my interviews, observations, and review sessions when generating data for this dissertation research. In addition, drawing from the exploratory research and the initial coding schema helped to sensitize me to important themes that I was likely to encounter when I analyzed the data generated in this dissertation research.

In the following four chapters, Chapters 8-11, I will present analysis of the data generated by carrying out the research design outlined in my research methodology, Chapter 6. These four chapters of analysis will be followed by Chapter 12, which will present a discussion of implications for theory and practice, future directions of inquiry

and a reflection on how my understanding about artisanal digital reformatting has changed since the original inception of this research.

CHAPTER 8: “SIGNAL WORK”: MATERIAL PRACTICES AND EPISTEMIC TECHNIQUES OF VIDEO DIGITIZATION

8.0 Chapter Overview

In this chapter, I analyze data generated from semi-structured interviews, video-assisted observations and review sessions related to the workplace practices of the eight “digitizers” recruited for this study, focusing on a cluster of subthemes that emerged under the theme of “signal work.” As described in my methodology, I will integrate analysis of digitizers’ material practices and epistemic techniques as they engage their eyes, minds and bodies in the work of artisanal digital reformatting, to understand how they calibrate their vision to produce “legitimate” copies through their work.

“Signal work” is used to refer to a cluster of micro-practices and epistemic techniques for carrying out the work of translating visual information from the representational system of analog videotape to the representational system of digital files. The signal in question is the video signal, which is a continually varying electrical voltage generated by playing back a videotape with a video tape recorder (VTR). Within the signal is encoded the video picture and sound information necessary for display on a video monitor.

Through observation of their workplace practices, I observed that digitizers could never experience the signal directly (unlike a film, within which each frame can be viewed on a light table with a magnifying loupe). Instead they must rely on a set of tools for measuring and visualizing aspects of the video signal: (1) A calibrated cathode ray tube (CRT) video monitor (analog, digital or both); (2) waveform monitor; (3) vectorscope; (4) audio meters; (5) capture window of video capture software; and (6) software-based visualizations. Several of the participants were observed using two open

source software packages: one is called Vrecord, which allows for visualizing and evaluating the signals and the resulting digital pixels during the digitization session. The other is called QCtools and is used for analysis of the digitized signals after the digitization session is complete.

This ensemble of tools represents a prototypical assemblage of components that was identified by observing participants' workplace settings and how they carry out their work of digitally reformatting analog videotapes, with minor variations to this prototypical assemblage observed across the different sites studied in this research. Some of this variation can be attributed to different workflows across sites. For instance, the workflow at site L5 varied in significant ways from the other sites because they do not carry out in-house digitization. Instead, participants at site L5 focus on the quality control aspect of the process, closely examining each digital file that is sent back to them from an outside vendor. Thus, for participants working at site L5, some of the key steps of digitization were absent from their descriptions of their workflows. In addition, participant P1_L1 pointed out that site L1 is doing more and more digitization off-site, even though P1_L1 admits doing a few digitization on site from time to time. This impacts the day to day work of digitization and removes the participants from direct engagement with the digitization labor, yet they still can be seen to be engaging many of the same micropractices in prepping analog source tapes and evaluating the products of the digitization process during the QC process. At the same time, we can see significant differences between participants at site L3, P1_L2, P2_L2, and P3_L2, when we would expect close conformance since they work within the same institutional context. This is also perhaps indicative of the ways in which individuals creatively enact their personal

practice in personalized ways, even when their institutional context prescribes general plans for action. Thus, there is still interpretive flexibility in the way in which the workflow may be implemented, while still remaining within the normative boundaries of the institutionalized practice. An important element in that practice is the videotape itself, which carries the analog video signal and provides the material support of the emergence of the video signal and its journey through the various points of observation and intervention in the assemblage of technical components.

Based on an analysis of participants' statements and actions throughout their workflow, the work of digital reformatting appears to be focused on the forming of meaningful matter in the world.⁴⁸ The conversion, processing, and encoding of analog signals into digital code is central to digital reformatting. Because analog video signals are invisible electrical signals, participants must use tools for measuring and visualizing those signals in order to form knowledge claims about the reasons for their observed behavior. Participants accomplish this work through activating and manipulating the video components within their video transfer lab, in which a series of analog and digital components are wired together, with the measurement and adjustment tools at critical points. This allows for analysis of signal characteristics at each stage, their adjustment, and the visualization of those adjustments. The basic material infrastructure of the video lab, including the equipment racks and furniture, typically predates the digitizers. Digitizers inherit some pre-existing video components from former workers or

⁴⁸ Capurro and Hjørland (2003) in their survey of historical conceptualizations of the concept of information point to classical and medieval understandings of information as "giving form" (p. 341) to matter. Returning to this earlier definition of information as "in-forming," helps us to understand how artisanal digital reformatting is best understood as a form of craft, of careful shaping of matter in the world, rather than an unproblematic transmission of signals, as in the Shannon and Weaver (1949) model of information transfer.

administrators, but they are observed patching in new equipment, re-routing signals and making adjustments throughout the process. Even when working with components that other works might have designed or assembled, a particular digitizer still needs to understand how they are interconnected with wires, in order to make necessary adjustments and swap out equipment if necessary.

Figure 6 shows the key components in the signal chain and identifies the places where preservationists can observe and evaluate the signal and signal chain components (“points of observation”) and sites where they can make changes and modify the signal or signal chain components (“points of intervention”). This was derived from observing the activities of digitizers working in their lab spaces, and through their explanations of their workflows provided.

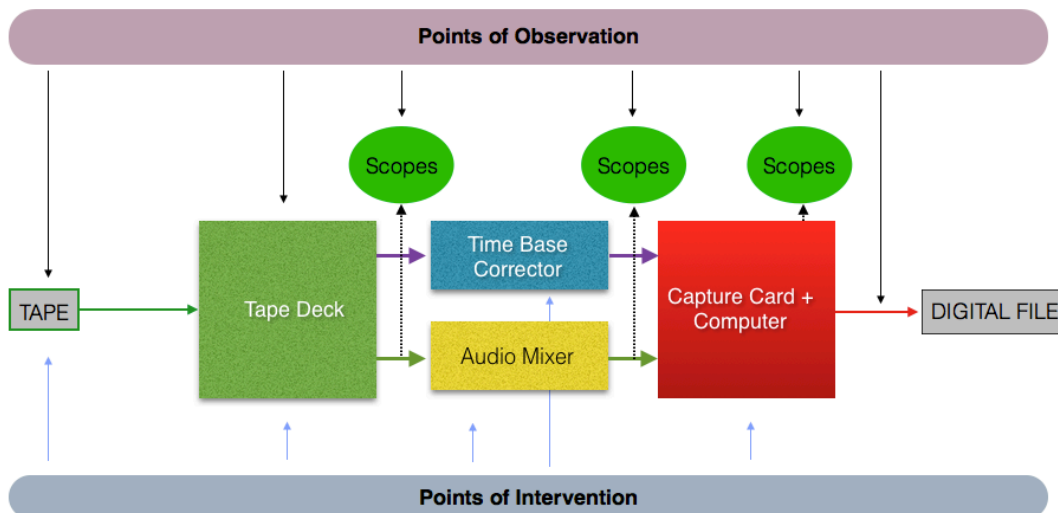


Figure 6 “Signal Work” – The Signal Chain

The process of translation from analog to digital requires participants to trace the signal flows through this “signal chain” of components in order to locate the source of breakdown and errors; manipulate components in that chain (by physically disconnecting

and reconnecting wires); and monitor and adjust signals at different points along the signal path during the process of calibration and during video capture. These are observed micropractices guided by efforts to identify and diagnose “errors” at various points in the signal, and a set of epistemic techniques used to support those efforts, by utilizing measurement and visualization tools.

The following sections will describe the sociotechnical labor of “signal work” as a cluster of micro-practices that involve the coordination of the hands and eyes of digitizers to monitor and make adjustments to shape how the invisible video signal flows through a chain of electronic components; describe the epistemological problems that arise in this process; and analyze the epistemic techniques that participants integrate into their practice in order to overcome these epistemological problems and establish some degree of certitude in their knowledge around the diagnosis and correction of errors in the video signal. In the following subsections I will describe the ways in which digitizers were seen shaping the video signal (8.1) by adjusting the sequence of video components connected in the “signal chain” (8.1.1); integrating knowledge acquired through points of observation along the signal’s flow through the “signal chain” (8.1.1.1) with their manual adjustments at points of intervention in the signal (8.1.1.2). At the same time, within their descriptions of their work, digitizers define an “epistemology of the signal” (8.1.2) in which they work to make signals intelligible under conditions of uncertainty due to the inherent indeterminacy of the signal (8.1.2.1), working to overcome limits to their knowledge about the signal (8.1.2.2), and balancing subjectivity and objectivity in their decision-making. Section 8.2 discusses the repeatable clusters of micro-practices implemented by digitizers to form knowledge claims and aid decision-making in the

process of artisanal reformatting, conceptualized here as “epistemic techniques.” Section 8.3 reflects on how “signal work” and the enactment of epistemic techniques within the work of digitizers were observed to vary across different sites and what this suggests about artisanal digital reformatting as a socially recognized practice. Section 8.4 will summarize the findings of the overall chapter.

8.1 Shaping the Signal

The central goal of artisanal digital reformatting is to produce a digital copy of an analog video signal encoded on archived videotapes. This requires the use of a chain of technological components, “the signal chain,” linked together in order to translate the information encoded within the analog video signal into the digital realm.

8.1.1 The Signal Chain and Instrumentation

Based on an analysis of the components observed in each participant’s workspace, and through conversations with participants, I identified the components and tools of instrumentation and how they are sequenced in order to reconstruct a prototypical signal chain used to carry out the work artisanal digital reformatting (as shown in Figure 6).

Based on my observations of participants’ work spaces, I defined the following video components and pieces of instrumentation that are linked in a series, forming what I refer to as “the signal chain,” and are depicted in Figure 6: (1) video tape recorder (VTR), or video deck, for electro-mechanical playback of analog video tapes; (2) time-based corrector (TBC) or other processing components used to stabilize and adjust the signal; an audio amplifier to adjust the synchronized audio signal; (3) capture card in computer to convert analog signals to digitally-encoded files; and (4) computer software

used to capture converted video signal and encode video files (see Figure 6 for a visual representation).

Through observation of their work and interpretation of their statements, it was found that the videotape is treated and discussed by participants as an active and unique element in the video lab that is the source of the video signal, as well as a culpable “agent” for producing errors in the signal. According to digitizers, a decaying tape can cause problems as flakes of oxide get caught in the video heads, disrupting the video signal.⁴⁹ In addition to the tape, digitizers also work to make sense of the various technical components that make up the digitization system. Digitizers were observed manipulating a variety of cables that they identified as transmitting video, audio and synchronization signals between the pieces of equipment in the signal chain. They showed me how to patch each piece of equipment so that the signal could be viewed on different monitors or video could be processed through different pieces of equipment. Based on digitizers’ own descriptions of their workflow they explained to me that the components were wired in a series, such that the video signal flowed from the VTR playing back the tape, through various components, to the digital capture card in the computer. One digitizer, P1_L7 explained “the basic notion of video archiving as [a] kind of shepherding a signal around from the actual medium, along the chain, and then, sort of, keeping track of your files and all the sorts of things that entails.” “Shepherding a signal,” as P1_L7 describes it, involves tracing the linear arrangement of the assembled

⁴⁹ The video tape recorder (VTR), which is directly engaged with the materiality of the analog videotape, is a complex technological artifact that incorporates electrical, magnetic and mechanical components to move a rapidly spinning video playback head across the tape, as the tape is moved through the tape path at a precisely synchronized rate (controlled by servo motors). At the same time, complex amplifiers and processors in the tape deck amplify and decode the modulated signal coming directly off the tape and make it “readable” by video components throughout the signal chain.

components, when breakdown in the system occurs or error is detected at some point in the signal chain (i.e., at the “points of evaluation” and points of intervention” discussed below) participants often have to physically disconnect components and connect other components using a patch bay⁵⁰ (See Figure 7) or by connecting cables directly into the backs of video decks and components (See Figure 8) in order to identify the location of the problem in the signal chain and/or select a more effective configuration of components in the signal chain.



Figure 7 – Patching Cables in Patch Bay
(Digital Photos Taken by Author at Site L2)



Figure 8 – Connecting Cables to Back of Deck
(Digital Photos Taken by Author at Site L2)

For example, in the review session, participant P1_L2 described the meaning of participant’s actions presented in the video recording, and reflected on the thought process of trying out different components in order to compensate for an error in the image quality:

P1_L2 (Review Session): I'm swapping stuff out. I'm like, ‘what's wrong with the image?’ uhm... we've had a few problems with them. They [that particular time base corrector] for some reason they have this, uh, for some formats they have this dotted line at the bottom of the screen where its introducing the artifact. So, we kind of haven't been using them as much. But they do work really well with 1/2" [open reel video format] I think.

⁵⁰ A patch bay consists of a plate of input and output connectors mounted in an equipment rack. Each jack is wired to the inputs or outputs of a particular piece of equipment in the rack. Rather than rewiring each connection each time a piece of equipment is swapped out, a patch bay allows for short runs of cable (patch cords) to easily connect and reconnect pieces of equipment on a single surface of input and output points on the patch bay instead.

P1_L2 is referring to the ways in which different video processing components, in this case a time base corrector (TBC) can be swapped out in order to select the best configuration of components for that particular format (1/2" open reel videotape) and circumstances. Swapping components is guided by participants' knowledge of how those components behave, based on previous experiences working with those different components in various contexts.

Digitizers draw on their memories of which components worked before in similar situations and swap components in and out of the signal path with this accumulated experiential knowledge guiding their decision-making process. This process can sometimes become chaotic and guided by what appears to be immediately expedient, as P1_L7 reflects on the experience of dealing with cables and patching components in the back of the rack at Site L7:

P1_L7 (Review Session): Yeah, the back of that, as you probably saw, as you might see here as you're playing through, uhm... the whole back end of the rack such as it is, is a huge mess. And I've been thinking for a long time, oh, I should clean that up, and put some sort of colored tape on the end so that I know which cord is which, and you know have them setup, so I'm not constantly going around back and doing what I'm having to do here, but you know, as what often happens for whatever reason, cables get switched out and they don't get switched back. You plug things in, because, it's really just some momentary, "I'll plug this in now because this needs to be over here..."

Swapping components can involve comparing the effects of two different components on the signal to determine the best fit for the situation, or to confirm the appropriateness of the selected components. These are important moments of decision-making, when digitizers reorder the complex technical ensemble of the digitization equipment. For P1_L7, this "work-around" overcomes the technological limitations P1_L7 perceives in system, enabling P1_L7 to re-order its technological components. This can lead to

situations where swapping out one component can improve one aspect of the signal and worsen other aspects. This is evident in participant P1_L2's statements while in the process of digitizing a color video signal recorded on ½" open-reel tape and getting a particularly problematic tape to produce a signal of acceptable quality:

P1_L2 (Think Aloud): This isn't working for color at all. [*Swaps out component in signal chain*] See that's fine. ...the head-switching is awful. Look at that. We tried it on both decks...

Digitizing ½" open-reel color videotape is perceived to be a particularly challenging task (See Figure 9 for an image of a ½" open reel deck). In this example, the act of P1_L2 swapping out one time base corrector (TBC) for a different one improves the color component of the signal, but does not help the intense head-switching⁵¹ that P1_L2 was seeing in the video image during the transfer.



Figure 9 – Color ½" Open Reel Video Tape Recorder (VTR)
(Digital Photo Taken by Author at Site L2)

⁵¹ “Head-switching” refers to the lines of distortion that can appear at the bottom of some analog video tape formats. This is caused by the alternating switching between the two video heads mounted on the spinning video head drum in the VTR. As the drum spins, each video alternately reads video signals off the tape, but there is a slight distortion in the signal at the moment in the video signal where the two video heads are switching. Typically this distortion would be hidden at the bottom of the frame of video and would not be seen on old CRT monitors due to their inherent “overscan” (i.e. some of the video image formed on the CRT tube is always cropped out by the edges of the video screen. Head-switching can be exacerbated if the tape is copied, as each re-recording can introduce an additional layer of head-switching to the bottom of the screen.

Since it may not always be possible to alleviate all errors with some problematic tapes, swapping of components can require participants to make difficult decisions about what types of errors will be less intrusive to the viewing of the imager compared with others, and digitizers develop heuristics for dealing with recurring types of errors. For instance, in showing me how to adjust the tracking control on a black and white, ½” open reel VTR, participant P1_L3 described methods developed for dealing with distortions caused by poor tracking:

P1_L3 (Interview): I pointed out that tracking line, which shows up in a lot of tapes. And so I know that I can’t completely get rid of that, but I can make it as unobtrusive as possible. You know, and there are some tapes that are absolutely beautiful, and they don’t have that tracking line problem. So that could be... That’s why I think maybe that particular camera that they used had a special tracking setting, or a default tracking setting. But that was a little different from other cameras. But that’s one example.

In this example, the participant is showing how adjusting the tracking control on the VTR can move a line of static that cannot be entirely removed from the video signal due to a poor alignment of the signal recorded on the tape to the rotating video heads, to the very bottom of the video image, so that it is less distracting to viewers. P1_L3 has identified this as a common problem for many of the ½” open reel tapes being digitized, and quickly adjusts the tracking on the VTR, while watching the effects on the video image on the CRT monitor, to correct minor errors identified in the signal. In this statement can also be heard participant’s aesthetic appreciation for the tapes and a nuanced understanding of each tape’s unique properties, which emphasize the “artisanal” aspect of participant’s work.

Swapping components can also help to identify the source of a problem in the signal chain or aid in eliminating components as possible sources of problems with the

video signal in the mind of the digitizer. The prototypical ensemble creates a situation in which decision-making can occur. In this example, participant P1_L7 is discussing the techniques of swapping components and different types of cables to identify particular sources of error, which can emerge at any point in the signal chain:

P1_L7 (Review Session): But then if you send it over there and it's fine, then okay it's obviously, then I've got to think about my setup. So it's either the deck or it's somewhere in the chain that I've got it hooked up; it could be a bad wire, maybe I've got a, maybe my audio hook ups are bad or my S cable is dead, or whatever. So then you've got to think like where in the chain that could be happening. So there you have to like switch out your cables and you know, see, again, see if you can replicate the same result with different cords or different decks, or anything in there, because it could, it could be something in the TBC, it could be something in the switcher.

Swapping components in the signal chain helps to diagnose the source of errors and can help digitizers make decisions that impact the quality of the resulting digital copy. At the same time, the physicality of swapping components – the fact that participants disconnect cables, move equipment, reconnect cables using their hands – offers digitizers an important source of knowledge that they can directly verify through embodied engagement with the technological system, which can be seen as an artisanal micropractice. Digitizers know that a particular cable is attached full or feels loose because they can tug on it and feel it; and if the signal has errors, they can verify the connections with their hands and eyes and develop a high degree of certainty that the physical connection is not causing any of the problems that they are observing. This also provides a means for digitizers to take full responsibility for their actions, as P1_L3 explained: “I just manually switch them out.... That’s been the easiest solution. Or, at least, if anything goes wrong, it’s usually my fault, so I can fix it” (P1_L3). In this quote, the physicality of swapping components is emphasized as an important source of

certainty about key components of the signal chain. As mentioned earlier, since the electronic analog signal cannot be directly perceived by the human senses, participants must place their trust in scopes that visualize the signal for them, which makes any parts of the signal path that they can physically engage with important sources of certainty in their practice. Physical engagement allows for a movement from uncertainty to certainty in the optimization of signals. The case of swapping cables and components with their hands offers a form of embodied knowledge that brings the digitizer into closer physical proximity to the underlying electrical signal than the scopes afford. Touching and manipulating the channels by which the electrons move from one end of the signal chain to the other enhances digitizers' ability to troubleshoot problems and construct greater certainty about the decisions they make when adjusting the signal path, and enables them to construct knowledge about their work.

8.1.1.1 Points of Observation of the Signal

Digitizers observe the video signal at multiple points along its journey through different components in the digitization system. For example, P1_L1 pointed out that comparing the different signal at different points in its translation from analog to digital representation systems helps to ensure that the signal is consistent from the tape to the digital file:

P1_L1 (Review Session): We monitor the post-digital signal. Digital and analog. It goes back out analog. We have the signal coming off the deck to compare the two. uhm... So you're measuring on different things just to make sure they are all the same.

Because participants would like to have full knowledge of what is happening at each component in the signal chain, they use CRT monitors and video scopes connected at different points along the signal chain to evaluate the signal at each point, including: at

the point where the signal is coming directly off of the VTR (which is in direct physical and magnetic contact with the source videotape),⁵² the point where the signal leaves the time base corrector (or audio amp, in the case of the audio signal), and the point after the signal has passed through the capture card and is encoded into a digital file. Being able to evaluate the signal at each point allows for the identification and remedy of errors (see Figure 6 “Signal Work” – The Signal Chain, above). Moving between and comparing how the video signal appears at each stage in the signal chain is part of the embodied action of digitizers that helps them move from uncertainty to certainty about the phenomena they are engaging with in their work. As discussed below, being able to monitor and measure signals at each point can allow the digitizer to identify any changes that the signal chain may be making to the original signal coming off of the tape. This also allows the digitizer to calibrate the signal path so that a known signal (a “test signal,” such as color bars and test tones) can pass through the signal chain without being altered to any measurable degree at any point along the way. P3_L2 uses a mixture of analog and video scopes to compare signals at different points throughout the signal chain:

P3_L2 (Interview): So we use both of those, which is really helpful to have the digital reference as well, because we just started using those recently. Yeah, so that’s... And then the fact that we have the two monitors also, which is really helpful as well. Ideally, we’d like to have three monitors,⁵³ so that we could watch

⁵² Analog videotape is composed of a long strip of plastic with magnetic particles embedded within it that is capable of receiving and holding varying magnitudes of magnetic flux. The video and audio signals are recorded using a video tape recorder (VTR) as changes in magnetic flux to the tape using recording heads (essentially small, precise electromagnets) onto separate tracks. On playback, the playback heads (again, essentially small, precision electromagnets) are used to read the changes in magnetic flux on the tape to reproduce the recorded signals. These signals are processed by on-board electronics in the VTR and output as analog video signal that can be displayed on a cathode ray tube (CRT) monitor (i.e., those old “tube,” “fat screen,” televisions that predated flat-screens).

⁵³ P3_L2 is suggesting that dedicated video monitors (CRTs) would ideally be attached at three points in the signal chain: (1) where the signal is coming directly off of the deck (“straight off the deck”); (2) where the signal is just about to go into the digital capture card in the computer (“pre”); and (3) where the signal is coming out of the computer showing the digitized video image (“post”). Having these distributed points of analysis gives insight into any problems that might develop between any of these points of observation.

straight off the deck, pre and post. But sometimes there just isn't room for three monitors. But that's really helpful.

P3_L2 points to the need for as many points of observation in the signal chain, but acknowledges that space limitations in the lab may limit what is practical, suggesting that a workable signal chain may deviate from the ideal and still produce acceptable digital copies. Digitizers point out that comparing visualizations of the signal at any point along the signal chain should be exactly the same, but they admit that since the analog signal is being translated into a different system of storage (digital encoding) and display (flat screen, high definition monitor), a comparison between the analog original and the digital copy will always look significantly different, and that this inherent difference in the materiality of analog and digital images must be taken into account when evaluating the quality of the digital copy. In showing me the digitization monitoring equipment in Site L2, participant P3_L2 reflected on the negative affective experiences of seeing significant differences in the quality of the analog image on the CRT monitor, when compared with the digital image on the computer monitor:

P3_L2 (Think Aloud): It's very frustrating... Sometimes the digitized image looks very different on like a computer monitor, versus a CRT monitor. Like for me, this [*gestures to CRT monitor*] looks great, it looks good. But here [*gestures to same image in capture window of the computer monitor*], it looks kind of grainy.

These perceived differences in how the analog and digital images look is unresolvable and related to the materiality of the image forming system of the analog and digital

Due to physical space constraints in the lab, having three dedicated monitors may not always be possible, so participants show me how they are able to wire multiple signals into one monitor, and then use a switch to switch between them. This allows them to compare signals by pressing a switch and swapping between two different signals, but P3_L2 suggests that ideally one would be comparing all of the video images from different points in the signal chain side by side.

worlds,⁵⁴ but it still frustrates P3_L2's efforts to produce what is perceived to be the highest quality copy. When comparing the analog and digital images, then, digitizers must learn to distinguish between differences that are attributable to the materiality of the particular viewing technology, and differences that are may be attributable to a problem within the signal chain. This is developed through direct experience developing an eye for the different types of visual media, as well as constantly checking between different points in the signal chain.

Comparing visualizations of the signal at different points in the signal chain helps the digitizer to detect differences in the signal at different points, identify the sources of those differences, and take action to adjust components in the signal path to compensate for those differences. The types of differences in the video image they encounter include brightness ("luminance"), saturation ("chroma"), and color balance ("hue"). Other differences they look for are visual "artifacts" that are errors that can crop at any point in the signal path, which can be due to problems with the tape, or with another component in the signal path, which can range from "drop outs," which appear as horizontal white streaks in the frame of the video image to "flagging," which is a tape tension problem that produces the top edge of the video frame to shift periodically from side to side (like a

⁵⁴ The display devices in the world of analog video are CRT (cathode ray tube) monitors that function by emitting a beam of electrons that scans across back of a screen of phosphors, forming lines of video that make up the video image. Once analog video signals are digitally encoded, they are displayed on a flat-screen LCD (liquid crystal display) computer monitor. Whereas the CRT works by emitting light through the activation of glowing phosphors via electron excitation, the LCD screen works by blocking and unblocking a continuous light source through small liquid crystals that are electrically controlled to allow more or less light to pass through the screen. In comparing the same image presented on these two types of imaging devices, digitizers must learn to see beyond the specific characteristics of the imaging devices to evaluate the quality of the final digital copy and how it compares with images at earlier points in the signal chain.

“flag” waving in the wind).⁵⁵ Additionally, any piece of video equipment is at risk to a host of other problems such as electrical hum due problems with the electrical supply in the building where they work or issues around the synchronization of sound and image due to improper wiring between components. Looking at scopes (waveform monitors and vectorscopes) allows for diagnosis of problems at the signal level. Waveform monitors visualize the voltage of the analog video signal over time, which allows for adjustment of brightness (balancing the whitest white and the blackest black of the image within the constraints of the signal standards for video broadcast); and vectorscopes, which visualize color elements of the video signals (measuring saturation and hue).

Figure 10 shows a typical video lab rack of equipment, with a CRT monitor mounted in a rack above a waveform monitor (on the left) and a vectorscope (on the right). This setup has the same components used in P3_L2’s workflow. P3_L2 spends a lot of time comparing video signals at each point along the signal path (see figure 6 above for the points of observation along the signal path). In this quote from P3_L2’s review session, we can see how comparing signals, once learned and integrated into practice becomes a routine that is difficult for P3_L2 to fully quantify, but is shaped by the particular circumstances of a particular tape:

P3_L2 (Review Session): I'll definitely do it [compare video signals] a decent number of times during the capture. Sometimes if there's a... uhm... maybe an aspect of the image that looks problematic to me, I will check more, because maybe I'll be concerned that, maybe I'll be concerned that I over adjusted levels.⁵⁶

⁵⁵Examples of visual problems with analog video tape are being collected in the *A/V Artifact Atlas*, a crowdsourced compendium of video errors available here: <https://bavc.github.io/avaa/>

⁵⁶Digitizers can use TBCs (time base correctors) to adjust various aspects of the video signal. While the main function of the TBC is to correct for “time base” errors, which are disruptions to the proper display of a stable video image due to slight variations in the timing of the video signal being played off of a tape, TBCs also include processing amplifiers that allow for adjusting the characteristics of the video signal by turning control knobs on the faceplate of the TBC.

Or that, again, maybe the TBC is introducing too much chroma⁵⁷ or flagging or something along those lines. Especially if there is errors on the tape,⁵⁸ that is something I will check for a lot, to be sure that it's consistent with the original, basically. Or, it's a good way to check if things are native or not sometimes, as well. Like how it appears straight off the deck versus through the TBC.⁵⁹ You know? That would be a part of it as well. I don't know how many times I do it, though. I certainly do it a lot more, if it's a tape that I'm concerned about.

P3_L2 moves their eyes back and forth, across the monitors and scopes throughout the capture process to ensure that no errors appear in the digital copy. In some ways this activity is routine, but it is also situated in that the routine is shaped by evolving the interactions between the materiality of the tape and the system components, and emergence of errors in the video signal.

Monitors and scopes often have switches that allow for multiple observation points in the signal path to be wired in and switched between, separate monitors and scopes can be patched in at each point in the signal path. The waveform monitor and vectorscope are modified oscilloscopes that use a monochromatic cathode ray tube to visualize different parts of the decoded analog video signal. The waveform monitor visualizes the luminance signal of one line of video (or two depending on the settings), measuring signal voltage, calibrated to IRE units (Institute of Radio Engineers), which can take values ranging from -40 to 100 (Weynand and Craig, 2004). The vectorscope

⁵⁷“Chroma,” is short for chrominance, which refers to “pure color information without light or luminance” (Weynand and Craig, 2004, p. 238). Digitizers can adjust this using the TBC controls. Changing this aspect of video signal will effect how saturated the colors will appear.

⁵⁸One difficulty that digitizers face is determining the root cause of an “error” in the video signal. Errors could be due to the condition of the tape. As videotape ages, it can change shape, become sticky and/or lose pieces of the magnetic material that is used to store the video signal, all of which will lead to errors in playback. In addition, a tape could have been recorded outside of the standards defined by video engineers, in which case video signals might not be calibrated properly and adjusted to fit within the standard range of signals that video equipment are designed to handle, which can cause distortion.

⁵⁹Digitizers compare the signal that comes “straight off the deck,” which is the video signal as it appears from the analog video tape being played back without any adjustments or processing, with the video signal after it is processed and adjusted by the time base corrector (TBC). This enables digitizers to develop knowledge about what the “original” video signal looks like, and compare it to how the TBC is potentially altering that signal.

(see Figure 11 below) provides a visualization of the color information in the signal. The visualization of the color signal produces an undulating blob of points representing color hue and saturation centered on an origin point of a circular display diagram on the screen of vectorscope. Different colors appear as particular points representing hue and saturation. Angular position relative to the circular *graticule*⁶⁰ indicates the hue of the color component of the video signal (the phase of the color subcarrier), and distance from the center point measures the saturation (the amplitude of the color subcarrier) (Weynand and Craig, 2004). Calibration targets etched onto the screen of the vectorscope allow equipment to be adjusted so that a known, standardized signal, such as SMPTE (Society for Motion Picture and Television Engineers) color bars⁶¹, will produce visualizations of the color signal that match the pre-set targets on the screen. Thus, these scopes help digitizers calibrate the system to a known threshold of adjustment and adjust signals based on what they refer while carrying out their work as “objective” measures, because they allow adjustment based on quantifiable and independently visualized elements of the video signal.

⁶⁰ The *graticule* is the calibrated set of measurement marks on the screen of the scope that allow numerical values to be assigned to particular visualized points that appear on the screen (See Figure 11, below).

⁶¹ “Color bars” refers to a video signal that can be played back from a tape or generated by an electronic device in order to calibrate video equipment so that colors and brightness levels match SMPTE specifications. The familiar sequence of white-yellow-cyan-green-magenta-red-blue (See Figure 10, below) provides a standardized way of calibrating signals and test equipment to a set of commonly accepted test values for the analog video system of visual encoding. Color bars and how they fit into participants’ work practices will be explored in greater depth in section 8.1.1.2.



Figure 10 – CRT Monitor (Top) Waveform Monitor (Left), Vectorscope (Right)
(Digital Image Taken by Author at Site L2)

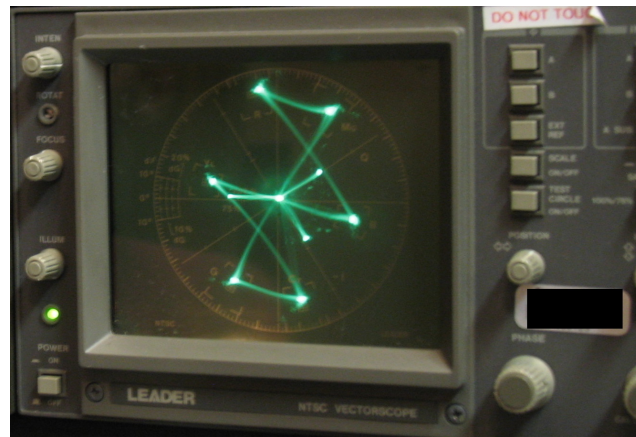


Figure 11 – Close-up of Vectorscope⁶²
(Digital Photo Taken by Author at Site L2)

⁶² Sending a color bar test pattern into a properly calibrated system will position the points on the vectorscope at the various targets indicated on the *graticule* (See Figure 11, above). Each target around the vectorscope graticule represents a standardized mixture of hue and saturation that each color bar should match. Measuring from the “due west” direction (degrees measured counter-clockwise) from the origin of the graticule, the standardized mixtures for each color bar is: Yellow = 347° phase, 0.319 Volts; Cyan = 104°, 0.451 Volts; Green = 61°, 0.423 Volts; Magenta = 241°, 0.423; Red = 284°, 0.451 Volts; and Blue = 167°, 0.319 Volts.

8.1.1.2 Points of Intervention in the Signal

Digitizers intervene in the signal chain when they calibrate the system; set up the tape for capture (“set-up”); and, less frequently, during the process of digitization. Initial calibration may involve running test tapes or signals. Test tapes can either be professionally-produced tapes that contain precisely generated video test signals, or they can be tapes that digitizers are familiar with and thus trust that if their equipment is adjusted based on that tape, the configuration will be accurate. To check proper adjustment of the VTR and/or introducing test signals generated by a test signal generator to calibrate other components in the signal path (such as TBCs, scopes and CRT monitors), as well as resetting any adjustments that had been made in the previous digitization session. These adjustments are intended to get the system back to a neutral, “baseline,” as discussed in P1_L1’s reflections during the review session:

P1_L1 (Review Session): And here, I'm putting the tape in, looking at bars, and then basically looking at all the systems that are going on to make sure that they are good. You know what I mean? That everything is set, that everything is how I expect, it's going smoothly, as accurately as possible, is kind of what I'm, is what I'm doing at this point. So that is like a step before this. And so then, with this tape, using the reference that's on the tape, to then, test the various, everything that is going to come into contact with, is kind of what I'm doing at the outset of this.

The use of a standardized test signal produces “color bars” – which P1_L1 refers to here as simply “bars” – on the CRT monitor, allowing digitizers to adjust system components to a signal that follows technical standards and is familiar to digitizers. It allows them to setup their equipment in a familiar way that they understand, so that the system is, in the words of P1_L1, “how I expect.” Like other standards that have been widely adopted, using color bars ensures uniformity and sameness across space and time of video signal

characteristics⁶³ so that a video system can be calibrated, tapes produced and video signals broadcast to television sets in a standardized and controllable way. Using test signals or tapes in this way helps digitizers reduce uncertainty about how the complex ensemble of components in their signal chain may be impacting the final digital copy.

Having more points of observation allows for more points to observe and calibrate to these standard “color bars” signals. The ideal signal chain would have monitors and scopes set up at each point in the signal chain, in order to construct knowledge of the signal, in what some participants call its “native state,” coming off of the original videotape. P2_L2 listed all the components in “the ideal” signal chain and how they should all match if they are properly calibrated:

P2_L2 (Review Session): We've got a CRT, got a waveform monitor... hopefully, the post digital, either SDI or Y-out scopes all say the same thing, right? uhm... those tend to depend on the format a little bit. uhm. you know if you're doing an off deck comparison to a post digital comparison, and the deck doesn't have a TBC and you're going through a TBC, uhm, you might be better off with a post TBC digital comparison. Or you might want to have all three if possible, so you can see what the signal looks like in its native state, what the signal looks like after you've made your adjustments, and then what the signal looks like after you've captured it. uhm.. I think depending on the format, and the deck, and the machine you're using, and the TBCs we have, those things will kind of vary but, I like more, because I like to look at it all.

P2_L2 wants total knowledge of the signal, including how it looks coming off of the tape (the “native” signal), the signal being adjusted, and the final signal at the point of digital translation.

The calibration of scopes and components produces a more knowable and manageable signal chain within which digitizers become more certain about the behavior

⁶³There are a variety of “color bars” test patterns, but the typical one encountered by video preservationists is SMPTE color bars, which were most recently standardized in 1991 as EG1-1990, “Alignment Color Bar Test Signal for Television Picture Monitors,”
<http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7236418>

of the video signal at different stages in the digitization process. For example, on reflecting on video recordings of P3_L2's micro-practices during the review session, P3_L2 describes setting levels, calibrating components, and what thoughts go through P3_L2's mind throughout this process:

P3_L2 (Review Session): So, obviously, you saw me going through setting all of my levels, so I try to be as confident as I can that my levels have been set correctly before I start, so then when I'm monitoring, my capture, I'm really primarily watching the CRT screen and comparing the two inputs.

Here we see this participant describing how the epistemic technique of comparison and matching (discussed later in this chapter) is important for carrying out the work of artisanal digital reformatting, as we see P3_L2 moving their eyes back and forth between different visual representations, adjusting the signal so that all points in the signal chain “match,” along such dimensions as brightness (adjusting black and white levels), color saturation, hue, sharpness, and the presence/absence of video errors. Digitizers' eyes must move in a systematic fashion across a spatial array of visual information sources (discussed later in this chapter as “patterned looking”). Only once they have established a baseline through calibration and a constant comparison of signals, will they make adjustments to the overall signal, affecting the final look of the digital copy. P1_L6 explains:

P1_L6 (Review Session): We're using the scopes to monitor the baseline of... using a reference of the color bars to be calibrated. So, we're using the vectorscope on the left to make sure that the... you know the color levels of the machine is in the right area, and then, on the right, the luminance, the black and white is within a certain range. And then, the only thing is, if our determination is based on whether or not to change anything, is if you cannot see it at all, it's too black to even see, then we will bump up the white, ever so slightly... you know to where it's discernable.

Calibration is used to establish a knowable signal chain within which a signal may be adjusted with predictable results. Only once the system has been calibrated and made knowable, made into a standardized and predictable system, can any adjustments be made to the signal that will produce predictable results. Without calibration of the equipment, the digitizer is not certain of how much to adjust the signal.

Once the system has been calibrated and the signal chain can be trusted to produce predictable results when adjusted, digitizers load a tape into the VTR, playback portions of the tape and adjust the system to compensate for any errors that may appear in the tape. This is an iterative process of running the tape, monitoring the signal on the CRTs and the scopes, and making necessary adjustments:

P3_L2 (Interview): When I'm studying the TBC, I'm normally watching the analog scope, but then I'll compare it to digital and be like, "Oh, this can come down a notch." And then I'll go back and be like, "Oh, go up a notch." It becomes a very fine line between being perfect, and then I'll check the deck and I'm like, "Oh, the deck is a little bit darker," and, "Oh, then that's too low."

A time base corrector (TBC) is a critical site of intervention where digitizers can make adjustments to the signal (Figure 12 - Time Base Correctors). A TBC is an electronic device (often containing analog and digital processing components) that corrects for timing errors in the video signal (stabilizing the signal and the video image), but also often has built-in processing amplifiers that enable adjustments to be made by the digitizer to the chrominance, luminance and position of the image frame.⁶⁴ Digitizers adjust these elements and watch as changes appear on the video scopes. They then confirm how the changes are shaping the visual appearance of the video image on the monitors.

⁶⁴The selection of a particular TBC can also have a significant impact on the resulting signal, as noted in the earlier discussion on swapping equipment. Different TBC models can handle different levels of error, adjust for timing errors differently and produce different quality of the video signal.



Figure 12 – Time Base Correctors (TBCs)
(Digital Photo Taken by Author at Site L2)

Errors in the signal can occur at any point along the signal path, including at the VTR or later on in the signal path at the TBC. Once errors⁶⁵ are observed, digitizers can intervene in the signal. This can be accomplished by swapping out equipment, as mentioned earlier, or by adjusting settings on one or more components in the signal chain. At the VTR, there are tracking controls, skew controls, and tape guides that can be adjusted in order to optimize the contact between the video head and the recorded video tracks on the tape. At the TBC stage, digitizers can make adjustments to the timing of the signal (which affects the position of the resulting image on the screen), the chroma (color) and luminance (brightness) levels to ensure that they are within the guidelines established for broadcast “legal signals.” In this case, digitizers have to interpret the

⁶⁵ Errors in the video signal can be the result of damage on the physical tape due to aging, poor storage conditions, or use; the quality of the video signal that was originally recorded; errors introduced at the point of copying, if the tape is a copy; electrical or mechanical malfunctioning of the playback VTR, or improper adjustment by digitizer; malfunctioning signal chain components, or improper adjustment by the digitizer; or improper selection of signal chain components for the particular needs of that particular tape.

abstract visualizations on the waveform monitor and vectorscope, which offer signal level visualizations of the video signal's voltage and phase. Any adjustments made at the TBC can be evaluated by looking at these scopes, as the visualization of the video signal can be shown to change at the same time as the adjustment is being made. For instance, P1_L1 explained the process of adjustment as one characterized by calibrating, monitoring the signal on the scopes, and adjusting to bring the video levels into accordance with the standard guidelines for video signals:

P1_L1 (Think Aloud): I would set up to bars, if there were bars, I would setup to them. And then go into content. So you can see here, we're going above 100 there, with the titles, and the blacks are a hair above too. So we're hot. ...bring the whites down. [*adjusting controls while looking at scopes*] Because it's a pretty white background. [*looks back at the video monitor to examine the image*] So that looks pretty good. I'm just going to go back to the titles again. So I brought the whites down negative 7.

In this description of digitization work, P1_L1 talks about adjusting the equipment to the video test signal that is often (but not always) recorded at the beginning of videotapes. This follows adjusting the system to a known tape so that P1_L1 is sure that the system is setup properly. After adjusting the system to these test signals, P1_L1 then lets the tape play into "the content," that is the area on the tape when the video image starts and P1_L1 can start to assess the quality of the video signal. In this case, P1_L1 looks at the waveform monitor and notices that the luminance part of the signal is too high, "too hot," and adjusts it. The "whites" (the peaks of the video signal) and the "blacks" (the lowest visible parts of the signal) are both seen on the waveform monitoring to be outside of the measurement points where they should be, and P1_L1 adjusts the signal accordingly.

As seen in this example, which is typical of the work of digitizers in setting up their signal levels when starting to digitize a tape, digitizers must coordinate their hands

(adjusting the controls of the TBC), with their eyes, which are evaluating the effects of the adjustments on the scopes, as well as scanning back to the CRT monitor to see how the video image is affected. Ideally, any problems in the system or with the tape will be detected in the calibration and set-up stages before the video capture has started:

P1_L2 (Review Session): Yeah, we could stop tape. If you're lucky enough and you're catching these problems when you're just testing it, because usually we test a tape first, and then, you know you can start making adjustments. Making adjustments to the tape guides. uhm... oh wow. It looks like there's some color going out of range.

In this example, participant P1_L3 describes the process of monitoring and adjusting the video image as the tape deck is playing during the setup phase of digitization work:

P1_L3 (Think Aloud): [*Adjusts skew control on tape deck, and thin line of horizontal static moves through the center of the video image*] So, I'm getting a lot of this flickering, skewing at the top. And that usually has to do with the skew adjustment, so I can kind of stabilize it. And then this bar of static [*points to horizontal bar of static across the bottom of the CRT screen*], I can bring that down with the tracking knob. And when I adjust that, it also starts to steady... we're actually getting a lot of flicker here [*Points to top of the video image*]. I noticed that the TBC I'm going through tends to enhance that effect. So, if I send it through a different TBC, it will look different. [*Stops tape playback and swaps out cables on one TBC and patches them into another TBC in the rack*]. So that's the plus side to having two different TBCs. Then again, these are the only ones we have that seem to be able to handle the signal. [*Starts tape playback again*] So, now it's a lot darker, but it's a lot more steady, I think.

This example also illustrates the ways in which signal work combines comparing and matching of video images, swapping elements in the signal chain and making decisions about how to produce the best quality image that best represents the original recording, oftentimes requiring a subjective decision on the part of the preservationist to decide what looks like the best quality given the physical condition of a particular tape. In this case, the participant must rely on personal aesthetic judgment to decide whether a darker image is preferable to one that is unstable and flickering. Digitizers try to take their own

personal aesthetic taste out of the equation and work to create a digital copy that is an “authentic” representation of the original using video scopes, even if the resulting copy does not look exactly how they would personally prefer it to look. P3_L2 described making an effort to be aware of personal taste interfering with the ability to be “objective” in the production of digital copies that accurately reflect the original video recordings:

P3_L2 (Interview): I always aim towards more saturated color, and other people don't. But just because I like really vibrant colors doesn't mean that I get to have them. But, that's where, like, scopes obviously come in really useful as well, because it can be hard. Sometimes I won't even realize that I'm leaning in a certain direction, but then I will.

P3_L2 expresses the need to always be self-monitoring the process of carrying out the work in order to ensure that adjustments to the video quality are not being carried out based on personal taste. P3_L2 goes on to explain the rationale behind focusing on objective measurements provided by the scopes, rather than relying solely on one's eyes and taste to evaluate the image presented on the video monitor:

P3_L2 (Interview): Because we're not here to improve an image, either, as much as we might want to. But I very much believe that if something's recorded to look bad... I mean, that's, it's not our... If somebody at a later point wants to make, you know, improve on this footage, well, then go ahead. But that's not our place. **Our place isn't to improve anything. It's to preserve an image the way it was recorded** [*emphasis added, zlk*].

P3_L2 is suggesting that employing “objective” measures helps to ensure that the video is adjusted in a way that maintains the visual quality of the original, which may involve restraining one's self from “improving” a video signal that was “recorded to look bad.” As will be discussed briefly in the next section and further elaborated in Chapter 11, P3_L2's descriptions of using “objective” techniques in order to remain “neutral” in the work of digitization expresses moral commitments to preservation values, such as

authenticity and integrity. Further, Chapter 11 will explore links between the articulation of commitments to preservation values and their enactment in digitizers' work.

8.1.2 Epistemology of the Video Signal

As can be seen from digitizers' descriptions of their "signal work," competently carrying out the work of digitizing analog videotapes relies on a complex assemblage of equipment for playback, adjusting of signals and encoding visual information into digital files. This complex system can produce puzzling outcomes, such as visual errors or other problems that the digitizer may need to investigate. Unexpected and unexplainable errors are more likely when dealing with decaying tapes, since tapes with damage can produce unstable video signals that behave in unpredictable ways. With more experience working with decaying tapes or a range of tape formats, digitizers develop an understanding of what to expect when a particular videotape format of a different vintage is played back (i.e., older tapes are more susceptible to decay). Even as digitizers become increasingly knowledgeable about how different types of tapes will behave, there are always limitations on the certainty with which digitizers can evaluate what is happening in the signal chain and translate their archival imperatives into an appropriate intervention. Because video images are visible in the magnetic inscriptions on the tape or in the electrical signal prior to display on the CRT, the images cannot be observed directly and digitizers are only able to "know" the signal through their tools of visualization, i.e., their scopes and monitors. The signal chain and the configuration of components that structure it produce results that are indeterminate and often resist full understanding by digitizers.

For video preservationists, this means "the signal" is often perceived as resisting complete knowability, requiring evaluation and interpretation of what the original

recording might have looked like at the time of creation and what is the best copy possible in the present, given the current condition of the tape. The “original” recording is difficult to reconstruct because of the indeterminacy of the signal and gaps in their knowledge about what is shaping the signal. As will be discussed in detail in Chapter 11, this commitment to developing certainty about the original can be interpreted as a reconstruction of the “authenticity” of documents as they are undergoing a process of translation from one medium into another. That corresponds to what Bonnie Mak and Heather MacNeil (2007) identify as a key archival value of “authenticity” in the age of digital documents: “An ongoing process in which librarians and archivists construct and reconstruct authenticity in accordance with their understanding of the nature of those resources and current conventions for managing them” (p. 47). In the work of digitizers, we can understand their efforts to be “neutral” and “to preserve an image the way it was recorded” in terms of reconstructing the “authenticity” of the original in the resulting digital manifestation. An important part of this process of reconstructing the authenticity of the original is the work of digitizers to deal with the indeterminacy of the video signal.

8.1.2.1 Indeterminacy of the Signal

Certain aspects of the signal can be seen by digitizers as inherently indeterminate, resistant to complete knowledge. Objective tools of measurement, such as video scopes, can be limited in their usefulness because tapes may not have been recorded properly to begin with or the videographer may have been intentionally adjusting chroma and luminance signals outside of broadcast standards for particular effects (such as in the case of avant-garde video artists).

Adjusting color properly for some older, more problematic formats is particularly seen as indeterminate. Interpreting the correct color information can be difficult, especially for tapes recorded by artists or amateurs on non-broadcast formats, such as ½" open-reel video tape (a favorite format of video artists and community activists). This makes adjusting the color properly for digitization problematic, because of the variability in the ways in which color was adjusted at the point of video creation, the many adjustments that can change the color signal in the signal chain, and the subjectivity of human color vision itself. The vectorscope helps to visualize the color signal coming off the tape in a predictable and measurable way, and it helps aid the subjective judgments of the digitizers as they also observe how the video image looks on the CRT monitor.

For instance, P3_L6 explained:

P3_L6 (Review Session): Ideally every tape would have color bars at the beginning of the tape [*inaudible*], but the great majority of the tapes don't, so, that's something that's almost academic... If just one tape out of a hundred is wrong, maybe two tapes out of 100 would have the damn color bars. I'm just doing it by eye, man, oh. Oh we have to shift the color, rotate it this way to make the colors look more natural. And then you're just taking your guess, right? You can tell when things look predominantly blue or purple, or yellow or brown, and you just got to... [*participant trails off*]

P3_L6 expresses the difficulty of adjusting the color dimensions of the video signal without an objective guide of having color bars recorded at the beginning of the tape to adjust to. Without accurate color bars at the start of a tape to adjust their signal path to, digitizers must rely on other aspects of the video image to guide the process of adjusting the signal chain, which can include adjusting to more subjective measures, such as a blue sky for outdoor shots or to peoples' skin tones:

P2_L2 (Interview): But those things, in practice, are a little bit harder than... Well, kind of blue skies, you know, like, how bright was that day? You know? The person's skin tone—Is it someone that has deep olive skin? The skin tone

reference on the vectorscope is pretty trustworthy in terms of different skin tones, but again, you wanna make those things as minimal as possible.

P2_L2 explains how you can both look at the subject matter of the video image on the CRT monitor and judge its verisimilitude to expected things in the world (e.g., a blue sky should look blue) and by using the scope to make sure that the skin tones recorded in a scene are registering on the vectorscope in the yellow quadrant, which roughly corresponds to Caucasian skin pigmentation as represented in color space of the video signal. Looking at the vectorscope can show if the overall hue of the video's color signal has been shifted towards red or green. Participants acknowledge that this approach replicates problematic assumptions about race and skin tone, embedded within the visual technology itself.⁶⁶

P1_L2 (Interview): You're supposed to, your vectorscope is supposed to hit yellow, and that's your quote unquote kind of racist skin tone, uhm, that you go for. The idea is that, you can't determine color, but you can always kind of determine skin tone, white skin tone, so if it's too orange, or if it's too tan or something like, that's kind of your reference. uhm, but uhm, yeah, I mean, adjusting that is pretty intense.

The last part of this quote is interesting because it suggests some of the stress experienced by the participant when adjusting their color signals, due to the fact that it is never possible to be completely sure of how the original was recorded and what it “should” look like. P1_L2 expresses a moral commitment to creating a high quality copy that closely matches the original, with the risk of making the wrong decision during adjustment, described by P1_L2 as “pretty intense.” Relying on these approximate measures of matching skin tone or a blue sky on the vectorscope lacks the precision of

⁶⁶See also Brian Winston's (1996) *Technologies of Seeing*, Chapter 2 “The Case of Colour Film,” for a discussion of how visual imaging technologies have historically embedded racial assumptions about the types of human skin tones that would most likely be recorded. Winston argues that Kodak's color film stock was designed to most effectively record white skin tones, with little less consideration for others.

using color bars to calibrate the image. The stress felt by this participant is due to this inability to fully “determine color,” due to the variability of the ways in which the video signal could have been adjusted during production, and the participant having to make the decision about what the resulting image will look like. Particularly with avant-garde video works, in which the video producer may have intentionally manipulated the color balance of the video, it can be difficult to determine the color intended by the producer of the original recording. P1_L2 explained that sometimes a decision just has to be made, in which case the participant will document the decision-making process by providing notes in a letter to stakeholders in order to communicate the rationale behind the resulting digital copies:

P1_L2 (Interview): It can be stressful, especially when it's an important work. Uhm, I mean, I lose sleep, what I was talking to you about the Doris or the Shirley Clark [*two avant-garde video artists*] tape - the color lock - I have no idea if I gave them what she intended, I just have- [*pauses*] I told them that; I wrote them a letter that they could keep with the materials saying what happened, and where I landed with that decision, and I don't know what else to tell you.

This quote shows how uncertainty about interpreting video signals properly and translating them into “authentic” digital copies can lead to stress, when P1_L2 fears that the copy produced might not be acceptable to the artists. At the same time, P1_L2 cannot spend all day on the same tape, but must move on to new projects, suggesting that digitizers do not have full autonomy in their work, but must often follow the schedules and deadlines imposed by managers or others requesting their digitization services. While digitizers work to gain full knowledge of the video signal through their “artisanal” work, their capacity to do so is limited by the time constraints imposed by modern labor relations and scheduling deadlines. To compensate for this, P1_L2 enacts documentary practices (discussed later on in this chapter) as a means for legitimizing professional

preservation action when full knowledge of the signals cannot be attained in a reasonable amount of time. It also shows how the work of artisanal digital reformatting work involves managing uncertainty within time constraints, with the work of digitizers being carried out at the limits of knowledge.

8.1.2.2 Limits of knowledge

While color is often understood by digitizers to be a problematic and indeterminate element of the video signal, interpreting other unexpected breakdowns and errors in signal work can also go beyond the understanding and knowledge of digitizers. All digitizers had stories of unexplainable phenomena occurring throughout the signal chain and their digitization workflow: “Sometimes, for some reason, things go off in the access file, and it will be out of sync. I don’t know why that happens. It’s not like super common, but common enough that we need to check” (P3_L5). When an unexplainable problem cannot be quickly solved it can produce stress for the digitizer, as described by participant P2_L3 when reflecting on what constitutes a “bad day”:

P2_L3 (Interview): Or a bad day is like... Particularly back when I was digitizing more, “Oh, I can’t figure out how to make this work. This tape is just not getting a good signal.” We’ve got better equipment now than we had when I was doing that stuff. Or we have more. We have a better TBC for... Or the TBC we have now interacts better with older tapes than the one I had, that was using before. So there were some tapes I was like, I just can’t get, this isn’t going to work. I’m gonna have to wait and figure out what to do with this later. And so, you know, that would be a bad day, like, “Oh god, somebody wants to see this and I can’t get it working.”

Self-described anxiety over a problematic tape and uncertainty over how to adjust the system properly to accommodate it shows the limits of knowledge that digitizers often face when carrying out their work. When the system behaves in unexpected or unexplainable ways, or an error is observed but cannot be explained or corrected, this

breakdown and inability to establish control over the signal can be quite stressful. A satisfactory explanation is sometimes never reached since participants must continue to work and cannot stop their entire workflow just for one tape. They often must *satisfice* (Simon, 1956), finding the less than ideal solution that will at least get the tape to play and produce a viewable copy, but which may never identify the underlying problem. In this example, P3_L6 discusses “rehousing” a set of problematic tapes (swapping out the reels of video tape from one cassette housing into another cassette housing), and discusses how the ability to acquire full knowledge about the problematic tape was limited by not wanting to play it again and potentially damage it:

P3_L6 (Interview): And, I basically rehoused them and got great improvement, but there was still something else going on, which was evident on the second tape. By the time it was just about finished, I heard a little bit of squeaking when I was playing back, in some part of the transport. I never really got to the point where I identified what was going on there, nor did I want to load the tape again and take a chance at damaging it. But I have a note somewhere of what tapes those were, and I can always go back and pull one, if you want to go academic on them.

What is evident from this description, provided by P3_L6 in answer to interview question IQ7, is that there is a distinction between practical and theoretical knowledge that is in tension when doing the work of digitization. As much as the digitizers want to know what is happening at the technical level of their digitization workflow, this desire to know is often frustrated, and they must move the project forward so that they can move on to new projects. Any problems that remain inexplicable are documented (either as a note on the tape itself or in its metadata record in the database) to acknowledge the problem and allow for future digitizers to potentially research the problem further. See Figure 13 in section 8.2.6 for an example of an error log produced by digitizer P1_L2.

8.1.2.3 *Subjective and Objective Decision-Making*

Throughout the practice of artisanal digital reformatting there is a tension between what digitizers' distinguish as "subjective judgments" (i.e. using trained eyes to evaluate the quality of video images presented on monitors) and "objective measurements" (i.e., using video scopes to visualize quantified properties of the video signal) that digitizers engage in when making decisions in their work of digitization. On one hand, digitizers use scopes that produce "objective" visualizations of the video signal that can be precisely measured along graticules (providing lines of measurement) positioned over their screens (see Figures 10 and 11) and they provide clear evidence of the real-time effects on the signal that are produced by their adjustments that digitizers make to the TBC (time base corrector) and other system components. Because the signal can never be directly observed due to its invisibility, and because errors are paradoxically seen as deviations from the reality of an "original" video recording that cannot be precisely known, working with video signals and making decisions about how they will appear in the digital realm often requires some interpretation or aesthetic judgment on the part of the digitizer. On the other hand, digitizers often expressed that they applied their own aesthetic judgments in the final adjustments they made to the image quality of the final digital copy, sometimes in spite of what the scopes and standards recommended. Participant P2_L2 even argued for ignoring the supposedly objective scopes, and letting the encoded video signal go beyond "legal" signal levels during capture.⁶⁷

⁶⁷"Legal video" is also known as "broadcast safe" video. The field of video engineering, supported by standards-setting organizations (including the National Television System Committee (NTSC) and the Society for Motion Picture and Television Engineers (SMPTE) established the standards for broadcasting analog video. They defined guidelines for what would be considered a "legal" video signal for broadcast. Signals that were too high or too low would not be displayed correctly on viewer's television sets. There is

Participants acknowledge the relationship between observing the measurements appearing on the scopes and interpreting the visual image on the CRT monitors as a tension between objective and subjective measurements. For instance, L1_P1 noted that the scopes are useful because they can help “gain more accuracy, in the judgment or the assessment that you're making. Yeah, that's the thing. You have all of this quote-unquote, ‘objective’ tools, but the end decision is a very subjective one.” Yet, at the same time, P1_L1 calls into question the assumption that these tools are ever truly objective, instead emphasizing the importance of the trained judgment of the digitizer who makes the final decision about how the final digital copy will appear. The objectivity and accuracy of the tools themselves can also be called into question when they do not produce digital copies that meet expected standards:

P2_L2 (Review Session): Yeah, I think, it's nice to be like “I really hit those targets.” And, you think it's easy to always hit the targets perfectly, but sometimes it's just one click. You think you've got it, and then you go back and watch it and go “How was that off? Why was that off?”

P2_L2 describes the experience of surprise at the failure of using objective measures to produce a properly adjusted signal. Objective measuring techniques, based as they are on idealized, prototypical “signals,” are limited in their ability to fully determine the “correct” way to adjust the signal chain when tapes that never met those idealized standards are played back. Instead, digitizers must employ their own subjective judgments based on their perceptions of the image, what they know about its production, and what they determine to be close to the original (“historicizing the tape,” as discussed further below). To structure their subjective judgments about the configuration of the signal chain and the resulting digital copies, digitizers employ a set of epistemic

a truly “legal” dimension to these standards since video broadcast over the airwaves is legally held to these standards by the regulatory power of the Federal Communication Commission (FCC).

techniques, discussed further in the following sections, which gather and interpret information drawn from a variety of visual sources in order to develop knowledge that supports and legitimizes their decision-making around the final digital copy.

8.2 Epistemic Techniques

Digitizers employ a range of epistemic techniques for generating knowledge necessary to carry out the work of artisanal digital reformatting. They utilize these techniques to help them observe the quality of the signal, evaluating the effects of changes they make to the signal chain and diagnosing the source of errors in the video signal. In data generated through interviews, video observations, and review sessions, the following epistemic techniques were identified within participants' practices: (8.2.1) applying calibrated vision; (8.2.2) patterned looking; (8.2.3) matching and comparing visual representations of signals; (8.2.4) historicizing the tape; (8.2.5) investigating the nature of errors; and (8.2.6) constructing copies.

8.2.1 Applying Calibrated Vision

Participants discuss “learning to see” and “developing an eye,” i.e. calibrating their vision through a combination of work experience, published visual examples⁶⁸ and advice from co-workers in order to detect typical errors in the video signal and evaluate the quality of the overall image. P3_L6, a digitizer who within the last year transitioned from working mainly with audio recordings to working with video recordings explained this as “developing an eye,” which means being able to identify aspects of the video image that are a problematic and require focused attention:

⁶⁸ Participants have mentioned two visual reference guides that classify and typify video errors: *The A/V Artifact Atlas* and *Compendium of Image Errors in Analogue Video* (Gfeller, Jarczyk and Phillips, 2012).

P3_L6 (Review Session): Again, we don't want to waste a lot of time, but, but since I'm in a certain part of my career here where I'm trying to learn, I consider it worth doing, when I see something that I'm not real familiar with, learn more about it. **It's developing your eye** [*emphasis added, zlk*], and you're developing your sense of insider triage, like well what really matters here and what should I stress out about or not?

Learning to recognize typical errors is an important part of entering the field of video preservation, and developing these typifications supports an important epistemic technique when applied to evaluating and adjusting the system and diagnosing and documenting video errors. Learning to first see errors and then identifying and naming them using conventional terminology helps to form knowledge claims about the video signal and its behavior.

Calibrating vision involves learning to detect and identify “typical” errors – i.e., deviations of observed video signals compared to an ideal video signal—that may be encountered in the work of digitization, and they must learn to recognize how particular video tape formats appear and are impacted by errors. Calibrating vision occurs primarily through carrying out the work of digitization, which also helps the digitizer develop a set of heuristics for dealing with problems. Participant P1_L2 reflected on the experience of learning to see errors in the ½” open reel video format, which illustrates how the calibration of vision is developed through the experience of transferring tapes:

P1_L2 (Review Session): I would say that after a few months you really, you start to tell the differences between artifacts, the differences between tape damage, and sync loss, and... uhm.. you know. Let's see, what else is good for 1/2"? uhm.. if there's a weird color error, that's messed up. most of it's in black and white. when you see you a color error... When I first started doing 1/2" and I saw a color error, I had no idea, what that... I was like "okay... that's not supposed to be there." uhm... it's yeah, you start, whenever you see an error that you can't fix, you try it on another deck and see if it looks better on another deck. uhm.. and I think through that process, you start to get a sense of what's kind of recorded in. there are some artifacts, artifacts towards the end of the tape, are likely to be recorded in. There are also, certain kinds of artifacts for when the battery starts

dying in the camera. and [her co-worker] only found that out because you can actually hear them, you can see the artifact and you can hear them say "the battery's dying, the battery's dying". We ought to put that one in *A/V Artifact Atlas*.⁶⁹ uhm... so, yeah, I mean. Yeah, it's. I wish I could describe better how you know. But, even then, you really never really know, you are never 100% sure what the cause of the problem is. I've had weird things happen where I will pack, all I have to do is pack the tape again and tracking errors are resolved. And all I did was repack it. So you think that's going to work for every tape... nope, just that one. [laughs] It's a process of elimination.

From P1_L2's description, recognizing error can be seen as only the first step towards making a decision about how to proceed. The recognition of errors allows them to eliminate causes of the problem ("process of elimination"), and it enables the digitizer to access a set of solutions learned through earlier encounters with previous tapes. The recognition of typical errors, the elimination of possible causes, and the selection of a course of action follow a path of activity that requires digitizers to exercise situated judgment as they respond to changes in a dynamic system, and must choose solutions whose underlying mechanics may not be fully understood. The above excerpt from P1_L2 is also instructive because it brings up the role of visual aids in helping digitizers learn to recognize errors. P1_L2 mentions a text, *The A/V Artifact Atlas*, which is a wiki-style website that provides illustrations and conventional nomenclature for typical video and audio errors. Participant P1_L6 also discussed how *The A/V Artifact Atlas* was useful for developing an eye for seeing errors, as well as for understanding their underlying causes:

P1_L6 (Interview): And using *The A/V Artifact Atlas*, like, the BVAC tools⁷⁰, those are great for video. You know, you learn, like, oh, why is it doing this? This

⁶⁹*The A/V Artifact Atlas* (<https://bavc.github.io/avaa/>) is a crowd-sourced compendium of visual examples of different types of video errors, explanations of their underlying causes, and preferred nomenclature as defined by the community of media preservationists that contribute to the site.

⁷⁰"BVAC tools" refers to a set of open-source tools supported by BAVC (Bay Area Video Coalition), which includes *the A/V Artifact Atlas*, and *AV Compass*, which are available here: <https://www.bavc.org/preserve-media/preservation-tools>

is ghosting.⁷¹ Like, you learn certain terms, if you're not familiar with video—like 'ghosting.' It kind of looks like there's a residual image of something. It's kind of like tracers.

By being able to identify errors and name them, digitizers are able to more precisely document any errors that appeared while they are digitizing a particular tape. Developing competence in detecting and describing errors is also important for the participants' confidence in their work. If they can name each error and address it in some way, then they can be assured that they have done everything in their power to produce the best quality transfer:

P3_L2 (Review Session): Having the experience to know if it's something worth stopping the capture for it, because you will be able to get a better result elsewhere, having the knowledge to know that even though it does look bad, this is the best result you're going to get, because sometimes it is. Sometimes the tapes are just in terrible shape, and there isn't anything else you can do. You have to be sure.

Calibrating vision comes with experience, but it is not a final state, and is perhaps best seen as an ongoing process of learning about new tape formats and the types of video signals they produce and encountering new types of problems from a decaying tape.⁷²

⁷¹The *A/V Artifact Atlas* suggests that "ghosting" may be due to image lag caused by early types of video cameras or by transmission problems during broadcast, if the recording is of a television broadcast: "The image lag causes smear or comet tails following fast-moving objects in the scene, and the prolonged exposure of a bright stationary object results in a slow decaying after image of x-ray type appearance. This long-term but faint after-image is called burn-in or picture sticking. In instances where comet tails or luma trails are visible, the visual artifact is sometimes referred to as "ghost" or "ghosting." Ghost also refers to an artifact of video transmission when there is a difference in primary and secondary radio frequency signals." A visual specimen of ghosting is available with the full description of this type of error: https://bavc.github.io/avaa/artifacts/image_lag.html

⁷²According to John Van Bogart (1995) in "Magnetic Tape Storage and Handling: A Guide for Libraries and Archives," improper storage and handling of magnetic tapes can lead to "binder hydrolysis," in which the adhesive that secures the magnetic particles to the tape begins to absorb moisture and can become sticky or start to let the magnetic particles flake off, or both. This can cause a range of playback problems including "dropout," which is defined as a "brief signal loss caused by a tape head clog, defect in the tape, debris, or other feature that causes an increase in the head-to-tape spacing" (Van Bogart, 1995, p. 38) and "stick slip" in which a sticky tape sticks to recording heads and then slips by, which can cause tape squealing and a distorted image. There are many other forms of tape decay that have been defined both in earlier reports, such as Van Bogart (1995), <https://www.clir.org/pubs/reports/pub54/Download/pub54.pdf>, and the more recent *A/V Artifact Atlas*, discussed earlier.

Digitizers suggest that sometimes they need to “recalibrate” their vision if they are switching from working with one video format to another:

P1_L3 (Review Session): Every tape is different, and maybe I'll do some Umatics for a little bit and then I'll go back to 1/2". It's always a tape or two into it, before I calm down, "no, this drop out is normal, this flagging or skew error is normal." My eyes need to visually adjust to it and then I become more comfortable with seeing it, before panicking that there is something horribly wrong with the machine. But then, always trying, doing all of the adjustments that I know I can do, that have fixed things in the past, and then if those don't fix it, then I determine that it's recorded in, or that it is something that I cannot go beyond. And then, that's when I have to say, “this is good enough.” I've done the best I can for this tape, with all the tricks I know.

This reflection from P1_L3 shows how moving between different videotape formats, each with its own behaviors and vulnerabilities to problems and errors, requires some brief adjustment to the digitizer’s way of seeing and judging video quality. At the same time, this process cannot take too long, since there are limits to how much time the digitizer can spend on each tape, and must “satisfice,” produce an earnest, but not necessarily optimal product, given the constraining factors of time and personal technique.

8.2.2 Patterned Looking

Part of the training of the eye is to develop patterns of looking, moving the eye across the image and the scopes in a structured pattern in order to compare CRT monitors and scopes at different points in the workflow. Participants move their eyes across these devices looking for errors or differences between the different points of observation.

If digitizers find something that catches their eye, they will focus on that particular part of the image, evaluate whether an adjustment should be made, and then focus on that particular part of the image while making the adjustment:

P3_L2 (Review Session): Sometimes there'll be, maybe there'll be an area that's been problematic, something that's been, a tracking error that's occurring. Obviously I'm going to be looking at that area and trying to adjust the tracking, or if there's a skew error I'm going to be looking at the top of the frame, while I adjust the skew, but as a rule, I'm trying to look at the image as a whole. uhm. I don't know how to describe it, but it's like... uhm... yeah, I don't know how to describe it. It's like pulling back from the actual content.

In this description, we can see how the digitizer is working from parts of the image as elements of a larger whole. This suggests a phenomenological orientation in which perceived *parts* of an entity (the discrete visual elements occurring over time within the video frame, as parts of the video signal) are related back by digitizers to form a coherent and cohesive *whole* (Sokolowski, 2000), in the form of a visual document. Also tellingly, when discussing how and where P3_L2 looks when digitization video, P3_L2 explains that it is *not* a process of watching the “actual content” of the video, but instead involves scanning and viewing the materiality of the image, i.e., rather than what the image is representing. “Content” in this case refers to the objects and unfolding narratives that appear and constitute the visual works within the video medium. To get lost in the “actual content,” would mean to stop watching for material imperfections in the visual image and watch as a viewer, engrossed in the subject matter of the unfolding narrative or artistic expression.

8.2.3 Comparing and Matching Visual Representations of Signals

Another epistemic technique important to the practice of artisanal digital reformatting is the comparing and matching of visual representations of signals. As discussed earlier, the points of observation in the signal chain (See Figure 6 above) provide digitizers with information about the video signal at different points in the system. Digitizers compare the visual representations produced by the video monitors and the scopes at different

points, and work to match them to each other in order to bridge the analog and digital realms of visual representation. This can be carried out to confirm certain aspects of the system: “Yeah, like I would use the scopes, the reason why we have both analog and digital scopes⁷³ is to make sure that they are both basically saying the same thing, or something very similar” (P1_L1). As participant P1_L2 explained:

P1_L2 (Review Session): Uhm, everything in theory should match up. What's going on in Vrecord, what's going on, we have analog scopes and digital scopes, and physical form. And then we have Vrecord scopes. All of those should be in-line. If they're not, then there's a problem. Some kind of problem with the connection, possibly the software.

The ideal signal should produce the same visual representation on each set of scopes and CRT monitors, and while the reality of the situation always diverges from this in practice, the process of attempting to match these visual representations provides a process for digitizers to gain confidence that they have adjusted the system to the best of their ability. At the same time as the digitizers work to match visual representations at each point along the signal chain, they acknowledge that the images may never match exactly. P1_L3 admits, “sometimes they don't match, or sometimes I still need to adjust the luma or the black levels, after the bars have passed, because it doesn't capture everything. They're a good starting point” (L3_P1). This suggests that matching is important for gaining knowledge about the system and the integrity of the signal, but that they still bring their own situated judgment into the decision making process. Comparing and matching allows them to make sure that they as close to an ideal signal as possible, or, in

⁷³ Video scopes, i.e. waveform monitors and vectorscopes, can either be analog in nature (an analog video signal comes into the scope and directly drives the CRT that images the video component on the screen of the scope); or, scopes can be digital, either in the form of software-based scopes that display on a computer screen a visualization of the video signal after it has been digitized, or a standalone equipment-based scope that accepts a digital signal and visualizes the digital video signal on a screen that resembles the analog scope. The analog scopes are thus used to measure the analog video signals before they are routed into analog to digital converter, and the digital scopes are used to measure the resulting digitally encoded video.

the words of participant P3_L2, “to make sure I'm not really missing the mark, you know?”

8.2.4 Historicizing the Tape

Another epistemic technique employed by participants is referred to here as “historical analysis.” Historical analysis refers to the ways in which digitizers integrate knowledge about the history of a particular videotape format and the historical context in which the particular videotape was recorded in order to adjust their expectations about the visual quality of the videotape and their sensitivity to errors. For instance, a participant may be less sensitive to errors from a ½” open reel tape recorded by an artist collective in the 1970s at the beach than a ¾” Umatic tape that was produced in a television studio.

Because each format and context shapes the quality of the image recorded on the tape, the digitizer can take that into account when adjusting the video signal and documenting errors. In the case of ½” open reel video from the 1970s, digitizers expect many errors, which are seen as both inherent to the format and due to how the tape decays over time, which will help them adjust their expectations and reduce their sensitivity to errors. As P3_L2 explained:

P3_L2 (Review Session): If you know your video formats, and your video history, and the way people were dubbing, dubbing tapes⁷⁴ in the 70s or the 80s. That's all kind of useful knowledge for, uh, ascertaining if errors that you're

⁷⁴ “Dubbing” refers to the practice common during the height of analog video production in which a tape was played back on one video tape recorder (VTR), and the resulting signal was recorded onto another tape on another VTR connected to the output of the first. So-called “dubbing,” this process was the only way to make an analog video copy before the development of digital technologies. Each generation of dubbing added some noise to the signal, so in professional video production, a “dub master” was often produced in order to both protect the master recording (the “edit master,” i.e., the final cut of an edited video production), and to provide one tape from which all other copies would be made to reduce “generational loss.” Outside of professional video production, tapes were often dubbed over and over again from previously dubbed tapes, resulting in increasing noise in many later “dubs.” Thus, it is not surprising to have errors accumulate at each moment of dubbing, so that the copy that reaches the archive, could have layers of errors that cannot be corrected because they occurred at earlier moments of re-recording, i.e. dubbing.

encountering are native to the recording, or if they're native to the format, or if they're something you're introducing. That's all useful information.

Integrating historical knowledge of the format and its production into their practice helps to recalibrate their vision for detecting errors in a particular tape, and enables the reconstruction of an “authentic” representation of the original within the digital manifestation. If the digitizer expects all ½” open reel tapes from the 1970s to have significant levels of video dropout, for instance, then the digitizer will be less sensitive to these types of errors and instead look for other, unexpected errors. This calibration of the digitizer’s eyes also helps to define the precision with which digitizers apply digitization standards to adjusting a particular tape, as expressed in this quote from P1_L1:

P1_L1 (Interview): But, also knowing that these works were not created with those standards in mind, so it's like you kind of have to, you have to keep them in mind, and use them as your reference, but then you're working with something that had no concept of that.

If the digitizer can associate historical information from the particular circumstances of the time of original recording or identify clues in other recordings from the same collection or era, then the digitizer can begin to integrate this knowledge into the identification of errors that may have been inexplicable earlier on in the digitization process. For instance, participant P1_L2 learned to link the appearance of certain errors in the video signal to the battery on the portable video camera used to make the recording beginning to fail. P1_L2 integrated clues that were gleaned from the audio recorded alongside the video image to help interpret and identify the errors and their underlying causes.

Historical analysis of tapes can also include integrating knowledge of the circulation, production and duplication (“dubbing”) of particular tapes into understanding what to look for in their quality:

P2_L2 (Review Session): It was a dub from, I think it was a film transfer to some format [then] to DV [*a digital video tape format launched in 1995, zlk*]. And I think from the second video format to the DV, there was some type of problem where a very faint line, horizontal line was running up the screen. And it was one of those things that when the content was on screen it just wasn't very visible, uhm. I sent it to a film editor and you know he spotted it pretty quickly, you know. But, when I was watching it, I just didn't, it didn't jump out at me as something glaring.

The errors and other visual phenomena that appear on the monitor are traces of the historical production of the tape, its circulation and layers of copying. Through guidance from a “film editor” colleague working for another organization, P2_L3 was able to see an error that was missed the first time watching a tape, and trace it back through a series of dubs that happened over time. Reconstructing this history of the copying of copies allows the digitizer to integrate knowledge of the histories of tapes with the appearance of visual errors. Traces of a tape’s circulation and duplication can be interpreted and used as clues by the digitizer for developing knowledge about the specific incidents of circulation and duplication that form the history of a particular tape, which aids in the decision-making process of detecting, naming and adjusting for errors:

P3_L2 (Review Session): The head-switching on 1/2", and I guess on a majority, well not a majority, but a decent amount of formats is a general indicator of a dub, uhm... it's not always the case because sometimes a tape may have been dubbed from another tape that already had double head-switching you know recorded in, so... so a lot of times it can indicate that it's a dub from another copy. I think there are other ways of telling... the generation of a tape, but to be honest, I'm not sure. I think there may be another way of [*unintelligible*] that information. But, I haven't learned that yet.

In this example, we see how this digitizer uses a visual error, in this case head-switching, to infer that the tape had likely been copied (“dubbed”) from another tape, since this often adds additional layers of head-switching to the bottom edge of the video image with each generation of copying. At the same time, P3_L2 acknowledges a personal lack of enough experience in the field to know for sure if the layering of head-switching is an accurate indicator of earlier acts of copying.

8.2.5 Investigating Errors

Historical analysis plays an important part in setting the stage for investigating the nature of errors found in the video signal. This epistemic practice draws knowledge gathered through other epistemic techniques and is constructed from the following micropractices: Detecting; identifying; diagnosing; correcting; and documenting errors. They form a constellation of micropractices that are enacted to produce knowledge claims about the nature of errors and enables for their documentation in documents and databases.

Investigating the source of an error integrates historical knowledge developed about the tape formats and the particular ways in which each can produce different types of errors; distinctions between analog and digital errors; and whether errors are inherent or introduced by the signal chain or human error.

Detecting errors takes two forms: (1) applying calibrated vision; and (2) using scopes to “objectively” measure the video signal. In the case of (1), the digitizer applies calibrated vision to monitor and detect visual artifacts in the visual representations on the CRT monitors. This is a skill that is developed “Just by watching, just by paying attention and having to pay attention all day to that stuff, you know? Just doing it, just doing it a lot. Yeah, that’s pretty much it” (P1_L7). Repetitive transferring of tapes, gaining

experience, makes the detection of errors part of participants' everyday routines. When something stands out to them they must focus and try to identify what sort of error they just saw. The second form (2) uses scopes to look at the video signal for problems that may not appear in the visual image. Digitizers learn to calibrate the scopes (waveform monitors and vectorscopes) and measure video signals to catch errors they might miss by only watching the video image on the CRT monitor. As discussed in the section on patterned looking (8.2.2), digitizers are typically scanning both CRT monitors and the scopes.

Successfully identifying an error depends on the digitizer's experience seeing typical errors and their knowledge of the underlying video technology. For instance, participant P1_L2 describes the experience of developing a familiarity with a type of error called "crash record artifacts":

P1_L2 (Review Session): There are a number of issues that are just typical of the format, and just inherent in those tapes. Crash record artifacts, it's in every tape. Crash record artifacts? When they turn on and off the tape? You know, when you're just filming and you stop and you start again, like there's almost always artifacts in between scenes. So, which is a pain in the ass when you use QC tools for quality control because it spikes in every scene change. So, when I first got here, I was noting every single one. Now I don't do that any more, now I'm just like 'crash record artifacts every scene change' that's all I need to know. Uhm... Let's see. So, I know that those are supposed to be there...

These errors appear whenever a certain type of camera starts or stops recording, suggesting that in some cases "errors" are not errors at all, but visual phenomena associated with particular video formats and production methods.⁷⁵ Developing this knowledge about a common error helps the participant ignore this error and focus on the ones that actually need attention. Participants also draw on esoteric knowledge about rare

⁷⁵ *The A/V Artifact Atlas* uses the term "artifact," commonly used in the video preservation field, to refer to any anomalous visual phenomenon that might appear in a video image.

video formats like the ½” open reel CV video format from the 1960s. Sometimes an error can be the result of playing back a tape on the wrong equipment as in the case of this CV videotape being played on an EIAJ tape deck. At the time of my visit to the lab at Site L3, participant P1_L3 was unsure of the source of the white streaks running horizontally through the video image. However, when I followed up with P1_L3 for the review session, the error had been identified:

P1_L3 (Review Session): That's about becoming familiar with what those errors tend to look like. So, these white lines, the video is actually CV video. Yeah, not an EIAJ type one. And we have a few tapes that don't note that, but I've played tapes that did note that to see how they looked, and I got similar results, and so it was matching what I know for sure with things I need to diagnose.

Digitizers need to develop an eye for detecting errors, and for distinguishing between them. They also need to be able to distinguish between analog errors “native” or inherent to the current condition of the analog tape (i.e. therefore uncorrectable) and digital errors that introduced by the digital reformatting process (i.e. errors that can be corrected, such as a malfunctioning time base corrector (TBC), or computer error). In carrying out quality control of a video file received back from an outside vendor, P1_L5 explained that digital errors were easier to sort out than analog ones:

P1_L5 (Interview): I mean, if it's digital, it's, you can tell, you know. I feel like digital errors are like pretty obvious, but, uhm. You don't know if like, if the vendor might have introduced dropout because of their playback machine. You know, there are considerations to think about, so. We try to like just make sure that the image and the sound are like, you know, as high quality as possible.

It becomes important to distinguish between analog and digital errors, because if the source videotape is analog, then the presence of digital errors indicates something went wrong with the digitization components further down the signal chain from the analog components.

Once errors are identified, they can be documented and possibly corrected (or in the case of site L5, where all of their digitizing is done off site, they can request the vendor to have the work entirely redone, with the modifications suggested by P1_L5). Diagnosing errors involves finding the root cause of the error. Often the successful identification of the error is enough to identify the root cause of the error. As one digitizer explained:

P3_L6 (Review Session): Most of the decks allow you to manually adjust the tracking and see that you're getting a maximum value for that [*in video points to video signal meter on the deck showing the strength of the video signal*]. It kind of knows, gets an idea of how good the tracking is; the machines can tell that, and they give you a little read out, so... but given that's as good as it can be, and you see some of these weird things going on, then it's a matter of why are they happening, it's not the tracking, it's something else; it's just the tape got stretched at the beginning, or is it the heads dirty again. It's just really, really poor signal level.

In this case, the use of measuring tools (i.e., the video signal meter) helps to identify the root cause of the visual error, enabling the digitizer to differentiate between problems associated with a “stretched tape” and problems associated with dirt on the video heads. Through these experiences, the digitizer learns to interpret together the visual image on the CRT monitor and information about the video signal level provided by the scopes and measuring devices. Going through the process of diagnosing an error can lead to new explanations for its cause (such as dirty tape heads), and possible solutions (such as cleaning the tape heads). On the other hand, errors that are initially nameable and appear knowable may not be resolvable (for instance, in the case of a stretched tape). Naming an error (“tracking error”) can lead directly to a solution (“adjust tracking”), or if that solution fails, it can lead to extended process of considering all other possible causes

(e.g., dirty VTR heads or physical damage to the tape). In the case where an error cannot be fixed, participants begin to consider these errors “inherent” or “native” to the tape:

P1_L2 (Review Session): It looks like there's a color lock problem here. uhm... It's really hard to say with 1/2". It's just kind of like. You get kind of like this... I can't describe it but, you can definitely get this kind of feeling when something is "native," so to speak. When something is resolvable, and something isn't resolvable. It's kind of hard to explain how. But as far as like what I watch.. uhm... mainly I'm just, I mean watching the image is the best thing I can watch. you know, yeah. The scopes... I mean obviously, you want to keep everything in range, you don't want to clip anything. uhm... but, again, with 1/2" it's so hard, it wasn't meant to be broadcast, broadcast range wasn't really a thing with 1/2". So, it's all over the place anyway, so kind of, I don't know. I'm not being very articulate, I'm sorry.

As participant P1_L2 describes, sometimes this process of distinguishing between errors that can be corrected and errors that are “native” to the tape relies on the digitizer’s intuition, and in response to my questions about this process P1_L2 appears to struggle to put into words the cognitive process of diagnosing the source of an error and determining the possibility of fixing it. The process of diagnosis is further complicated by the fact that errors appearing in the signal path may not be due to any problem with the physical tape or the configuration of the signal chain, but with the original recording or subsequent duplication of the video content on the tape. To help distinguish between errors recorded on the tape (and thus those that cannot be corrected) from errors due to the playback equipment and configuration and adjustment of the signal chain, digitizers will often play back tapes on different equipment, which helps to reduce the perceived likelihood that their equipment is causing the problem:

P3_L6 (Review Session): And I can often... sometimes the problem happened when the thing was being recorded. I can usually suss that out by playing it in a totally different playback machine and see if the same thing is happening in there. And I'm like "okay, it's likely, likely that there was a problem with dirty heads on the recorder" or the tape itself; the tape is degraded and it's just not going to play well on any machine, but.. I've gone as far as to record the same exact section of

something on two machines and like go in, and frame by frame and see if the exc-
- not just the same type of thing is going on, but literally, frame by frame, yeah,
seeing the same exact effect.

In this description, participant P3_L6 shows how fine-grained the diagnosis of errors can become and how the lab-like environment of artisanal digital reformatting can be open to experimentation in digitization techniques. P3_L6's efforts of creating digital copies of the same tape on different machines and then comparing each version frame by frame to see if this very brief error showed up in both cases suggests that comparing different visual representations of a video signal can also be an important epistemic technique within the process of diagnosing errors. Being able to diagnose errors helps digitizers decide whether or not they should continue working on a project, or whether the errors that they detect are uncorrectable, in which case they should stop trying to improve the quality of the digitization.

Diagnosing errors, being able to name them and establish certainty about their underlying causes supports participants' documentary practices. Any errors inherent to the original recording or due to decay of the videotape are documented with information about their underlying causes and the digitizer's attempts to ameliorate them. Digitizers express the importance of documenting errors and the decisions they make to correct them both in order to communicate information to viewers about why the resulting digital copy looks the way it looks, and provide accountability for their best efforts to create the best quality tape. Any errors that digitizers cannot fix are documented in order to provide evidence that they were observant and careful in carrying out their work:

P1_L7 (Review Session): Yeah, oh yeah, I always make sure to yeah, take note of, if there's damage we can't fix, or if like audio drops out, just to sort of, if audio drops out and that's just the way the tape is, I also make a note of that, so people

know when they're reviewing this five years in the future that, you know, it's there for that reason, not because I screwed it up.

Documenting errors supports a form of accountability that protects the video preservationist against claims that they were not adequately taking care while they were doing their work. In this sense, it helps to support their identity as a professional, and supports the legitimacy of their professional practice and their work by expressing moral commitments to preservation values such as “authenticity.” Documenting errors is also very important for communicating to future users that an error was unfixable, so that they can understand the reasons why a digital copy looks a certain way.

In addition, documenting when no errors are detected helps communicate that any unusual visual elements can be linked back to something from the original time of recording, for instance camera adjustments. This helps establish such preservation values as “trustworthiness” and “authenticity” (Duranti, Eastwood and MacNeil, 2002). By documenting all of the decisions they made and any errors they saw (or did not see) at the time of digitization, this enables “trust” that the resulting digital manifestations are “authentic,” i.e. accurate representations of the analog originals. For instance, P3_L5, while going through the quality control process, explained: “I’m also going to write ‘as described,’ because I really didn’t see anything that we’re looking at... ‘some camera adjustments’... “ (P3_L5). Beyond documenting errors in the service of accountability (to users, to vendors, to original video creators) and the authenticity of the digital manifestation, documentation is also used to communicate information about the transfer of the tape so future users understand the context of translation into the digital form:

P1_L5 (Interview): And then we try to note like the issues, you know, because it also comes back to access, too. If something is distracting for the user, we'll note

that, too, so that that can go in the online records so that the user knows that it's like in the original. Yeah. So, we try to describe what we see.

The expressed concern for giving the context necessary for potential viewers (or “users” in P1_L5’s terms) articulates a preservation imperative to documenting the work of preservation for the benefit of future generations. Private informal practices of documentation are also used to help develop the personal knowledge of participants about their practice, their tools or a new type of error or breakdown that needs to be remembered. Keeping a private journal to reflect and record new experiences was mentioned by several participants, and they made it clear that it was not an institutionalized practice:

P1_L3 (Interview): This is probably, it’s not an official thing. It’s not, it might not even be recommended practices. I keep a project journal on my work computer, and sometimes at the end of the day or the end of the week I just type up, “Oh, I worked on this deck. I tried cleaning this, I tried cooking it up this way, or building this cable...” That kind of thing. And so, I can at least go back and say, “Oh, I did try that,” or, “Oh, this went wrong with this particular deck.” So, this is a project journal on a timeline. But it’s very, it’s not consistent, it’s not. It should be. I should be better at it.

ZLK: So you look back on that and say, “Oh, wait. I tried to build that cable on this day, and it didn’t work because of the pins, or...”

P1_L3: Yeah. Or, “I remember doing something, but which deck did I do it to? Which one was I trying to fix? Was it the one I’m working on now, or another one?” So I was keeping track of that...

Participant P1_L3 points to the importance of documentary practices to not only offer accountability and communicate about how the work was carried out, but also to track and reflect on personal experiences, to record and document workplace knowledge that may often go unnoticed and remain tacit. In the case of P1_L3, who works alone and is the only digitizer in Site L3, this becomes a way of collecting and managing knowledge about what machines are working, what interventions or modifications were attempted, and the success or failure of digitization activities. This type of documentary practice was

also common at other sites, as well. Figure 13, below shows an example of a log of errors that P1_L2 was using to document errors and adjustments (made using basic text edit software on a desktop computer), while working to translate a problematic ½” open-reel tape.

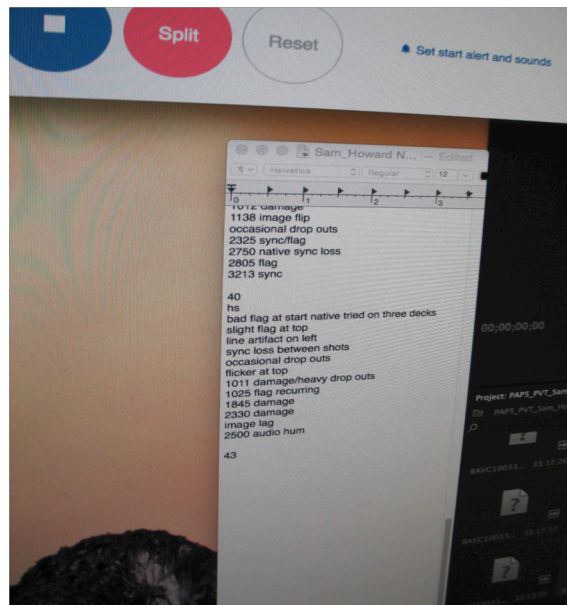


Figure 13 – Error Log
(Digital Photo Taken by Author at Site L2)

The error log becomes a key place for quickly documenting errors as they are constructing digital manifestations of analog originals. In this example, we can see that the digitizer is keeping track of every little error, including among others, “slight flag at top,” and “audio hum.” These errors are documented and then added to the catalog record or spreadsheet in which other information about the analog original and the digital manifestation is stored. If these are errors that cannot be adjusted or accounted for, then documentation helps to “communicate to the future” the current state of the videotape when it was transferred. In this example, I asked P1_L1 to reflect on processes of documenting those errors that could not be resolved in the shaping of the artisanal copy:

ZLK (Review Session): So, in cases like that, if you have to let that be the final version, are there steps you can take, do you have to... make a note about for other curators, or... ?

P1_L1: Yeah, the way I'm doing it, if that happened, and there's no way to go to another source, it's just like "this is what it is" and you just document. You would document regardless, but that would just live with this file that "hey, there's this at this point, there's no way to remedy it" so in effect, it becomes part of the piece almost.

P1_L1 explains how documentation helps to communicate the rationale for why the digital copy appears as it does, that it was the best possible copy, and that through documenting it, this information becomes "part of the piece," i.e. part of the identity of the work. P1_L7 reflected on the use of documentation as an important means of communicating with the future and for constructing the legitimacy of the work, acting as an emblem of a digitizer's commitment to preservation values:

P1_L7 (Review Session): Yeah, oh yeah, I always make sure to yeah, take note of, if there's damage we can't fix, or if like audio drops out, just to sort of, if audio drops out and that's just the way the tape is, I also make a note of that, so people know when they're reviewing this five years in the future that, you know, it's there for that reason, not because I screwed it up.

These examples show how documentary practices play an important role in the communication of information about the works being digitally reformatted and help to express digitizers' commitments to preservation values, i.e. that they are committed to producing authentic and trustworthy copies for future users. This is an important micropractice in the work of "constructing copies," both in the sense of producing high quality copies of visual documents, as well as in terms of constructing their contexts and identities. As discussed in the following section, the process of constructing copies is also a process of reducing uncertainty in the work of digitizers about the nature of errors.

8.2.6 Constructing Copies

The array of epistemic techniques that participants are observed enacting in the practice of artisanal digital reformatting suggest the range of intellectual gaps that must be filled in for the copying of analog tape to be carried out in a meaningful and legitimized way. But what sort of “copy” emerges from the application of these techniques? The motivation appears to be to ensure that the copy produced is produced in the best possible way, and to assure the digitizer that they can trust their equipment and their actions; but, what is the relation between the copy and its source? As will be explored in the chapter on the moral order of preservation (Chapter 11), discursively constructing this linkage between copy and source, and defining the strength of that linkage, appears to be important for defining the legitimized and institutionalized practice of digital reformatting. There is no “natural” mimetic relationship between the digital copy and its source, because there is no stable ontology of the indeterminate video signal. Instead, as discussed earlier, the signal chain that runs from the analog tape to the digital file, carries an invisible signal that is only viewable through scopes and monitors. Participants often referred to the signal as something inscrutable because it could never be directly observed, in contrast to motion picture film, which can be viewed frame by frame on a light box. Participant P1_L2 discussed the difficulty in understanding the signal:

P1_L2 (Review Session): I've been showing people in presentations that image, but completely warped and damaged so that people understand what's; why that signal; just sort of visualize. That's always been my problem with video is that it's so hard to visualize what's going on. As opposed to film, which is photographic.

Participant P1_L1 even suggested that since the video signal was always indeterminate and dependent on playback equipment for its existence, the concept of an “original” was not applicable to artwork recorded on video: “Well, I mean it's... the nature of this work,

there is no original. There's the myth of the original. There's no original. So we keep that in mind.” This indeterminate aspect of the video signal helps to foreground discursive practices of legitimization so important for maintaining the meaningfulness of the practice for participants. Producing the best copy, then, is an interpretive process, which requires participants to imagine an original entity into being, in order to produce a legitimate copy.

8.3 Variations in Participants’ Practice

In this section I will begin to sum up the analysis on digitizers’ “signal work” and draw some important distinctions about the ways in which the particular micropractices of artisanal digital reformatting can vary across sites. Table 7 summarizes the various modes of epistemic techniques that participants were observed enacting during their observation sessions. For the most part, there was not much variation found in the prevalence of epistemic techniques. “Historicizing the tape” and “constructing copies” were the only two epistemic techniques that were not identified across all participants who were observed. It is unclear why these epistemic techniques were not observed in the work of P3_L5, P1_L6, P3_L6, and P1_L7, but this could be due to the fact that identifying these epistemic techniques depended in part on participants’ reflections on their own actions, and some participants may have been more articulate than others in expressing their self-understanding of their own thought processes.

At the same time, it is important to point out that *signal work* is not a monolithic, unchanging practice shared by all participants at all times in the same way. Rather, my analysis of the statements and micropractices of digitizers outlines the prototypical stages of the practice, the particular contours of which this can be seen to vary with differences

in the particular formats being copied, the workflow, technological configuration and institutional structure. The following epistemic techniques were identified through analyzing data generated from interviews, video observations, and review sessions: (8.2.1) applying calibrated vision; (8.2.2) patterned looking; (8.2.3) matching and comparing visual representations of signals; (8.2.4) historicizing the tape; (8.2.5) investigating the nature of errors; and (8.2.6) constructing copies. Table 7 lists the participants, their positions, types of materials being digitized at their sites, and the types of epistemic techniques they were observed engaging in or verbalizing. The importance and centrality to the practice of each epistemic technique, as outlined in the preceding sections, can be seen to vary along these dimensions, even as the central structure and underlying epistemological concerns of *signal work* remain constant.

As discussed in the methodology chapter (Chapter 6), the participants and sites were selected based on criteria that sought to identify sites of “artisanal digital reformatting,” i.e. small-scale sites of digitization involving preservation professionals, working closely with materials to produce legitimized digital copies; however, “in the field,” these sites were found to exhibit important differences that added unexpected variability to the data generated.

In the following sections I will discuss the ways in which the practice varies across participants and sites. Throughout, I will be drawing insights from Table 7, which summarizes differences in the observed modes of epistemic techniques and formats between sites and participants and how it impacts the particular epistemic techniques involved in *signal work*.

Sites (6)	Participants (13)	Role	Formats Being Digitized	Modes of Epistemic Techniques (Identified through Observations of Work and Participants' Verbalizations)					
				<i>Applying Calibrated Vision (8.2.1)</i>	<i>Patterned Looking (8.2.2)</i>	<i>Comparing and Matching (8.2.3)</i>	<i>Historicizing Tape (8.2.4)</i>	<i>Investigating Errors (8.2.5)</i>	<i>Constructing Copies (8.2.6)</i>
L1: Large Art Museum (Northeast)	P1_L1	Digitizer/ Conservator	Digibeta	X	X	X	X	X	X
L2: Nonprofit, Work for Hire, Preservation Services (West Coast)	P1_L2	Digitizer/ Administrator	½" Open Reel	X	X	X	X	X	X
	P2_L2	Digitizer/ Administrator	Hi-8 Video	X	X	X	X	X	X
	P3_L2	Digitizer	¾"Umatic; ½" Open Reel	X	X	X	X	X	X
L3: Nonprofit, Fine Arts, Distributor and Archive (Midwest)	P1_L3 ⁷⁶	Digitizer	½" Open Reel	X	X	X	X	X	X
L5: Audiovisual media preservation project (outsources digitization) West Coast)	P3_L5 ⁷⁷	Quality Control	16mm Film; VHS	X	X	X		X	
L6: Preservation Dept., Academic Library (Northeast)	P1_L6 ⁷⁸	Digitizer	VHS	X	X	X		X	
	P3_L6	Digitizer	VHS; Audio Cassettes	X	X	X		X	
L7: Nonprofit Video Archive, Work for Hire, Preservation Services (Midwest)	P1_L7 ⁷⁹	Digitizer	VHS	X	X	X		X	

Table 7 – Epistemic Techniques and Formats Observed Across Sites

As can be seen in Table 7, there are some differences between sites and participants in terms of the epistemic techniques they engaged with in their practice. We can see that digitizers at sites L1 and L2, as well as L3_P1 at Site L3 were observed engaging in all

⁷⁶ P2_L3 was excluded from this chart because P2_L3 is an administrator who was no longer involved in digitization work, and thus was not included in the observation sessions.

⁷⁷ P1_L5 was excluded from this chart because P1_L5 is an administrator who was not included in the observation sessions.

⁷⁸ P2_L6 was excluded from this chart because P2_L6 is an administrator who was not included in the observation sessions.

⁷⁹ P2_L7 was excluded from this chart because P2_L7 is an administrator no longer involved in digitization work, and thus was not included in the observation sessions.

five epistemic techniques listed in Table 7. Digitizers at Site L6 and Site L7 were observed engaging in all of the epistemic techniques, except “historicizing the tape.” The quality control person, P3_L5 at Site L5 was also observed engaging in all of the epistemic techniques, except for “historicizing the tape,” suggesting that the work of quality control requires similar types of educated perception and calibrated vision as digitizers. Administrators (i.e., P2_L3, L5_P1, L6_P2, and L7_P2) are responsible for planning preservation projects, and so are often not as directly engaged in carrying out the work of artisanal digital reformatting. These administrators were not observed carrying out the work of digitization.

Based on their responses to interview question IQ6, there was significant variation in the terms used and sequencing of stages in the workflow described by each participant (see Appendix K - Prototypical Workflow and Participants’ Idiosyncratic Workflows).

8.3.1 Variation in Participants’ Individual Workflows

During semi-structured interviews, participants were asked to describe the key steps in their workflow. Each participant outlined an idiosyncratic series of steps, which fit within the same larger categories of a prototypical workflow but provided different nomenclature and granularity at each step. This variability indicates that each participant has a different mental model of the workflow and classifies each discrete step in different ways, and that when asked to describe their workflow they are not drawing from a pre-determined plan of action, but recalling memories of sequences of meaningful actions that require them to interpret and name. From these different descriptions (generated by asking them IQ6), a prototypical digitization workflow was generated (see Appendix K - Prototypical Workflow and Participants’ Idiosyncratic Steps), which identifies the

prototypical key steps along the far left column. Along the other columns are listed the steps described in the interview with each participant.

This table organizes the descriptions provided by the participants in their interviews when asked to describe the key steps in their workflow (interview question IQ6). Together these “idiosyncratic” workflows recorded in Appendix K were used to construct an overarching “prototypical” workflow. Differences in how participants categorize the key steps in their workflow suggest individual mental models of the structure of their practice. Different formats can also shape their work, as discussed in the following section.

8.3.2 Variation Related to Formats

The contours of artisanal digital reformatting are shaped by the particular media format being digitized. Digitizers described how the level of focus they needed to give their work depended on the particularities of the videotape format being worked with:

P2_L2 (Review Session): Well there are formats that, you know, are in much better shape than others, so there will probably be less to document in general. And yeah, certain problems, you know, again, with DV tapes, you're going to have a whole range of digital errors that you wouldn't have an analog to uhm.. So there the language would be different. But often there's overlap for sure. Tape damage may express itself differently with different tapes, with different formats. But, we'll use the term to refer to the general pattern of behavior. Visual behavior.

Knowledge of this variability emerges through their ongoing practice. Through the experience of working with many different tape formats, digitizers begin to develop a sense of what sorts of “visual behavior” they can expect from different videotape formats.

Digitizers learn what to expect from different formats and plan accordingly:

P3_L2 (Review Session): So, sometimes, if I have one or two false starts I'll clean again, just to be sure. Especially with older tapes. Say, a Digibeta versus a 1/2". Digibeta there's almost no [*inaudible*] whatsoever, and with 1/2" it's extremely rare to get a tape that isn't just filthy. It will be shedding so excessively.

Experience with different formats shapes digitizers' expectations about how difficult it will be to copy a tape. If it is an older format, such as ½" Open-reel, they can expect much more tape decay and dirt to affect the process of digitizing a particular tape, than a newer format, like a Digibeta tape.⁸⁰ Developing this knowledge through the experience of working with many types of tapes enables them to adjust their expectations and identify in advance which aspects of digitizing a particular tape may require more or less focus on their part. In some cases, because the components of the playback equipment of older formats are bigger and more easily accessible to digitizers' screwdrivers and cleaning tools, older formats can require less precise focus in cleaning decks than newer formats, requiring a different distribution of focus along the workflow in these cases:

P3_L2 (Review Session): Some of the formats are more time-consuming just because they're leaving so much dirt on your deck. The only real positive, I guess, of cleaning an older format, is [that] the moving parts are a lot bigger, so it's easier to actually see what you're doing, or if you're trying to clean that MiniDV deck, it's neigh on impossible.

Beyond these technical differences that may impact the relative need for focus at each stage in the workflow, as we can see in Table 7, each format has a different look and behavior that must be taken into account. Participant P2_L2 is a digitizer who works with a range of video formats and describes the ways in which the work is shaped by the particular format being digitized at that moment:

P2_L2 (Review Session): I think it depends on the format somewhat... uhm... oh, it certainly does. If I'm transferring DV tapes, I'm looking for different things than if I'm transferring half-inch open reel. So it always depends on the format, and the more you do it, the more you know what the format should look, what it can look like. Uhm, what it ideally does look like. Uhm, that's just a learning process that comes with time. Like again, I'm working on a Betamax project right now. I've

⁸⁰While the video signal recorded on Digibeta tapes (also known as "Digital Betacam") is encoded as binary code, i.e., it is already digital, the materiality of the videotape is still susceptible to decay, and requires the same video scopes and computer equipment to transfer into a digital file properly.

transferred a ton of tapes, but I haven't transferred a ton of Betamax. So, I'm kind of learning through this, what I think is a good looking tape, what I think is a bad looking tape, you know, and so on. Drop out will look different. Depending on the camera, depending on your setup, you know, areas without recorded content will look different. Can you recognize what that snow looks like? Maybe, for certain things. uhm.. But that's only going to come with experience.

From this quote, it is clear that P2_L2 is still learning and developing a sense of what each video format looks like, how it behaves and what to look for in terms of errors and other problems. P2_L2 suggests that learning these format-specific differences can only come with more experience.

In addition to format-specific differences and differences in the ways that participants categorize the stages in their workflow, the particularities of the technological ensemble of components in the video digitization signal chain can also shape practice, as discussed in the following section.

8.3.3 Variation of Technological Configuration at Each Site

In terms of the variation of each site's technological configuration, site L7 lacked both critical video scopes in the signal chain for objectively measuring the video signal, and the TBC controls necessary for changing the parameters of the video signal. This was acknowledged by the participants interviewed at that site, suggesting that they saw this as a deviation from the prototypical configuration, thus suggesting that normative conventions of practice also shape configurations of technology, foregrounding deviations from those normative conventions. In describing the process of ensuring the highest quality digital copy is obtained through the minimalist workflow at Site L7, P1_L7 suggested that lacking scopes and having little control over the signal required more subjectivity on the part of the digitizer:

P1_L7 (Interview): Make sure, you know, it plays all the way through, that there's not some strange error with the file, anything like that. Does it look and sound like it did when I transferred it, you know? Because, I mean, again, you sort of have to use your eye and ear, because there's not really, again, we don't have a lot of scopes, we don't have a lot of the stuff like that. So, it's not like I can say, like, "Wait a minute. The IREs are... They're supposed to be -21. What's going on here?" So, you kind of have to wing it somewhat, and just sort of go, like, "Well, you know, this is the best I could get. Does it look like what I transferred?" That's essentially what it looks like, and make sure I didn't make the problem worse.

This excerpt addresses issues discussed earlier about the relationship between subjective and objective observations. In this case, the participant acknowledges that the lack of scopes makes the practice more subjective than objective, and frames this technological configuration as a deviation from the normative, prototypical configuration. While lacking the necessary "objective measures," P1_L7 indicates a preference to defer to the scopes if they were available to use: "I sometimes wish there was a way to more, sort of, quantify what's going on. But we don't, so. If that was an available option, I'd probably defer to that a little bit more." This suggests that even though the technological configuration at Site L7 does not integrate all of the normative points of observation and intervention, P1_L7 acknowledges this deficiency in P1_L7's conceptualization of the overall workflow as a deviation from the ideal. This suggests that the prototypical workflow and technological configuration both circulate as normative knowledge, permeating sites that both conform and deviate from these standards.

8.4 Chapter Summary

In this chapter I have described the array of micropractices and epistemic techniques of digitizers engaged in artisanal digital reformatting of analog video recordings, and conceptualized them under the expression of "signal work." The signal chain is a key element that structures their practice, providing points of observation and points of

interventions, which provide the means for applying their epistemic techniques in order to produce digital copies that meet their own subjective measures of quality, guided by the objective tools of visualization and methods of analysis. Table 7 summarized the common epistemic techniques shared by most digitizers showing few variations between digitizers even across different sites, and Appendix K showed how each participant describes his or her workflow using different terms and dividing the workflow up into different levels of granularity. Drawing on historical knowledge and typologies of errors, the work of digitizers emerges as hybrid: It is a routine at times, but is also prone to key moments of intense cognitive and material labor, where digitizers must form new knowledge about the underlying characteristics of the tape and the signal that is produced through the apparatus of the signal chain. Digitizers define in their descriptions of their work an “epistemology of the signal” (8.1.2) in which they work under conditions of uncertainty due to the inherent indeterminacy of the signal (8.1.2.1), working to overcome limits to their knowledge about the video signal, and (8.1.2.2) balancing subjectivity and objectivity in their decision-making. Digitizers were observed enacting a range of epistemic techniques in order to form knowledge claims and aid their decision-making in the process of artisanal reformatting, including: drawing on their (8.2.1) *calibrated vision*, which enables them to see errors and identify typical errors associated with particular video formats; engaging in (8.2.2) *patterned looking*, which requires them to discipline their vision, moving their eyes back and forth between monitors, scopes and video decks, looking at the materiality of the video image, rather than its content (although content can provide clues to properly adjusting color, as in the case of looking at blue skies and skin color as a guide); (8.2.3) *comparing and matching* signals to

calibration targets, as well as to prototypical errors; (8.2.4) *historicizing the tape* as a particular artifact in time, integrating knowledge about its production context and the particular storage conditions to understand way the signal on the tape behaves in particular ways; and (8.2.5) *investigating errors*, which uses knowledge gathered by the use of the other epistemic techniques in order to diagnose the likely source of the error. Errors are identified and diagnosed through the typifications of errors that digitizers develop through experiences of digitizing tapes and by referencing guides to errors, such as *The A/V Artifact Atlas*. (8.2.6) *Constructing copies* is another dimension where digitizers integrate knowledge from other epistemic techniques in order to develop a tentative understanding of the relationships they forge between the source “original” and the resulting digital copy, using documentary practices to communicate the “trustworthiness” and “authenticity” of the resulting digital manifestations to future users. Enacting these epistemic techniques, facilitated by the points of observation and intervention in the signal chain, digitizers are able to produce knowledge about the indeterminate and inscrutable video signal and make decisions that enable them to produce digital copies that are as close to the original as possible. Digitizers construct “the original” by balancing their use of objective measuring tools (i.e. scopes) and their subjective embodied perceptions and trained vision.

I have also outlined several ways in which “signal work” may vary in the range of epistemic techniques that may be integrated into participants’ work practices, and associated them with differences in involvement in the work of artisanal digital reformatting (i.e. administrators have less involvement in the work of digital reformatting, so they were observed engaging in fewer epistemic techniques), the formats

being digitized and the particular institutional context. This is useful information for tempering these generalizations as well as for beginning to understand the ways in which the practice can vary across space and time. The fact that participants were often quick to point out when and where their signal work deviated from the prototypical workflows that I derived from their descriptions. This suggests that participants share an idealized workflow that is part of their shared understanding of “signal work” that circulates across different sites. This shared understanding emerges from the community knowledge that they engage with through professional conferences, specifications documents, and other means of communicating preservation knowledge, as will be discussed in greater depth later on in Chapter 10.

The analysis in the following chapter will adopt a phenomenological perspective in order to analyze the experiences of digitizers as they carry out their work. This will help to extend the analysis beyond digitizers’ mental labor and planned action to gain insight into embodied and temporally-oriented dimensions of the work of artisanal digital reformatting.

CHAPTER 9: SENSORY AND SITUATED DIMENSIONS OF ARTISANAL DIGITAL REFORMATTING

9.0 Chapter Overview

The previous chapter, Chapter 8, explored how knowledge is constructed through a cluster of epistemic techniques employed by digitizers in carrying out their “signal work,” i.e. their micropractices of monitoring, diagnosing and adjusting electrical signals in order to produce legitimate digital manifestations of analog originals. In the following chapter I will discuss the sensory-cognitive and situated experiences of digitizers engaged in the practice of artisanal digital reformatting, adopting a phenomenological perspective in order to interpret embodied and temporally orientated dimensions of their practice. As discussed in my theoretical framework, Merleau-Ponty (2002) stresses the situatedness of human experience, with “the body no longer conceived as an object of the world, but as our means of communication with it” (p. 106). The experience of human perception is understood as grounded in a particular body in time. This notion of an embodied and situated human actor as the grounding for all experience suggests an analytic approach that considers the role played by the full body in consciousness and orient ourselves temporally by intending to absent phenomena across space and time.⁸¹

Adopting a phenomenological perspective shifts the focus of this analysis from the cognitive processes and decision-making of digitizers as they carry out the tasks within their digitization workflows to their reflections on the sensory-cognitive and situated experiences of training their perceptions and developing competence in the physical activities of artisanal digital reformatting.

⁸¹ Recall the distinction made by phenomenological philosophers between *consciousness* and *intentionality*. Consciousness refers to our experience of the world, while intentionality refers to the directedness of the mind to things, distant or near in time/space.

In order to understand the experiences of digitizers as they calibrate machines and develop competence in ways of seeing and acting in order to produce legitimate digital copies, I asked participants during interview and review sessions to reflect on their experiences carrying out daily routines of digital reformatting (IQ16, see Appendix D – Interview Protocol) and to reflect on their memories of when they first started doing this type of work and needed to develop competence in their practice. In this chapter, I will discuss (9.1) digitizers’ sensory-cognitive training of their vision and developing embodied understanding; (9.2) digitizers’ experiences of uncertainty and breakdown in their work, and the impact it has on the affective dimensions of their daily work; and (9.3) the ways in which they orient their practice in time.

9.1 Training Vision and Developing Embodied Understanding

As discussed in Chapter 8, the application of “calibrated vision” is an important epistemic technique that depends on the digitizer’s previous efforts of learning how to calibrate their vision through apprenticeships or professional practice. But the calibration of vision is not purely cognitive or visual but is situated in a range of embodied dimensions of knowledge construction. Epistemic techniques also depend on knowledge acquired through other bodily senses, including touch, hearing, and smell, and further, processes of expert decision-making in adjusting video signals also involve coordinated and routine bodily routines, including, handling tapes, adjusting knobs, buttons, and switches on machines, and swapping wires from the back of video decks. Participants reflected on the stressful experiences of entering the field and having to develop confidence in their practice. They learned to see errors and integrated their senses into their decision-making. They learned to coordinate their actions and evaluate the results by assessing the

materiality of analog tapes, carrying out processes of digitization and assessing the resulting digital copies. Asking digitizers to reflect on their memories of entering the preservation field and learning to confidently carry out the work provides insight into the ways in which they had to develop particular ways of perceiving and judging, learning to engage vision and their other senses. This gives insight into the sensory and situated dimensions of knowledge construction in the practice of artisanal digital reformatting of analog video recordings.

9.1.1 Entering the Field

Digitizers face a particular way of learning how to see and understand the phenomena related to the video signal as part of their initial training, evaluate the signals, and take action to adjust the signals. All the participants, regardless of their educational training, describe a common experience of learning to watch video images and visualizations of video signals in their earliest experiences of carrying out work in the field and gaining practical skills. They learned through practical, hands-on experience, which occurred at their current jobs (in the case of P1_L2; P3_L6), or through previous opportunities of direct engagement with digitization technologies, including working as a freelancer doing tape transfers (P1_L1); working at other archives and digitization labs in internships (P3_L5; P1_L6); through closely working with experts in the field through apprenticeships (P2_L2; P1_L3) or fellowships at other preservation institutions (P3_L2). This was true of the seven participants who had received academic degrees from moving image preservation programs (P1_L1; P1_L2; P2_L2; P3_L2; P1_L3; P1_L5; P1_L7).

Digitizers explain how developing an eye for spotting and identifying video errors emerged through repetitive encounters, with formal education providing only a limited

degree of technical ability that supported digitizers' initial confidence in these abilities.

P3_L2, who has been in the digitizer role at Site L2 for only one year explains how

P3_L2's formal education at the Selznick School established a foundation for becoming

confident in the work but that it was really carrying out the actual work of digital

reformatting that enabled the development of digitization skills:

P3_L2 (Review Session): I don't think I could have done, started this position, and been successful in this role if I didn't have a background in moving image archiving. But uhm... yeah. But it's video, that's a whole other world. I think so much of it has to be learned hands on. You know, you're in a technical role, primarily versus you know, uhm... The technique of capturing content isn't something that is focused much in any of the archival training programs, from what I can gather.

P3_L2 is expressing a common sentiment shared by digitizers, that there are limits to the

technical knowledge that they could learn through their formal education, and that they

learned the technical aspects of digital reformatting by carrying out the work on a daily

basis.

Since the knowledge necessary for carrying out digital reformatting work is acquired through the experiences of doing it, digitizers describe beginning their jobs without feeling fully confident in their knowledge to competently conduct the work.

When digitizers were asked to reflect on their experiences entering the field and learning

how to carryout the work of digitization in their current jobs (in response to interview

questions IQ4 and IQ4a, and in their review sessions), they expressed feelings of anxiety

related to uncertainty over performing the work correctly. Four of the digitizers (P1_L2;

P3_L2; P3_L5; P1_L7) explained that it took around three to six months of experience

doing digitization work to become comfortable doing it; while two other digitizers said

that it took more than a year to become comfortable doing this work (P1_L1; P2_L2);

and three (P1_L3; P1_L6; P3_L6) said that they were still developing confidence in their work. In each case, digitizers emphasized the importance of learning to do the work, including being able to detect errors in the signal, by repetitively doing the work. P1_L7, who has worked at Site L7 for approximately 1 year, was asked to reflect on the process of developing the ability to see errors and other problems with the video signal (interview question IQ9):

P1_L7 (Interview): How did I learn how to do it? I don't know. Just through repetition, just by having a good eye and noticing. Like, I think I could spot pretty quickly if, like, the pixel aspect ratio is off, or something like that.

ZLK: How do you develop a good eye?

P1_L7: Uhh...

ZLK: Do you think anyone can develop a good eye?

P1_L7: I don't know. Maybe. I think so. **Just by watching, just by paying attention and having to pay attention all day to that stuff, you know? Just doing it, just doing it a lot.** Yeah, that's pretty much it [*emphasis added, zlk*].

In this excerpt, P1_L7 describes how being able to carry-out the work is based on having a “good eye” and being able to notice errors in the video image. When I asked about how to develop a good eye, P1_L7 was not sure; however, when I asked if anyone could develop a good eye, P1_L7 reflected that someone would need to spend all day “paying attention” and “just doing it,” i.e. carrying out the work of digitization.

The need to “develop an eye” through “just doing” the work of digitization can lead digitizers to experience significant stress when starting their jobs doing this work. Only after going through the repetitive process of digitizing tapes do they begin to develop confidence in their decision-making and begin to trust their own eyes. For instance, digitizer P2_L2, who has been working at Site L2 for two years, reflected on the stressful situation encountered when starting work at Site L2's video digitization lab:

P2_L2 (Interview): I was completely thrown into it, and it was, it was really overwhelming. Yeah, I mean, I think a big problem was, kind of, the... It was

just a very rough transitional period, and there is just no way else to describe it. You know, a lot of institutional knowledge was lost, you know, and had to be, kind of, reconstituted. And that was a challenge, you know? It was, it was frustrating to feel like I wasn't properly trained. But, you know, I think we've come a long way, as I said, so...

ZLK: Since last summer?

P2_L2: Since last summer, yeah. And the funny thing is I never... Looking back I'm like, yeah, I'd probably do things differently on certain projects, but I don't think there's anything where it's, like, a glaring bumblefuck, you know? I mean, there have been mistakes. Don't get me wrong.

P2_L2 explains how the stress experienced when starting this new job was linked to a lack of certainty about how best to carry out the work, which P2_L2 linked back to a lack of adequate training. P2_L2 describes having not yet developed practical knowledge of how to properly use the technology or how to make decisions that impact the resulting quality of digital copies. P2_L2's use of profanity in the second to last line of this quote helps to emphasize the stress experienced in this situation, while at the same P2_L2's novice work did not apparently lead to any major problems, even when P2_L2 was still learning, often through trial and error, how to carry-out the work. To add complexity to the experience described by P2_L2, there had been some rapid turnover in staff, which contributed to a vacuum in institutional knowledge about how to digitize properly. P2_L2 also acknowledges making mistakes along the way, but that none of these were "glaring," and making them was seen as a necessary part of the process of learning to "develop an eye," i.e., develop the visual abilities necessary to carry out the work of digital reformatting properly.

Digitizers' perceptions of limitations in their understanding of technical processes also generate anxiety for them. For instance, P3_L6 discussed the anxiety experienced in being introduced to an unfamiliar video encoding technology:

P3_L6 (Interview): FFmpeg is, like, a whole thing in and of itself, the capabilities with that stuff. And I was like a deer in the headlights here four or five months ago. But I've learned a lot so far, but I'm sure I have even more to learn about that and its capabilities. That's a great tool, for audio and video, so.

Initially, anxiety over a lack of technical knowledge is characterized by feelings of inadequacy due to a lack of understanding about the underlying technologies of video engineering and digital encoding. However, through their experiences of repeatedly digitizing tapes, participants come to develop greater confidence.

Much of the knowledge they draw on in their work is situated, and therefore is difficult to fully understand without carrying out the work itself. P2_L6 described experiencing the realization that having full knowledge of how to do something is not possible until you attempt it: "And once I started conceiving of it, it was like, okay, I don't have to know everything. Let's just figure this out." Part of gaining confidence for participants is developing an embodied understanding through working with the tapes, video components, and digital software and hardware on a daily basis. This can only be developed through the experience of repeatedly copying tapes and watching video images until these routines become embodied and routinized, as suggested in this quote from P3_L2:

P3_L2 (Interview): So I think *that* [i.e., learning to preserve film, *zlk*] does help a lot, just learning, learning how to watch an image, even if it is a different sort of image. And here, just getting used to... I mean, some of it is just learning myself, from just constantly watching tapes.

P3_L2 reflected on previous educational experiences and learning to preserve film and the feelings encountered when "learning to see" analog video images through the repetitive work of digitization. This emphasizes the ways in which the "learning how to watch," (a synonym of P1_L7's notion of "developing an eye") is bound up in learning to

see the particularities of different visual media technologies through repetitive viewing and becoming familiar with them. As digitizers become more confident in their abilities, their associated feelings of inadequate knowledge slowly dissipate. As P3_L2 explained:

P3_L2 (Review Session): Not that I ever thought that I was doing a bad job, but I certainly worried an awful lot, whereas I guess I've just gotten more competent and more confident in my skills, so now when I'm still aware of it, I think I don't let it stress me out on a daily basis, which is probably better.

Fear of inadequacy in the eyes of other practitioners slowly dissipates as P3_L2 gains more and more experience, gaining confidence in the ability to properly carry out digitization work at the levels expected by the wider community of preservation professionals. “Developing an eye” and “learning to watch” allows for the seeing of errors, and the detection of errors is thus tied to the increasing of a digitizer’s competence.

9.1.2 Learning to See Errors

As discussed in Chapter 8, being able to see errors is an important competency of artisanal digital reformatting, and it informs the digitizer’s decision-making and subsequent actions. They must develop the ability to detect errors in the video signal, learning how to “read” the video images displayed on the CRT monitors or the signal measurements displayed on video scopes in order to detect anomalies in the signal chain or problems with the recording. During the review session, while we were watching together the recording of P3_L6’s work carrying out quality control on a video file, P3_L6 explained how being able to detect errors was developed through becoming familiar with how analog video images behave, developing experience and an understanding of the impact of the materiality of the tape:

P3_L6 (Review Session): Yeah, blink, like I noticed, it looked like, just going by there, a little losses of sync and stuff like that. Yep, that's the kind of stuff that you've got [to] get familiar with, and learn, how concerned am I about that? Often at the beginning of a tape you see a lot of that, right? Glitches and things because the tape has been rewound a number of times, it's stretched a little, it is what it is. I don't get too worked up about stuff that happens in the first five seconds of a tape.

Learning to see errors is not just about repetitive viewing of tapes, but also involves learning to take into account the context of the errors, in particular, developing an eye for how different videotape formats behave and what types of errors can be expected from them. This is critical for understanding whether an error should be attributed to what is inherent, or “native” to the tape, or something that the digitizer can adjust. P3_L6 integrates knowledge about the materiality of the tape (that early sections of the tape can get stretched) and explains the process of learning to ignore common errors that are inherent to the tape format. In Chapter 11, I will further elaborate on this theme of how participants distinguish between aspects of their practice that are “inevitable,” i.e., those situations in which they can do nothing to change the outcome, and those that are “intentional,” i.e. situations in which they can intervene and effect a particular outcome (See Wuthnow, 1987, pp. 73-75).

Learning to see errors involves moving from the experience of anxiety, through periods of training to the normalization of vision and the achievement of competence. This process of gaining experience is common to any field of mastery. For instance, P3_L5, who does quality control, describes the difficulty of learning to distinguish between the look of different formats and how developing this ability depended on working with a range of tape formats and developing a sensitivity to inherent aesthetic characteristics of each medium:

P3_L5 (Interview): I did quality control as an intern at the Bay Area Video Coalition. So, that was the first time I had encountered it. It was, it was very difficult to, basically, different video formats look different, and kind of have their own aesthetic and before you know that, what is digital and what is normal for this format? And so that really required the experience of looking at a lot of different formats and like talking to people who had done it. And, yes, 1/2" open reel always looks like this, it's not, it doesn't look great, but it's normal.

P3_L5 describes this process of training their vision, learning to recognize how different types of videotape formats look when played back on a video monitor. The work of artisanal digital reformatting requires that all workers involved have gone through repetitive viewings of a range of analog video formats before they “develop an eye” for the types of errors that each format is prone to, developing confidence in the ability to differentiate between different “native” errors and those aspects of the video image that indicate problems that need to be addressed through their practice.

Digitizers can be seen to train their vision in two senses of the word: They adjust their vision and sensitize it in order to “catch” anomalies in the rapid flow of the video signal, which is visualized as a sequence of roughly 30 frames of video per second,⁸² observed along the various points of observation of the signal chain; and at the same time, they adjust their expectations about the image quality and types of errors that may appear due to differences in how particular videotape formats behave.

These embodied practices of visual judging are difficult to communicate through language. We have seen how “developing an eye” for seeing errors, the training of a participant’s vision, takes place primarily through repetitive viewing in the context of carrying out the work of digital reformatting, rather than through learning in formal educational contexts. At the same time, digitizers have difficulty putting into words

⁸² To be more precise, NTSC analog color video is recorded at 29.97 frames per second. With interlaced scanning (typical for most analog video formats), each frame is made up of two alternating fields, one field of odd scan lines and one field of even scan lines.

exactly how they learned how to carry out their work because their engagement in this work is focused on visual phenomena that may be difficult to express in language. Some digitizers described having a difficult time putting into words this experience of learning to see errors and being able to diagnose them. One digitizer acknowledged the difficulty in trying to train new staff to see errors:

P1_L1 (Review Session): In doing training, uhm, and teaching video preservation and stuff, like that is difficult. It's hard... it's pretty much like, it's kind of like a language -- I'm trying to come up with a good analogy... but, it is kind of hard to communicate this information, or pass this information on, because it really is like “learned from experience” information.

This digitizer acknowledges the inherent visual nature of this knowledge and the difficulty inherent in communicating it verbally. Thus, “developing an eye” for digitization work can be seen as a case of learning to think visually, seeing and making decisions without translating that knowledge into linguistic form. This visual thinking can be manifested as a “feeling” or “intuition” of how the video image should look, as they work to construct the digital copies. Through “developing an eye,” digitizers can be seen to calibrate their vision to structure their seeing and judging, which enable them to confidently differentiate between errors they can correct and those they cannot. Thus, shaping the ability to look and make visual judgments is an important aspect of becoming competent in the construction of visual copies.

As we saw earlier in this section, digitizers’ experiences of learning to see errors progress from a state of uncertainty and anxiety, to one in which detecting and diagnosing errors becomes “intuitive.” The seeing of errors resists being fully articulated in language, with judgments and decision-making happening sometimes fully through visual thinking. At the same time, digitizers’ decisions must at some point be translated

into linguistic form, when they are documented within their reports, but when they are fully engaged with digitizing, adjusting and calibrating, digitizers rely primarily on visual techniques of knowledge construction. For example, P1_L2 reflects on the experiences of trying to evaluate the source of an error in a video that P1_L2 was setting up for digital reformatting:

P1_L2 (Review Session): You get kind of like this... I can't describe it but, you can definitely get this kind of feeling when something is "native," so to speak. When something is resolvable, and something isn't resolvable. It's kind of hard to explain how. But as far as like what I watch.. uhm... mainly I'm just, I mean watching the image is the best thing I can watch.

P1_L2 describes being able to distinguish errors of the video signal that are “native,” or inherent to the original, as a “kind of feeling” that resists verbalization. P1_L2 learns to understand how to interpret errors in the video image by watching the image. This suggests that for digitizers, the experience of learning to see errors is dominated by visual forms of interpretation that may not be verbalized, and that this learning process is directed at habituating patterns of viewing.

9.1.3 Embodied Judgment: Engaging the Senses

Seeing errors and engaging visual forms of knowing are supported by other dimensions of embodied judgment, through learning to use the other senses, such as hearing, touch and smell, to form knowledge about analog videotapes and make decisions about how best to digitize them. Video tape recorders (VTRs) and other components in the video signal chain, often produce sounds and vibrations that offer additional clues for identifying and diagnosing errors. For example, in the review session, P2_L2 gave more detail about using the sounds the VTRs make as they are operating to understand what is happening with the materiality of the tape being played back:

P2_L2 (Review Session): You can hear things when you're sitting next to a machine. And it helps you kind of know what's going on, you know. Uhm, that might not be as, it might not be visible in the resulting digital file in the same way. But because you were there listening to the machine, you'd know it.

P2_L2 describes listening to the machines as another way of gaining knowledge about what is happening to the tape that is being played back inside the VTR, providing knowledge of the hidden interior of the machine. A tape may be damaged or the VTR may be malfunctioning which can produce such sounds as “squealing” (as noted by P2_L2) or “crumpling” (as noted by P1_L6), each indicating a problematic situation developing within the interior of the VTR that the digitizer may need to act upon in order to prevent the tape from being damaged.

Listening for sounds can also help to identify errors that appear in the video signal that would otherwise be missed, both by listening to the sound recorded on the tape and by listening to the VTR mechanism. An intermittent problem with the video signal may be missed while monitoring the image visualized on the CRT, but might be picked up if the same problem with the tape is impacting the soundtrack, too. Additionally, the motors and transport components running the videotape through the VTR may make a whirring, buzzing or grinding sound that can be a clearer indicator of a particular problem with the tape than the video image alone can convey. For example, P1_L1 identified listening to the soundtrack as a useful aid for detecting visual errors:

P1_L1 (Review Session): You'll be able to like... like something that only happens for a half second also happens acoustically, and for some reason the acoustic is really what triggers, “oh, there was something there.” More so, because optically, you could blink and not see, is part of it.

Hearing errors in the soundtrack can draw attention to an error that is only on screen for the blink of an eye. This experience is bound up in the materiality of the different

recording technologies. Analog video images are composed of visible frames (traced by an electron beam scanning the back of the CRT's screen), while sound is a continuously varying signal. Each frame (composed of two interlaced fields) of video is only on screen for roughly 1/30 of a second (or 1/60, counting fields). While, it is possible to blink one's eyes and miss an error in a frame of video, hearing is continuous and can detect even a brief gap, pop or pitch change in the audio signal. Digitizers will split their auditory attention between the sound in the room of the equipment operating and the audio recorded on the videotape. They typically wear headphones or use speakers in order to listen at low volume levels to the soundtrack on the videotape while they are digitizing, while at the same time listening to the sounds the equipment is making:

P1_L6 (Review Session): Well, we usually keep the sound on very low, so it's, it's always in the background. And you kind of listen for anything that might be wrong with the tape, you might hear crumpling.

By keeping the sound low, digitizers establish an environment in which they can monitor for anomalies in the audio, which is established as peripheral to their perceptions of the visual signal. They listen for differences in the signal from this established background signal level. At the same time, digitizers constantly shift their aural attention from the sound quality of the recording to the VTR itself, because sounds coming from the mechanics of the playback mechanism can also indicate problems with the tape and can help identify or diagnose errors. P1_L2 discussed how lacking aural acuity negatively impacted P1_L2's ability to gather information from the sounds made by the VTR when it encountered problems with a tape, and P1_L2 reflected on the ways in which other co-workers described how they used their ears to listen for mechanical problems with the VTR ("deck," in this context):

P1_L2 (Review Session): They listen to the deck, because they can hear when tape damage goes by. And that makes a big difference. Because if you can hear that, then you're not going to freak out if you see something on the deck... see something on the screen and you hear that something went through the deck, then you know that it's tape damage. Uhm... so, but if you don't hear that sound, then it might be, "What was that?"

Listening for anomalous sounds emanating from the VTR as the tape is played helps digitizers make visual errors more understandable and reduce uncertainty about their causes. If digitizers are able to trace a perceived sound to a physical deformity on the physical tape, this can help digitizers identify the root cause of the types of errors they are seeing on the video monitor. Digitizers draw on hearing, constantly shifting focus between the content of the audio recording and the materiality of the mechanism – the “squealing” or “crinkling” sounds that digitizers learn to detect and use as further evidence to diagnose the source of errors in the video signal. Digitizers’ sense of hearing offers additional information to guide decision-making, by providing knowledge of how the tape is behaving as it is played on the VTR.

Supplementing their vision and hearing, digitizers also engage their sense of smell early on in their workflow, when they are evaluating the physical condition of a videotape, at the handling and conservation stage of the digitization workflow (Step 3, “Tape Assessment,” See Appendix K – Prototypical Workflow and Participants’ Idiosyncratic Steps”). Digitizers hold the tape up to their noses and sniff the cassette or reel of tape for indications of decay:

P1_L6 (Think Aloud): [*Picks up a VHS tape and holds it with their hands*] We check to make sure that the tape is in operation, is operational, and doesn’t exhibit any signs of molding, or oxide flaking, or [*opens case and holds tape up to nose*] doesn’t have a funky smell. [*closes flap and lowers case*] There is no telltale signs, of deterioration, so that’s good. It *seems* like it’s functional. Sometimes we have found tapes that will squeal because the lubrication in the tape is starting to breakdown, for VHS.

Detecting typified odors emanating from the videotape is integrated into a routine of tape handling and inspection that seeks to gain knowledge about the material condition of the tape, such as material decay and mold contamination, before introducing it into the VTR and playing back the tape. For cassette-based formats, this requires the manipulation of a latch that keeps the little plastic door on the cassette's case closed. Opening the cassette's door allows the digitizer to inspect the physical tape with both eyes and nose:

P1_L7 (Review Session): I'll open up the little door and see, I'll take a sniff for one thing, see if it's... if it's really that bad, you should take it out of the case, I find. That becomes pretty rare. Uhm, give it a sniff, take a look at the parts of the tape [that] are visible⁸³ to see if anything looks particularly damaged or mold, or something like that.

Hands, eyes, and nose are integrated to examine the materiality of the tape and detect any signs of breakdown. This action is routine but relies on a subjective human sensation.

There is some interpretive flexibility in terms of describing and diagnosing the underlying source of the odor. These subjective differences are acknowledged so that digitizers know they are detecting the same problem:

P1_L1 (Interview): Yeah, Umatic, if you smell crayons...

ZLK: That's a sign?

P1_L1: It's either dirty... I smell crayons, other people say dirty socks. But that's a clear indicator that something's going on.

The presence of particular odors, detected when handling particular formats can give insight into whether the tape is decaying or not. These smells have become typified to a certain degree within the community of media preservationists, but depend on there meaning through linking the array of possible subjective impressions that can be related

⁸³ For cassette tapes, the edge of the coiled up tape is visible through one or two small clear plastic windows mounted into the cassette shell. Opening the protective flap on the side of the tape allows for the surface of the tape to be inspected. For open-reel tapes, i.e. those that are on single reels without any casing, the edge of the tape is visible through cutouts in the side of each flange of the reel.

to an underlying phenomenon of decay: Some digitizers smell the decaying Umatic tapes as “crayons” and others perceive this as “dirty socks,” which suggest the role of subjective perception in interpreting olfactory experiences.

Touch is a mode of perception that is integrated throughout all embodied activities as participants must handle tapes, press buttons on machines, and coordinate the adjustment of knobs while watching the effects these manipulations have on representations of the video signal. The place in the workflow where touch seems to require the greatest degree of embodied judgment is in the cleaning of the VTRs (part of Step 7, “Set up.” See Appendix K – Prototypical Workflow and Participants’ Idiosyncratic Steps). Depending on how dirty or decaying a tape is and how attuned the particular digitizer is to dirt, digitizers may clean their machines before every new tape to be transferred (for dirty, problematic tapes), or at the start of each day (for cleaner or less-problematic tapes). While most of the internal video components of the VTR are quite durable, digitizers must be careful with the fragile (and difficult to replace) video heads, and develop just the right amount of pressure to clean them without damaging them:

P1_L3 (Interview): You know, you don’t need to treat the video drum like a piece of porcelain, but maybe treat it like some thick glass. And so that level of comfort just comes over time. And I think I was able to convey to [P2_L3], at some point, maybe not even on purpose, that I have that level of comfort with equipment.

Digitizers develop skilled forms of touch, smell and hearing, and integrate them into their application of calibrated vision, constituting a fully embodied practice. Only taste is absent as a source of knowledge in the practice of artisanal digital reformatting, or at least digitizers did not offer to show me any examples of taste being integrated into their work.

9.2 Breakdown and Uncertainty

While the anxiety of being a newcomer to the field dissipates with experience, system breakdown and uncertainty about the causes of errors continue to contribute to negative affective experiences for digitizers. Participants discussed these in terms of (9.2.1) distinguishing between good days and bad days; (9.2.2) fear of making mistakes; and (9.2.3) experiences of “bad tapes.”

9.2.1 Distinguishing Between Good Days and Bad Days

Participants were asked in their interviews to reflect on what constituted a “good day” and a “bad day” for them in their work (interview question IQ10 in Appendix D – Interview Protocol). For digitizers, good days working at their jobs are characterized as those days that are free of problems in system performance and quality, as well as days when they have a chance to view some interesting content, while they are monitoring the video image during capture. Bad days are characterized by the behaviors of problematic tapes, when damage befalls tapes, or when systems breakdown. Looking at how these problematic situations are interpreted by participants gives insight into the range of problematic situations that can arise and how they impact digitizers’ experiences.

Beginning with a description of what a “good day” constitutes, one digitizer expressed how the experience of a “good day” is linked to the proper functioning of technological systems, which can vary from day to day:

P1_L7 (Interview): Oh man. All my decks work. I’d be overjoyed. I’d be so happy, yeah. If there’s no, sort of, technical catastrophes, no mechanical catastrophes, if I get to look at some interesting material, which I’ve been pretty lucky about. Even material—I mean, golf is kind of pushing it—but, even material that’s sometimes, like, boring I think is kind of interesting.

Again, the experience of digitization is tied to technological systems that can easily malfunction or behave inconsistently. In this quote, P1_L7 also brings up the idea that the nature of the content can play a role in impacting the experience of digitizing as well. Even boring content can contribute to the experience of a good day if the technological systems are working properly. “Bad days,” on the other hand, are typically due to unexpected and inexplicable breakdowns, which cause stress and frustration, even though breakdown is always a risk. Breakdown is always a risk and digitizers expect, however, when it happens it still can slow or stop the workflow:

P2_L2 (Interview): A bad day, you know, tapes are impossible to transfer, you don’t really know why, and it’s going to require, kind of, a lot of intensive research to figure out why. And things break. I mean, anytime something breaks. I feel like my mood is, like, very connected to the state of our equipment. And so if a machine goes, it can be, like, a bad day, and I’ll be pissy. Because I know what it involves to actually get it fixed.

Mechanical breakdown disrupts the smooth movement of digitizers through their workflows. It poses epistemological gaps in understanding about their causes, and is doubly problematic because, if the equipment cannot be fixed through the know-how of the digitizer, it has to be serviced by a visit from a video engineer or involves sending out the deck to be repaired. The inability to fix a deck and/or having to send it out for repairs leads to frustration and anxiety from the digitizer, and often work on a particular project cannot continue until a solution is found.

Digitizers characterize “good days” in their work as days in which equipment works well and there are few problems with getting the tapes to playback in order to produce a high-quality signal, i.e., their tools become “transparent” and their work can progress smoothly. At the same time, system breakdowns occur regularly, and stress is a constant theme, expressed both in relation to when it is not possible to easily find the

cause of a problem, and through an ongoing fear of making mistakes in judgment. System breakdowns can quickly transform a “good day” into a “bad day,” and digitizers can develop negative feelings towards particular tapes or entire videotape formats that become inexplicably prone to consistent breakdowns.

9.2.2 Fear of Making Mistakes

Fear of making mistakes in judgment, even when the technology is functioning properly, stems from digitizers’ commitments to making the best copies they possibly can and their perceived risk of potentially falling short. The complexity of the signal chain, the multiple points of observation and intervention, the ability to swap out different components, and make very fine adjustments to the VTR and the signal processing equipment, make it difficult to know when the quality of the digitized video signal is being captured at a sufficient level of quality. When asked what aspects of the work required the greatest level of attention in the work (interview question IQ6a), P2_L2 explained how the work requires attention throughout the whole process because the nature of the video technology resists full knowledge of the process:

P2_L2 (Interview): You just, you kind of try to do the best you can. We’ll often play things directly off the, of the deck. But again, you don’t know exactly. It could look different on another machine. And it often does. And so there’s always this, like, test tapes on multiple machines type mentality, just to make sure that what you’re seeing on one playback device is what you’re seeing on the other, or worse for better. You know, and you kind of make that call. So yeah, that’s digitization.

In this quote, P2_L2 describes two techniques for reducing uncertainty: Playing the tapes back and viewing the signal without any other mediating components, and playing the tape on another machine. This allows P2_L2 to develop some certainty about whether a problem being observed in the signal is due to the tape, the machine, or a mediating

component. At the start of this quote, P2_L2 expresses being limited in the ability to reach an ideal level of quality, and instead must “try to do the best you can.” At the end of the quote, P2_L2 appears resigned to the inherent uncertainty in fully knowing the video signal and being sure that P2_L2 is doing the best work possible, acknowledging “that’s digitization,” i.e., suggesting that this is intrinsic to working with analog video recordings. These aspects of their work can become stressful for digitizers, because they want to produce the best copy, but they could conceivably keep making additional adjustments, and trying out different combinations of equipment, *ad infinitum*. In the following example, one digitizer discusses the multiple moral commitments going through the digitizer’s mind while adjusting the video signal for a difficult tape produced by video artists who intentionally manipulated the standard color signal in inexplicable ways.

As discussed in Chapter 8, color requires a fine degree of consideration and at times the “correct” color adjustment can be indeterminate. P1_L2 describes negotiating multiple competing imperatives between technical standards and best practices, on one hand, and on the other hand, P1_L2’s own “instincts,” and expresses the stressful experience that these tensions can contribute to:

P1_L2 (Interview): And so you've got the standards and best practices in one ear; keep it all in broadcast range in one ear; and then you've got your instincts going as well; and you kind of have to like, just make a decision you know: “At what point am I going stop trying to play this on different decks to see where it looks better? At what point am I going to stop using different TBCs [Time Base Corrector, *added zlk*]?” At some point, you have to make that decision. And, uhm, that's pretty key because, at that moment, it's probably going to be the last time that this work is going to be digitized, and that's what's going to be out there forever. That's very dramatic, but- we forget that when we're actually doing the work I think. But, uh, it can be stressful, especially when it's an important work. uhm, I mean, I lose sleep, what I was talking to you about the Doris, or the

Shirley Clark tape, the color lock⁸⁴, I have no idea if I gave them what she intended, I just have- I told them that; I wrote them a letter that they could keep with the materials saying what happened, and where I landed with that decision, and I don't know what else to tell you.

P1_L2 is discussing the work carried out on two collections of videotapes produced by avant-garde video artists, such as Doris Chase or Shirley Clarke. For avant-garde video recordings, which were often intentionally recorded outside of the signal thresholds of the broadcasting standards, a clear solution is not always apparent, and difficulty in getting the objective measurements provided by the scopes and the technical standards to align with embodied judging is also stressful. P1_L2 has to decide when the quality of the digital copy is sufficiently high enough, which indicates when P1_L2 feels able to stop trying out different pieces of equipment (in this case swapping out different TBCs to see which one provides the best stabilization to the video signal). In this quote we can see that fear can emerge from trying to apply standards to problematic tapes, and having to rely on instincts to decide the best course of action. In the case of obsolete tape formats, P1_L2 acknowledge that this could be the last time anyone ever plays back the original tape. This contributes to the stress of the job, since the outcomes of P1_L2's actions will determine how the video content will be seen into the future. P1_L2 expresses a strong archival commitment to the artists who created the original tapes and documenting the decisions made so that art curators and other future viewers will understand why the digital copies look the way they do. This also shows the role played by documentation in P1_L2's work as a means of reducing the anxiety about making a decision under conditions of uncertainty. By documenting the reasons for certain decisions, P1_L2

⁸⁴ "The color lock" refers to a small adjustment screw mounted on the ½" open-reel video deck that allows for the color signal to be adjusted. P1_L2 showed me how this can be adjusted with a small screw-drive while running a tape and watching the scopes and the video monitors to see how the color signal is affected.

provides written testimony of the rationale for action, so that P1_L2 will no longer “lose sleep” thinking that P1_L2 possibly made the wrong decision. Through documentation, P1_L2 restores herself as a rational actor working in a context of indeterminacy, complexity, and breakdown in the video signal. As we will see in the following sections, it is common in the practice of artisanal digital reformatting for equipment breakdowns to turn good days into bad days, and particularly bad tapes to torment and produce anxiety for digitizers.

9.2.3 Experiences of “Bad Tapes”

Digitizers often develop negative feelings for individual tapes or entire tape formats that are particularly problematic to digitize. Digitizers often reflect on these experiences choosing dramatic or even profane language to express frustration. When reviewing the video footage of P1_L2’s digitization work, P1_L2 exclaimed passionately in regards to dealing with a particularly problematic tape:

P1_L2 (Review Session): What a shitty tape! I remember that. I remember, like, you sat down. Jesus Christ, this is one of the worst tapes I've ever gotten. [laughs]”

Particularly bad tapes can leave a strong impression on the memory of the digitizer. This can be due to indeterminacy, as in the case of difficulty in adjusting the color component or the instability of the video signal, each resulting in a protracted and difficult process. In the case of P1_L2, “bad tapes” can be due to particular aspects of the format or the production process, as in the case of P3_L2:

P3_L2 (Review Session): I hated that tape? I like *remember* this tape. Because it was dubbed from 1/2", so like the native issue is a part of that as well. I mean it's hard to like see obviously uhm on this video, but I'm sure there was just a bunch of image artifacts. And the levels are notoriously difficult to control on 1/2", so some of that has been dubbed in onto your Umatic as well.

Affective responses to problematic tapes are expressed alongside careful explanations of the material behaviors of particular formats. The affective impact of problematic formats is bound up in P3_L2's feelings of frustration due to uncertainty. At the same time, digitizers have expectations about the typified behaviors of particular tape formats, such that they prepare themselves for tapes likely to become problematic. As we saw in Chapter 8, digitizers actively work to manage uncertainty in their work through enacting epistemic techniques that help to identify, diagnose, and adjust for errors in the video signal.

At the same time, epistemic techniques help digitizers to manage their expectations about what they are likely to see when playing back certain tapes, so that they are not surprised by unexpected errors and lose focus in their work. P3_L2 reflects on how the work requires a lot of focus and that going through the painstaking tasks of digitizing problematic tapes requires keeping calm:

P3_L2 (Review Session): I would say particularly again with older formats that tend to be very problematic. There have been occasions where it has taken me all day to get anything off a tape. And while it's satisfying when you do get it captured, it can be hard, you know. What time was it? I guess Friday, I was already in a bad mood about Trump.⁸⁵ I had to capture a tape in like 10 different segments. We also try to avoid... We always try to do a complete capture, but... no matter what I did with this tape, it was just shedding so badly, that I would get three minutes in and I would have to stop it and rewind, capture it again.. It was very, very hard. But the content looked, I mean it didn't look great, but that was because of the way it was recorded, but you know, I did get all of the content off of the tape, which has to be of course, the primary concern. It was an arduous task. It can be frustrating and stressful. I'm always just concerned to do well, you know, to make sure I am treating all of the content respectfully, you know, I'm certainly aware that this is probably the last shot for a lot of these tapes, so, it's a responsibility that I don't take lightly.

⁸⁵ Participant P3_L2 is referring to the election of Donald J. Trump as President of the United States of America, which took place on Tuesday, November 8, 2016.

While P3_L2 is dealing with negative affective dimensions of frustration and stress due to the difficult process of digitizing a particular tape in 10 different sections, as well as the extra-situational anxiety associated with current political news, P3_L2 tempers these feelings with a call to personal moral responsibility, to treating “the content respectfully” and producing the best quality copy possible. P3_L2 expresses how the need for concentration is particularly acute because the tape is in bad condition and this may be the only chance that anyone has to copy it before it becomes unplayable. This adds an additional layer of anxiety, as this is a “one time shot” for this tape, at which point the video signal encoded in its magnetic particular will be irretrievably lost. As we will see in Chapter 11, the development of meaningful, normative practice is bound up in these stated commitments to particular moral objects, and the linking of the digitizer’s programs of action, “real projects,” that work to ensure those moral objects are materialized. In this example, we can see how digitizers may experience working in a high stress context of production that involves handling potentially unique and fragile materials. They must keep focused in their work, exercising care and responsibility, in a stressful context in which their mood, the quality of decaying tapes, and their commitments to preservation imperatives collide. In the following section, I will discuss how the experiences of digitizers are oriented in time and the role this plays in their work of constructing digital copies.

9.3 Temporal Orientation

As embodied subjects, human consciousness in everyday life is marked by the perception of an unfolding present, but mental focus can be directed to events and objects distant in place and time. Digitizers also make their actions meaningful by orienting them in time.

They guide their decision-making process by reconstructing the past while simultaneously looking to posterior events.

9.3.1 Looking to the Past

In Chapter 8, I described the ways in which digitizers apply historical analysis to form knowledge about errors on particular tapes. Looking at this aspect of their practice through a phenomenological lens shows how it is based on participants' expertise, training and embodied knowledge, which directs their minds to events in the past. By looking at the tape as an object that moves through time, accumulating traces of past events, digitizers direct their minds towards the time when the tape was recorded and the tape's transmission to the present moment via earlier events of storage, copying and archiving.

By historicizing the site of production and re-circulation, digitizers incorporate knowledge of these phenomena with the current state of the tape, in order to construct meaning of why the tape behaves a certain way and to diagnose errors that have developed as it has moved into the present time. For instance, P1_L3 explains how integrating knowledge about the environmental conditions in which the video was originally recorded can give insight into what to expect when playing back the tape:

P1_L3 (Review Session): Damage or finding out that a tape was filmed at the beach, recorded at the beach. Exposed to humidity and sand. And the deck was exposed to all of that, so any tape recorded around the same time may show similar issues. So... pulling as much information about the tape and then [*inaudible*] the tape before doing anything.

P1_L3 must reconstruct the social context and site of production in regards to the recorded image as well as the materiality of the videotape medium. By conceptualizing the tape as an object that accumulates traces of its context, and integrating knowledge of

the tape's history of production and storage, the digitizer is able to develop knowledge about the present state of the videotape. Is it damaged, covered in sand, creased? How much of the signal being produced from the tape in the present can be attributed to the context of creation or the vagaries of its circulation and storage? How does a tape's history impact the quality of the video signal that is possible to get off the tape? By directing intentionality towards these past events and persons, P1_L3 can begin to address these questions that hinge on a construction of the contexts and contingencies of a tape's movements through time.

When looking to the past, digitizers describe shifting their mental focus from pre-existing knowledge of the tape's past and the empirical traces from its past that act as clues to the reality of the tape's present condition, to the quality of the signal that can be played back from it. This in turn enables digitizers to work backwards from the present tape to its past, to fill in gaps in their historical knowledge with clues acquired from the tape's materiality and its content. In this example, P3_L2 describes how it would be ideal to know precisely how a particular videotape was originally recorded (so that the digital copy could be produced to conform to that state), but that often its "production history" is not known:

P3_L2 (Review Session): Generally, you're not going to know the whole production history [of a tape, *zlk*], but you can tell a decent amount, about how your recording came to be by looking at your content, you know.

P3_L2 reflects on how gaps in historical knowledge about how a tape was originally recorded can be filled in by looking for clues in the video content. Digitizers can analyze all of the content recorded on a tape, i.e., the audio and video images that are encoded in the video signal, as sources for clues:

P1_L2 (Review Session): There are also, certain kinds of artifacts for when the battery starts dying in the camera, and [my co-worker] only found that out because you can actually hear them, you can see the artifact and you can hear them say “the battery's dying, the battery's dying.” We ought to put that one in *the A/V Artifact Atlas*.

This digitizer reflects on a past experience with digitizing tape in which an atypical and mysterious error was identified and diagnosed by linking audio content from one of the tapes (i.e., the camera operator caught on tape saying “the battery’s dying”) with the presence of an error in the video signal appearing at around the same time on the tape. By decoding the meaning of the visual phenomena using a clue recorded in the tape from the moment of creation, the digitizer is able to confidently classify a new error, developing personal mastery of the work of digital reformatting. P1_L2 discusses the possibility of adding the newly discovered error as a new specimen to the crowd-sourced *A/V Artifact Atlas*, which suggests the role played by digitizers orienting themselves in time to the construction of typified knowledge in the wider community. As we saw in Chapter 8, developing typifications of errors is linked with digitizers’ epistemic practices, including historicizing the tape (as discussed in section 8.2.4).

Acquiring knowledge about earlier events of copying is also important to understanding the current appearance of a particular tape in the present. Copying of tapes onto other tapes (“dubbing”) happened quite frequently in the era of videotape recording, as part of earlier production workflows and preservation efforts. Participants look to the chain of copies that leads back to the original, drawing on knowledge of production techniques, as well as visual clues from the aesthetic qualities of each media format in the tape’s historical position in a sequence of copying events:

P1_L3 (Review Session): VHS always kind of looks really soft and not very detailed, but Umatic can look very crisp. So if it was recorded on Umatic, then,

it's often knowing the history of the content... that to be... did somebody record on 1/2" originally and then transfer to Umatic, and then I digitize the Umatic? But to look for the telltale signs that I see in 1/2" before I assume that I'm getting all those crazy dropout on a Umatic tape. I encountered that actually very recently with tapes from the library, where the content was originally 1/2", put on Umatic, and then saw the telltale skew and some of the head-switching that I would normally see.

Sometimes these chains of copying events can produce new errors or obscure old errors in the present video image. Digitizers must be careful that the changes in aesthetics inherent to copying from one format to another do not conceal minor errors in the image. P2_L2 describes one experience of not being sufficiently careful with a tape that had moved from film to several analog and digital videotape formats:

P2_L2 (Review Session): It was a dub from I think, it was a film transfer to some format to DV. And I think from the second video format to the DV, there was some type of problem where a very faint line, horizontal line was running up the screen. And it was one of those things that when the content was on screen it just wasn't very visible, uhm. I sent it to a film editor and you know he spotted it pretty quickly, you know. But, when I was watching it, I just didn't, it didn't jump out at me as something glaring.

By reconstructing the chain of previous copying events in the life of the tape, P2_L2 was able to identify the present problem and address it. Until this chain was reconstructed and P2_L2 received advice from a film editor friend, the error in the image remained hidden.

Looking to the past can also play a role in constructing the meaning of their overall practice embedded in the historical development of the field of preservation. For example, P1_L2 acknowledged that the copying of analog video signals to new formats continued an established tradition of copying in the video preservation field that began in the 1970s when copying between different analog formats was used as a method of distribution and preservation:

P1_L1 (Review Session): People have been doing this for 40 years. A lot of us our like "oh man, in past five years, we're on the cutting edge of video

preservation." But no. This has been going on for like 40 years, it's constantly been evolving, but really, the ethics have kind of been there. But like, and it's been more iterative than it has been. Because we're like "things are moving so fast," but they're not.

P1_L1 acknowledges that even as the technology may be evolving quickly, the underlying preservation ethos guiding the field of video preservation was established four decades earlier, well before the development of digitization technology. Rather, digitization is seen to continue a tradition in the video preservation field that has used copying from one format to another as a strategy for preservation. This suggests that looking to the histories of particular tapes or looking to the past of the video preservation field itself can contribute to the construction of preservation more generally, and in particular, to the detection and diagnosis of errors in the practice of artisanal digital reformatting.

9.3.2 Preparing for the Future

Digitizers also direct their intentionality towards future events and people, through the ways in which they construct future users and uses and articulate archival imperatives of accountability and documentation as commitments to the future. They situate their practice in a chain of custody of visual knowledge by their institution that does not end with their copying activity, but continues through the ways in which users are expected to put the copies to use, and future preservationists will manage and migrate digital copies to the digital formats of the future.

9.3.2.1 Constructing Future Users and Uses: Archival Imperatives

Digitizers look to the future in a very general way, with little understanding of exactly who will be using or viewing the digital copies they are creating. See Table 8 for a breakdown of how participants constructed the future users and uses of the products of

their digital work, which was based on participants' responses to IQ5a (See Appendix D – Interview Protocol). On one hand, participants have little specific knowledge about future users and uses of the digital copies they produce, instead deferring to the policies and institutional imperatives that shape the distribution and storage of their work. For instance, when asked about who P1_L3 expected would use the digital copies that were being created (IQ5a), P1_L3 explained that these uses were limited by the type of institution that the work was being conducted in:

P1_L3 (Interview): I would like to see more researchers using it. But because [my institution] is set up as such a video art distribution organization, there's not really room to make that transition to being a research collection.

In this quote, we see how institutional restrictions can intervene in the ideal type of user that the participant is expecting. P1_L3's ideal use is "researchers," but this use is obstructed by the policies of the institution, which make it unlikely to open up the collection as a "research collection." Institutional policies can also impact what types of data on the use of the digitized copies is collected, which can limit knowledge. When asked about who P1_L5 thought would be using the digital copies being produced at Site L5, P1_L5 explained that the institution hosted its digital copies on the Internet Archive, and because it did not track users, it made it difficult to know who was using them and for what purposes:

P1_L5 (Interview): We put all of our files, our access files, on the Internet Archive. Which is, I know that they serve a very broad base of people. We know, we have, we've had like 1.7 million, we've had over, we're climbing up to 2 million visits or streams, whatever you want to say. So far, I don't know what people are doing, or who they are. But I think it's probably just general research. Probably some scholarly research, I'm sure, and then probably just people like, curious people, uhm.

[...]

Who's using digital collections? Because I feel like, with the Internet Archive I know, they're very protective of users, the user's identity. You know, because they're like a library, so they want it to be anonymous, which I understand.

P1_L5 describes very high levels of usage of the digital copies, but can only speculate on who is actually using them because P1_L5 does not have additional information on particular users due to the Internet Archive's privacy policy. This policy supports "library values," but it restricts full knowledge of users, requiring participants to imagine users and their uses.

Looking at Table 8, we can see that some of the contexts that participants identify in which their digital copies may be used include their organization, artists, researchers, students and the general public. On the other hand, digitizers describe having strong commitments to the ideals of preservation, which has a deep commitment to maintaining knowledge for future use. At the level of digitization, this is expressed by participants' efforts to produce the highest quality copy possible. For instance, P1_L3 talked about choosing to digitize at a quality level that captured frequencies in the audio sound track beyond the range of human hearing, in case those frequencies were useful to future users and uses:

P1_L3 (Interview): And so is this capturing maybe outside the scope of what you would normally see or hear?

ZLK: Yeah.

P1_L3: But, by doing that, people can use that content. You don't know what they're going to be able to see and hear in the future, and how important that will be.

P1_L3 implies that future users may have entirely different sensory capabilities or needs for visual and aural information that present users may not appreciate, therefore making it essential to capture the video at a quality level above the present capabilities of human vision and hearing. When asked to define "preservation" (IQ1b, See Appendix D –

Interview Protocol), P2_L3 equated it with accessibility, and identified a range of potential uses expected for the digital copies being produced:

P2_L3 (Interview): I guess, in my thinking, it is maintaining the information—be it video or whatever—keeping it accessible and able to be viewed and accessed, or studied, enjoyed, screened, whatever, into the future.

Thus, participants envision the digital copies produced by their institutions as fulfilling commitments to a range of potential future users and unknown uses. At the same time, in responses to IQ5a (See Appendix D – Interview Protocol) they describe how documenting their actions throughout the work of digitization also communicates information to future social actors, although imprecisely known or understood, about the work digitizers carried out to produce the digital copies.

Sites (6)	Participants (13)	Expected Users	Expected Uses
L1: Large Art Museum (Northeast)	L1_P1	Conservators, curators, other museum staff, researchers	Curation decision-making Museum exhibitions, Research
L2: Nonprofit, Work for Hire, Preservation Services (West Coast)	L2_P1	Video Artists	Re-use
	L2_P2	Video Artists, other archives	Unknown
	L2_P3	Video Artists	Depends on what the artist wants
L3: Nonprofit, Fine Arts, Distributor and Archive (Midwest)	L3_P1	Universities, Researchers	Distribution, Exhibition
	L3_P2	Universities, Researchers	Distribution, Exhibition
L5: ⁸⁶ Non-profit, Media Preservation Project (West Coast)	L5_P1	Researchers	Web access, Exhibition
	L5_P3	Library Patrons, historians	Web access
L6: Preservation Dept., Academic Library (Northeast)	L6_P1	Faculty Researchers,	Research, Exhibits
	L6_P2	Student Researchers	Exhibits
	L6_P3	Students, Researchers, General Public	Research, Reuse
L7: Nonprofit Video Archive, Work for Hire, Preservation Services (Midwest)	L7_P1	Clients (for-hire work); public (own archives)	Unknown (for-hire work); online viewing (own archives)
	L7_P2	Clients (for-hire work); public (own archives)	Unknown (for-hire work); online viewing (own archives)

Table 8 – Expected Users and Uses Identified by Participants in Interviews

⁸⁶ Site L4 was visited, but was eventually excluded from this research because it was found to be an unsuitable site (i.e., the work of digitization was carried out by non-professionals and thus did not fit the definition of artisanal digital reformatting).

We see from Table 8 that expected users and uses vary across research sites, as expressed by participants within the semi-structured interviews. As they attempt to constitute potential, future users by directing their intentionality to future events, participants acknowledge the inherent indeterminacy of these future users, and refer to institutional relations as guiding their expectations of future users. For instance, P1_L2 works for a digitization lab that is housed at a non-profit media arts organization that does preservation work for artists:

P1_L2 (Interview): The people who are going to be using the copies are probably the artists themselves. We encourage open access, but generally what they want to retrieve that work so that they can reuse it somehow.

P1_L2's understanding of future use is limited to who specifically requested the digitization, in this case, the video artists who created the video recordings. While participants are aware of their institutions' key missions (See Table 1 for a comparison of key elements of each site's mission statement), they have limited knowledge of who else may use the digital copies after they give the digital copies to the artist. P1_L3 acknowledged how the structure of the organizational context placed limitations on how future users might use the copies being created:

P1_L3 (Interview): I would like to see more researchers using it. But because [our organization] is set up as such a video art distribution organization, there's not really room to make that transition to being a research collection.

Some digitizers (P2_L2; P1_L3; P1_L6) expressed uncertainty over whether the digital copies they were creating would be used in any meaningful way. For instance, when asked about who would use the digital copies, P2_L2 explained:

P2_L2 (Interview): Ideally, whoever we happen to serve and many others. Um, I think we really try to encourage people to make their digitized materials widely available. But ultimately that's kind of up to the artist or the organization.

This quote shows how, in cases where the videotapes being digitized are not part of the participant's home institution, the artist or the organization requesting the digitization work plays a significant role in determining how the digital copies will be made accessible and used. Other factors they see as shaping the future of the copies they create include their workflows and special projects:

P3_L2 (Interview): It's very much dependent on the project. Sometimes we're literally just transferring entire films that a filmmaker would specifically have made. So in those cases, maybe festivals or things like that. I do really like working with other archives, because then there's a much more, kind of, set path.

In this example, understanding future users depends on the project, and this is always indistinct and dependent on the goals of the particular project or the organization that is leading the project. This site, L2, works with a variety of organizations, but tends to work with video artists, and must balance future uses with the authenticity of originals, in relation to the author's intent. At site L6, an academic library where faculty members are the main clients, P1_L6 discusses having only a vague idea of the uses to which the digital copies are going to be put to:

P1_L6 (Interview): So, luckily, the ones that I've mentioned do have, have already had access. People have already used them in research, or have been exhibited in displays. But otherwise, I imagine it really depends on the research interest and what's, kind of, happening. Because digital humanities is getting so big, I can see that what we digitize could be made more useable in the future, or may just be more used in the future, if not more useable. Or maybe I'm just being hopeful that what I'm doing has a purpose.

In this example, P1_L6 directs attention to the potential research interests of future researchers, which are conceptualized as evolving, and making the copies more "useable" or "used" in the future. At the same time, at the end of this quote, P1_L6 admits being uncertain if the digital copies will be used for significant purposes or not. In contrast,

P3_L5, a quality control expert at site L5, indicated being very confident that the digital copies are being accessed and used for research:

P3_L5 (Interview): Definitely people who are users of the library they belong to. I think, the partners are the best at telling their patrons what exists, but I hope that other historians of California or even outside of California, would find our whole collection and be used, and use it across partners.

At the same time, P1_L5, who worked as an administrator and quality control expert for site L5, admitted having no idea of who was using the digital copies or what they were doing with them:

P1_L5 (Interview): So far, I don't know what people are doing, or who they are. But I think it's probably just general research. Probably some scholarly research, I'm sure, and then probably just people like, curious people, uhm...

These examples suggest that there is some variability between sites and participants about how they conceptualize who will view the products of their labor in the future, which can be associated with different mission statements of institutions, the nature of the original video tapes participants are working with and certainty or uncertainty they have about how the digital copies that they produce will be used. This suggests that “the future” to which they orient their present work is an imagined unity that is shaped in the mind of the digitizer by the particular institutional mandates and projects going on, but because future users can never be fully known, they need to construct their own idiosyncratic narratives about who might use their digital copies. Rather than orienting their work towards particular users or uses, they focus on constructing the legitimacy of their practice and maintaining abstract values of transparency and accountability, and rely on their documentary practices to communicate about the context of their work to an unknown future, which will be further discussed in the following section. Digitizers must orient themselves in time to construct digital objects that can be used by potential posterior

users, while at the same time respecting the authenticity of the originals through historicizing the tapes and documenting their choices.

9.3.2.2 Communicating Knowledge to the Future

Even as digitizers acknowledge the limitations of directing their focus to unknown users of the digital copies they produce, they imagine their work as a communicative process with the future, in which they communicate their adherence to archival values, provide evidence of the high level of care and quality of their work, and document the presence of uncorrectable errors in the video copies that they produce, for the future users of the copies.

Through the work of producing copies and documenting the manner in which they document their work, digitizers see themselves as communicating across time, expressing their adherence to the values of accountability and transparency in the execution of the work for some unknown future viewer. Communicating that their work was conducted “properly” is accomplished by providing information necessary for future viewers or preservationists to believe that the digitizers did their work following accepted practices. Documenting uncorrectable errors is an important way of legitimizing their actions because it shows a future reader of their notes that they were in fact aware of the errors, tried to fix them, even if in the end they were unable to correct for them. While problematic tapes often cause digitizers great anxiety, documenting “uncorrectable” errors by enumerating all the points where the file deviates from the highest quality, offers them one way of communicating to future users that they did the best they could and that the digital file is of the highest level possible. An error that cannot be corrected needs to be documented in some way or otherwise accounted for, because the presence of

an error without a note by the digitizer would suggest that the work may not have been done to the best of the digitizer's abilities, as expressed in this quote from the interview with P1_L7:

P1_L7 (Interview): I always make sure to yeah, take note of, if there's damage we can't fix, or if like audio drops out, just to sort of, if audio drops out and that's just the way the tape is, I also make a note of that, so people know when they're reviewing this five years in the future that, you know, it's there for that reason, not because I screwed it up.

P1_L7 explains how errors are communicated in order to legitimize P1_L7's practice, communicating important information to future users that the work was carried out to the best of P1_L7's abilities. These uncorrectable errors and the digitizer's documentation of the errors also become part of the history of the tape, as noted by digitizer P1_L1:

P1_L1 (Review Session): Yeah, the way I'm doing it, if that happened, and there's no way to go to another source, it's just like "this is what it is" and you just document. You would document regardless, but that would just live with this file that "hey, there's this at this point, there's no way to remedy it" so in effect, it becomes part of the piece almost.

P1_L1 is working with videotapes created by artists, so the implications of uncorrectable errors becoming part of the work is highly problematic, but if no other replacement copies are found to exist, the uncorrectable errors will become part of the work going forward, making it essential that the digitizer fully document the work to ensure full accountability and transparency to the future.

In addition to documentation, digitizers can communicate to the future through the ways in which they choose to capture the content of the videotape. One digitizer described capturing videotapes past the end of the content on the tape, leaving a little bit

of black at the end of a digital copy so that viewers in the future can trust that all of the content recorded on the tape was transferred to digital form⁸⁷:

P3_L6 (Think Aloud): It should be reassuring to someone, a scholar or someone, using this material later, to see something at the end; that gives them some confidence that we didn't cut it off somewhere. You want to at least see things go to snow...

P3_L6 is directing attention to how a future viewer will be watching the tape and what sort of assumptions he or she will be making about the digitizers' actions based on the final seconds of the digital copy. In this case, rather than making a note indicating that all of the content was captured, P3_L6 uses the digital copy itself to show to the viewer that the entirety of the tape was captured.

Even though they have little knowledge about who specifically will use their digital files or how they will be used, through their documentary practices and digitization work, digitizers communicate evidence to the future that they carried out their work with the utmost care and focus, and that all content has been captured and all errors accounted for. Their actions and observations of visual behaviors of tapes are stored in databases and spreadsheets at their institutions, or provided to users with the files produced. As bodies in time, it is important for digitizers to orient themselves temporally and to direct their mental focus on the historical events and chemical processes that brought the archival videotapes to the present with them at the same moment in time, as well as to direct their focus to future through documentary practices, i.e. recording their actions and decision-making process in databases and documents distributed with the digital copies that they produce.

⁸⁷ This approach was not discussed by any of the other participants, suggesting that this is not a codified practice at this institution, but rather the participant's own idiosyncratic technique of communicating with the future. What is clear from his statement, however, is the participant's impulse to communicate to future users using visual content of the digital copies being produced.

By looking to the past, digitizers align themselves with a media artifact's complete lifecycle (past, present and future) and by looking to the future digitizers speculate on future users of the digital copies that they are producing. For instance, P1_L1 conceptualized working with a particular video copy as merely one moment in the "life of the work" as it moves through time:

P1_L1 (Interview): Preservation is a, it's an active thing, it's never, uhm, and it never ends. It's not like, "we digitize it, we're good." It's like "nope, that's just like another milestone in the life of this work. So, really what we're doing is we're extending, or trying to keep these works alive for as long as we can. Uhm, with the idea that they may die at some point. And so we try to mitigate that, but we are aware that that is a possibility.

This quote from P1_L1 points to an understanding that preservation is an active and ongoing process throughout the lifecycle of a document and that personal engagement with the work is limited to moving it to its next "milestone" in its history. The human lifecycle metaphor is punctuated by P1_L1's acknowledgement that works may sometimes "die," i.e. become inaccessible, indicating that preservation, while temporally oriented to the past and future, is tied to efforts in the present moment to move visual documents to their next "milestone," their next (momentarily) stable form.

9.4 Chapter Summary

In this chapter I have analyzed the sensory-cognitive, situated and affective aspects of digitizers' experiences of developing the competence to carry out the work of artisanal digital reformatting. Taking a phenomenological perspective draws the focus of analysis to understanding how digitizers train their vision and develop embodied understanding in their practice by interpreting their reflections on their personal experiences as expressed within interviews and review sessions.

In this chapter we saw (9.1) digitizers reflecting on their experiences of training their vision and developing competence in physical activities for engaging with the equipment and tapes. They described their experiences of (9.1.1) entering the field, and becoming competent and developing mastery in their practice by (9.1.2) learning to see errors and “developing an eye” and cultivating their (9.1.3) embodied judgment by engaging and coordinating senses of hearing, smell and touch with trained seeing. Digitizers also described their experiences of reducing uncertainty and the related affective dimensions of dealing with breakdowns and other unexpected or unexplainable events. Participants discussed these in terms of (9.2.1) distinguishing between good days and bad days; (9.2.2) fear of making mistakes; and (9.2.3) experiences of “bad tapes.” These aspects of participants’ reflections on their experiences suggest the central role of affective dimensions (fear, anxiety, and bad days) of their experiences in their practice, as well as the artisanal aspects of this work, i.e. dealing with unique “bad tapes” that require careful handling and attention.

Digitizers also make their actions meaningful by (9.3) orienting them in time. They do this by (9.3.1) looking to the past, in which they consider the tape as an object that moves through time and direct their minds towards the time when the tape was recorded and earlier events of copying and archiving; and (9.3.2) preparing for the future, in which they direct their intentionality towards posterior events and people, by (9.3.2.1) constructing future users and uses and (9.3.2.2) articulating archival imperatives of accountability and documentation as commitments to the future.

This analysis of digitizers’ interpretations of their experiences suggests that artisanal digital reformatting is an embodied practice that has affective dimensions and

involves participants orienting themselves temporally with the movement of videotapes from the past to the future. It takes time for digitizers to develop the expertise to confidently see errors, and this confidence comes through doing the work of digitization, which can take months or years to fully develop. Anxiety is a common affective state describe by participants and can be due to inexperience or t unexpected problems and breakdowns. This chapter offers insights into their anxieties when entering the field and learning to see errors, and the engagement of their senses in embodied judgment situated in dynamic and problematic work. Even as they establish confidence through experience and “calibrate” their vision to perceive and interpret errors, digitizers report experiencing negative affective states due to equipment breakdowns, gaps in their knowledge, and problematic tapes that produce stress and fear, and turn good days into bad days. The work can also be seen as “artisanal” in the sense that in their work, digitizers must carefully balance their preservation commitments to posterior users with the work of reconstructing the authenticity of original video recordings that are typically unique and fragile materials. The analysis in this chapter suggests that the practice of artisanal digital reformatting depends in part for its social meaning on digitizers’ abilities in training their vision and other senses and developing competence in the physical activities necessary for carrying out the work of artisanal digital reformatting. In order to engage with videotapes as material artifacts and construct meaningful practice in the present, digitizers were also seen to orient themselves temporally, i.e., developing the ability to reconstruct the past of analog originals and accommodate the needs of future users for digital copies. The practice of artisanal digital reformatting thus can be seen to depend on digitizers integrating their embodied judgment and trained vision with the decision-

making enabled by epistemic techniques and objective measurements, structuring plans of workflows and policies.

The following chapter (Chapter 10) will present an analysis of participants' reflections on their sources of knowledge. This analysis identified three zones of knowledge – *personal*, *institutional*, and *community knowledge* - across which digitizers engage with different types and carriers of knowledge, such as visual guides, tools, standards, and experts, in order to evaluate and integrate technical knowledge into their local work of artisanal digital reformatting. Exploring these zones of knowledge provides insight into the social circulation of knowledge and its role in shaping the practice of artisanal digital reformatting of analog video recordings. This provides the backdrop for the emergence of artisanal digital reformatting as a socially meaningful practice and provides insight into how its common elements develop across the different contexts of practice studied in this dissertation.

CHAPTER 10: ZONES OF KNOWLEDGE

10.0 Chapter Overview

As discussed in Chapters 8 and 9, the practice of artisanal digital reformatting relies on an array of epistemic techniques and embodied judgments, which can only be fully developed through the experiences of carrying out the actual work of digitization. In Chapter 8 we saw how digitizers enact epistemic techniques in order to coordinate their eyes and hands to observe and adjust analog video signals and Chapter 9 described the experiences of digitizers as they train their vision and how they learn to see errors in the video signal. By engaging in what I call “signal work” in the context of the material practices and epistemic techniques of artisanal digital reformatting, digitizers translate between analog signals and digital codes by manipulating the components of “the signal chain” and form knowledge about errors using their trained vision and using hands and eyes to intervene in the signal. From the analysis in Chapter 8 and 9 emerged an understanding that errors in the video signal are the key objects of knowledge. Further, digitizers must train their vision to detect and understand errors. This work is dependent on the development of embodied judgment through individual digitizers’ ongoing and situated experiences of digitization work that is carried out and made meaningful within the “occupational community” (Van Maanen and Barley, 1984) of media preservationists. For participants in my study, they acted in the context of a wider community that actively produces and sanctions new practical knowledge regarding preservation including standards and best practices intended for widespread adoption. This wider community develops and circulates knowledge applicable for both small, artisanal digital reformatting organizations, and larger organizations that may produce digitized content at

higher levels of production, working to circulate standards and expert knowledge into institutional and personal zones of knowledge. The circulation of this knowledge contributes to constructing a common practice shared by participants.

By encouraging participants to reflect on how they know what they know, three concentric zones of knowledge were identified in which the digitizers engage with different types and carriers of knowledge, such as standards and experts. These zones are positioned in decreasing relevance in relation to their context in which they carry out their *signal work*. They include: Personal knowledge (10.1), which includes everything that they may encounter immediately in their work space, and contains the array of technical activities that constitute “signal work” as a situated physical activity; institutional knowledge (10.2), which is the stocks of knowledge of their particular organization that are replicated through knowledge stored in institutional documents, people and artifacts; and community knowledge (10.3), which is referred to by participants as knowledge “out there” and “in the field,” suggesting the outside community space as opposed to the space of local knowledge – where new ideas can be contested or consensus reached in the wider occupational community of media preservationists.

Within each zone, knowledge can be added to, accepted, incorporated into digitizer’s personal knowledge, modified, contested or rejected. These zones of knowledge and knowledge carriers are visualized in Figure 14 below. While the dominant arrows in Figure 14 suggest a primarily inward flow of knowledge from the outer zones inward, there are also weaker feedback loops that emanate from the inner zones of knowledge outward. This is consistent with a theoretical perspective that is

informed by social practice theory that conceptualizes practice as both structured by existing social structures, as well as constituting and structuring them (Schatzki, 2001).⁸⁸

In the research sites analyzed in this dissertation, it was observed that local practice in artisanal digital reformatting is both shaped by community and institutional zones of knowledge, and that local practice also contributes to shaping these zones of knowledge.

The zone of personal knowledge is both a site for replicating institutional and community knowledge, and a site for creating new institutional and community knowledge.

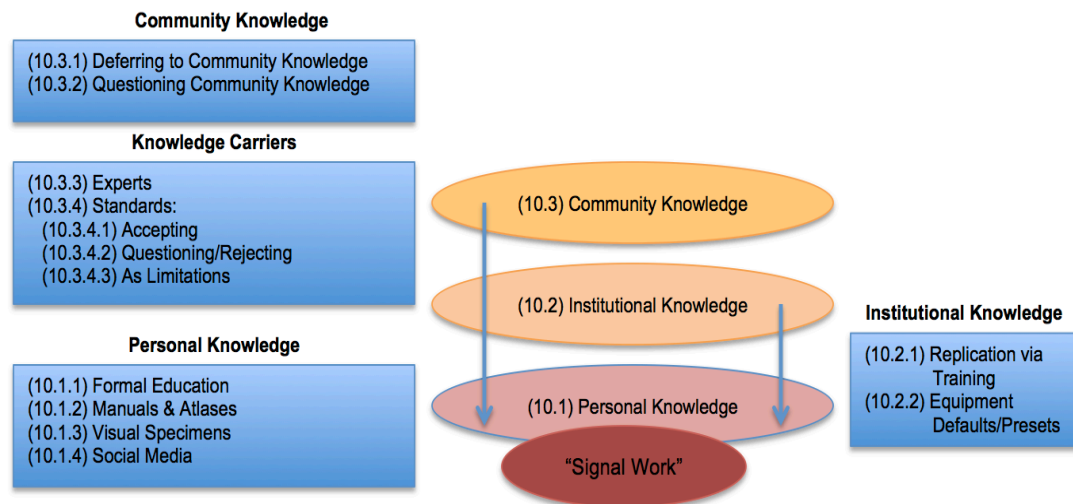


Figure 14 – Zones of Knowledge

⁸⁸ Additionally, these “zones” emerged as themes drawn from participants’ statements, and they should not be treated as monolithic categories with precisely defined boundaries. For the sake of clarity and to maintain focus in this analysis, I will focus in this chapter primarily on the centripetal movement of knowledge across these zones and its translation into local practice, relying on the perspectives of participants as the central locus of understanding in this study. In the social phenomenology of Schütz (1970), we see a similar conceptualization of human knowledge as structured as decreasing zones of relevance projected outward from the position of the knowing human subject. Schütz (1970) defines four decreasing “zones of relevance”: (1) “that part of the world within our reach which can be immediately observed by us and also at least partially dominated by us”; (2) “fields not open to our domination but mediately connected with the zone of primary relevance because, for instance, they furnish ready-made tools”; (3) “other zones which, *for the time being*, have no such connection with the interests at hand”; and (4) “zones which we suggest calling absolutely irrelevant because no possible change occurring within them would – or so we believe – influence our objective in hand” (p. 112).

As discussed in Chapters 8 and 9, digitizers draw on embodied and situated forms of knowledge, as well as practical and theoretical knowledge circulated throughout the larger community through standards and the work of experts. As they engage their bodies in routines of visual calibration and patterned looking in order to detect and diagnose errors, they problematize the distinction between mental and manual labor. The work of artisanal digital reformatting could be characterized as “technical work” and the digitizers as “technicians,” as laid out by Stephen Barley and Julian Orr in their introduction to their edited collection, *Between Craft and Science: Technical Work in U.S. Settings* (1997):

Technicians’ work is simultaneously associated with science and craft, which have historically stood on opposite sides of the divide between mental and manual labor. [...] They are expected to ensure that the ‘system’ runs and to rescue us from the complexities and ‘normal accidents’ (Perror 1984) of the technologies we create but no longer understand. (p. 14)

Digitizers appear to fit this definition of technicians, and can be seen as mediating between intellectual and technical concerns of translating between analog and digital forms of visual information. In Chapter 8, I focused on the technical work of digitization, and in Chapter 9, I focused on the experiences of the digitizers who carry out this work. In this chapter, I will discuss the social circulation of knowledge, its sources, sites and modes of engagement, in order to better understand how knowledge from the community becomes integrated into local practice.

10.1 Zone of Personal Knowledge

This section presents the analysis of participants’ statements prompted by interview questions following the observation sessions, as well as statements from their review sessions, in which they watched video clips of their workplace activities and asked to

reflect on them. Within the zone of personal knowledge, participants describe supplementing their knowledge gained through doing the work of digitization by drawing on what they learned through (10.1.1) their formal education; (10.1.2) by using manuals and atlases; (10.1.3) by using “visual specimens”; and (10.1.4) by seeking out information on social media. The content of personal knowledge is primarily oriented towards the practical knowledge that emerges through the ongoing experience doing the work, the “manual” dimension of technical work. This practical knowledge, which is open to linguistic explication, should be considered alongside the embodied and situated forms of knowledge that were discussed in Chapter 8.

10.1.1 Formal Education

Formal education plays a significant role in shaping personal knowledge of digitizers, even though it is not perceived to directly provide the practical knowledge necessary for carrying out the work of digital reformatting. In responses to the interview questions (IQ4 and IQ18),⁸⁹ participants stressed the importance of their formal education for becoming familiar with concepts and terminology related to media preservation, and for establishing the foundation for their professional identity.

One of the administrators and former digitizers, P2_L3 (see Table 2 - Characteristics of Participants for full demographic background information) emphasized the importance of getting a master’s degree in library science for moving P2_L3’s career forward and bringing earlier “amateur” digitization work up to a professional level:

P2_L3 (Interview): You know, I was hired as a guy to make dubs and ship ‘em out to people. And over time, when they decided that they needed to take this

⁸⁹ IQ4 was “What background preparation did you receive in order to do this job?” and IQ18 was “What sources of information are used to make and evaluate decisions about digitization?”

more seriously, then they, I mean, I think, just because I was here, and I guess I get along with people and what not, they're like, "Hey, do you want this job?" I'm like, "Okay." And at that point I was like, well, if I'm gonna take it more seriously... That's when I went back to grad school. And was just like, I'm taking this job more seriously. I'm gonna stop doing other things, and I'm moving full-time into this. I'll at least go, sort of, learn the principles of library science and collections and collection management, that kind of thing.

For P2_L3, who already had the technical proficiency to carry out much of this work, going back to school to get a master's degree in library science was the key to moving P2_L3's identity from a "guy [hired] to make dubs and ship 'em out," to a professional media preservationist who sets policy and manages workflows. Going back to school also symbolized a moment of committing oneself fully to this career and establishing commitments to professional imperatives, by setting aside other projects. Similarly, P1_L5 also valued formal education for grounding professional work:

P1_L5 (Interview): Yeah, I think so. I mean, but it's interesting, I don't know, I feel like that foundation, I'm very appreciative of that foundation because it is empowering, you know?

ZLK: Right, definitely. Uhm, when you started this job, were there any types of activities, or skills that you needed to practice to get confident in your position?

P1_L5: Yeah, I mean I feel like, the handling the physical part was actually the easiest part, it was handling the digital part that felt more new. I mean I had done some, uhm, because PFA [Pacific Film Archive] transfers, uhm, they do some film transfers in-house, and uhm, and of course acquire born digital stuff, so I had some experience, but I never had the experience of handling and being in charge of like a digital collection in its entirety.

P1_L5 sees formal education as establishing a foundation for knowledge, which "empowers" P1_L5 to competently make decisions in the work, building off of the earlier work of P1_L5's career. As indicated in Table 2 - Characteristics of Participants (Section 6.1.2), of the thirteen participants in this study, seven participants have degrees from professional moving image archiving programs and three participants have a Master of Library and Information Science Degree. While establishing an important foundation of

professional concepts and administrative skills upon which to base their practice, formal education was seen by participants as offering very little embodied knowledge applicable to their current work. This suggests the limitations of formal education for transmitting this type of knowledge. Formal education also may present students with “ideal” examples of properly calibrated video signals that may not reflect the types of signals that digitizers will encounter in the real world. When working with tapes that are decaying or were originally recorded by artists that did not follow broadcast standards, video signals can appear as a chaotic and outside the bounds of the “ideal” video signal. As described by P1_L2, in order to carry out the work, it is necessary to develop an understanding of problematic video signals, i.e. those that diverge from the ideal video signal:

P1_L2 (Review Session): I think that, one of the things I don't think video preservation classes are very good about is teaching people what a bad signal looks like. Conceptually. Whenever they show you what's in a signal, the vertical blanking and the back porch and all of that, it's always like these perfect lines. But... I think that, so... I've been showing people in presentations that image, but completely warped and damaged so that people understand what's- why that signal- just sort of visualize.

For P1_L2, the knowledge of the ideal video signal needs to be supplemented with as many examples of “bad” signals as possible, since those are what one is more likely to encounter when dealing with aging archival video tapes. While “ideal” video signals will be stable and within the bounds of broadcast range, “bad” signals, those often encountered with old, artist-produced tapes, will be unstable and will move in and out of broadcast range, making it difficult to adjust the signal to make it stay within the standards of broadcast television. P2_L2 explains that the practical knowledge necessary for carrying out the technical work of digitization resists being codified within a set of

rules or formal curricula because the technology is complex and practical knowledge is provisional and undergoing a constant process of elaboration and refinement:

P2_L2 (Review Session): So it's kind of, it's an ongoing thing, but I think there is the potential to rethink the type of video preservation education that occurs. I think it's most easy to say "never do this, never do that," and it's a lot harder to understand all the technologies involved and all the problems that could be caused by certain decisions made or not made.

The perceived limitations of acquiring practical knowledge through formal education can be attributed to the situated and provisional nature of practical knowledge, which is acquired through carrying out the work itself. Establishing clear guidelines for artisanal digital reformatting is seen as limiting practice because it does not account for anomalies. P3_L2 elaborates on this theme, discussing the ways in which education from a moving image archiving program was essential for forming a conceptual foundation for carrying out the work, but that it did not impart sufficient practical knowledge to produce full confidence in doing the work:

P3_L2 (Review Session): As for my actual understanding of video and video history, and how to interact with video equipment is almost entirely learned at [this organization]. A lot of it is just trial and error, and also like talking to [co-workers], reading.

[...]

I don't think I could have done, started this position, and been successful in this role if I didn't have a background in moving image archiving. But uhm..yeah. But it's video that's a whole other world. I think so much of it has to be learned hands on. You know, you're in a technical role, primarily versus you know, uhm... the technique of capturing content isn't something that is focused much in any of the archival training programs, from what I can gather. So, it wasn't at George Eastman House [P3_L2's media preservation educational program, *zlk*].

This passage identifies the limitations of formal education for the acquisition of practical knowledge necessary to support technical work and points to the important role of communicating with co-workers and referring to published texts in developing personal

knowledge. This suggests that within the zone of personal knowledge, individual learning, the replication of locally institutionalized knowledge, and the influence of community knowledge are interwoven.

10.1.2 Manuals and Atlases

Texts and documents are also knowledge carriers that bridge community knowledge and personal knowledge. These can range from equipment manuals that explain how to calibrate equipment, to published books that explain the underlying technology of video signals, to “atlases” of errors created by members of the community that offer examples of analog and digital errors. These materials encode procedural information and taxonomies of errors in order to provide reference materials for preservationists when they are carrying out the work of artisanal digital reformatting.

Equipment manuals for commercial video equipment are published texts that are written for technicians and are distributed with particular pieces of equipment, offering instructions and explanations for how to operate the equipment. Over time they can become lost or misplaced, which removes an important source of knowledge from the context of their use. Recovering these texts so that they can be referred in the course of operating the equipment and supplementing them with books that describe the underlying electronic processes of the video signal, e.g., how the color component of the video image is encoded within the phase and amplitude of the color subcarrier signal, enhances digitizers’ understanding of the technologies that they engage with on a daily basis. As P1_L2 explained:

P1_L2 (Interview): Everyone keeps telling us to read the manual. The manual of the deck. Use the manual. We've got to do more of that. I actually go back to "How Video Works", that book, a lot. I know it's very basic, but, I actually read a little bit everyday, just so that I'm constantly remember why... why I do these

things, you know? What's the technical, what's actually happening? Because sometimes you just get in this rote place, where you're just kind of doing this and doing this and doing this, because I'm supposed to. So, if I read this basic information, it keeps refreshing...

By referencing these technical manuals that explain how to operate the video equipment, this digitizer integrates knowledge developed through formal education and experience digitizing tapes with the procedural knowledge encoded in documents by the designers of the video equipment. Technical knowledge has both practical (“know-how”) and theoretical (“know-why”) dimensions of understanding to it. Digitizers acknowledge the limitations of their knowledge about the complex systems they are tasked with working with. P1_L2 discussed using manuals to overcome limitations in the practical knowledge at Site L2 concerning techniques for calibrating equipment:

ZLK (Interview): And do you calibrate the equipment, or? That you use, or?
P1_L2: Eh, we, I mean, we don't really know how. We've looked at manuals and we've tried, based on that, but, [my co-worker] is learning how to calibrate the Otari [reel to reel audio tape deck], she learned that at Stanford. I don't think we've, we don't really know how to calibrate the other machines, I don't think. We can calibrate Tektronix [Waveform monitor and vectorscope].

Being able to calibrate equipment to technical standards requires digitizers to look to manuals produced by the equipment manufacturers to supplement their existing knowledge.

10.1.3 Visual Specimens

Digitizers also build up their personal knowledge, adding to their stock of knowledge of typified errors and video phenomena, by referring to visual specimens of video errors, contained in printed or digital collections as atlases, or in the form of exemplars documented in digital video files. In building knowledge of video errors, P1_L6 explains

how visual specimens allow P1_L6 to develop a vocabulary for describing video errors, linking terms with phenomena seen during the course of carrying out the work:

P1_L6 (Interview): Yeah, I've learned a lot. And using *the AV Artifact Atlas*, like, the BVAC tools, those are great for video. You know, you learn, like, oh, why is it doing this? This is ghosting. Like, you learn certain terms, if you're not familiar with video—like “ghosting.” It kind of looks like there's a residual image of something. It's kind of like tracers.

As discussed in previous chapters, *The AV Artifact Atlas*⁹⁰ is a community-sourced collection of error “specimens” that is used as a visual guide for identifying typical errors in video signals.⁹¹ Visual references such as this are helpful for filling in gaps in knowledge for a digitizer working with an unfamiliar video format. While there is no standardized taxonomy, errors are referred and organized based on a practitioner nomenclature that comes from the field of video engineering and video preservation. Often names for errors will have multiple variants. *The A/V Artifact Atlas*, for instance, includes multiple variants of error names with visual examples (see Appendix L - Example of *A/V Artifact Atlas* Entry). Sample files, i.e., digital video files of video errors, are shared between organizations and are also used as exemplars that help in the diagnosis of signal errors by providing past examples of known errors for comparison to present, unknown errors:

P1_L3 (Review Session): We had had several tapes digitized by BVAC in the past, that were 1/2" tape[s]. And I looked at some of those video files to get an idea of how their images normally look. Like, “am I at a dropout sequence, or is it our setup that's causing more problems?” that kind of thing.”

⁹⁰ Available here: <https://bavc.github.io/avaa/>; Another collection of specimens mentioned by digitizers is the *Compendium of Image Errors in Analogue Video* (Gfeller, et al. 2013), which is a 272 page hardbound book that also contains a DVD with video clips of error specimens.

⁹¹ In the field of video engineering, visual errors and any other unwanted visual elements introduced by the signal chain are referred to as “artifacts.”

Visual specimens of errors offer important sources for developing personal knowledge, providing a way to incorporate community knowledge, “crowdsourcing” a wide range of experiences of video errors that one person might become familiar with only through a whole lifetime of carrying out digitization work. Thus, these collections of visual specimens provide digitizers with a compendium of community knowledge that can be easily integrated into the zone of personal knowledge.

10.1.4 Social Media

Social media and other online sources where community knowledge is shared are also important carriers that bring community knowledge into the zone of personal knowledge. When asked during the review session how P1_L1 keeps up with new knowledge in the community of media preservationists, P1_L1 explained:

P1_L1 (Review Session): I would say less through the organization, and more through the personal... honestly, I would say social media. Twitter and stuff, but also knowledge of the individuals doing the work.

Social media provides a means for expert knowledge to circulate quickly, and by its interactive affordances (i.e., digitizers and administrators can ask questions to the social media community), can be helpful in solving immediate concerns about a particular technical decision. As an administrator, P2_L6 explained:

P2_L6 (Interview): Yep, I use Twitter a lot. I’m not exactly a big Tweeter, but I definitely am a big consumer of data. I use it more as like, a “Oops, what about this?” you know, tool, and occasionally share things. I keep up with some folks that tweet way more than I do.

These “folks” that P2_L6 refers to are the experts in the field, and it is important to stay aware of the latest knowledge that they are communicating. Looking outside the organization and to the community helps to fill in gaps in personal knowledge. In response to interview question IQ18, participants identified social media as an important

way of acquiring personal knowledge, more so than any institutional sources of knowledge:

P1_L1 (Review Session): So, who am I talking to? Yeah. I would say less through the organization, and more through the personal... honestly, I would say social media. Twitter and stuff, but also knowledge of the individuals doing the work. So which you can find within professional organizations, but a great example is Dave Rice. Like I just know Dave Rice, everyone knows Dave Rice. And he makes his stuff freely available, and it's like, through a knowledge of him, I can gain, get knowledge and kind of awareness of other entities that are also doing other similar things. And that's primarily coming through social media. So like on twitter, he's tweeting out things, and I'm like "I didn't even know about that, I should look into that." That's where all the information is. It's just knowing who to follow.

In this quote, P1_L1 refers to the importance of a particular expert in the field, “Dave Rice” (a moving image archivist working at the City University of New York), in carrying the latest knowledge in the field and disseminating it widely. Keeping personal knowledge current and synchronized with community knowledge is ensured by staying attuned to new developments in community knowledge being circulated via social media platforms. This is dependent on successfully identifying the appropriate experts in the field and following their social media feeds. Digitizers can monitor these communication channels for new pieces of knowledge that they might integrate into their local practice, as well as fill in gaps in their understanding. These carriers of expert knowledge complement participants’ foundational formal education and the illustrative support provided by visual specimens, helping to bridge zones of community knowledge and personal knowledge.

10.2 Zone of Institutional Knowledge

While much of the knowledge necessary for carrying out the work of digital reformatting is developed through digitizers’ own efforts to “develop an eye” for interpreting video

signals and actively reading and learning about emerging knowledge in the field, this work is also structured in many ways by institutional knowledge. Institutional knowledge in this context refers to the stocks of knowledge stored in the form of the knowledge of institutional actors, documents and artifacts within the particular organizational context. In each digitization in which digitizers work, their development of personal knowledge is shaped by the pre-existing institutional knowledge in place, which is replicated and put into practice through a process of “learning the ropes” and becoming familiar with the processes and expectations associated with how work should be carried out in that institution. This process involves managers or existing staff members showing new workers how to do certain tasks and monitoring and correcting their actions as new workers learn workflows and policies. This replicates institutional knowledge sedimented in guidelines and standards adopted by the institution and interpreted by institutional actors who train new workers, encouraging them to mimic the actions of experienced digitizers in order to learn the “official” institutionally-sanctioned techniques of digitization.

Institutional knowledge is also brought into practice through pre-sets and default settings that shape the ways in which technical systems function. The following subsections will consider (10.2.1) the replication of institutional knowledge and (10.2.2) its materialization through the establishment of presets and default settings that constrain the functioning of digitization equipment to particular pre-defined operations.

10.2.1 Replication of Institutional Knowledge

Digitizers are introduced to institutional knowledge at the time when they join the organization and learn to do their work in their particular work site. For instance, when

first starting at Site L2, P3_L2 described having to be taught by another digitizer who had already been working there about how each model of TBC (time base corrector) affected the video signal:

P3_L2 (Interview): You really have to have a fairly intimate knowledge of your decks, of your TBCs, the ways in which... Like, when I first started, Ben would say, "Oh, DVC 4 is great for black-and-white. And DVC 3 is..." And I was like, "There is no way that is true." I absolutely was like, "I don't think so." But now I'm totally sold.

Institutional knowledge is replicated through transmission from existing workers to new workers, shaping how knowledge enters the zone of personal knowledge. More experienced workers begin by showing new workers how to do the work, encouraging imitation:

P1_L6 (Review Session): Well, I guess I had someone when I first started, someone showed me what to do. And I guess just trusting that. uhm... of course, I have heard differing opinions, and, but I really don't have any fear as to like voltage, based on watching other people do it, and not get shocked or electrocuted. Uhm... and, now, I do sort of wonder whether we need to be cleaning the heads after every use, which there's arguments that it would actually be better to clean it less to prevent the heads from deteriorating faster.

After they are shown how to carry out the work of digitization they are monitored and given corrective feedback (novices will be asked to re-do the work, with some suggestions for improvement) if they miss a step or do not complete a task properly:

P3_L2 (Review Session): I think when I first started working, maybe because I wasn't used to working with decks, because I was so used to working with film, that I wasn't really, I wasn't as aware of every area that could become dirty. So, there was maybe one or two instances where I thought I'd cleaned everything, and then once [P1_L2] came in and would be like "oh, well, that roller still has dirt on it."

After experienced workers begin to trust that the new workers are beginning to do the work properly, they will stop monitoring them and will leave them to do their work unsupervised. At this point new workers internalize the watchful eye of the experienced

worker, and begin self-monitoring. If they feel like they have done something inconsistent with the established way of doing things, they will stop their work and go find an experienced worker to check any decisions that they are unsure of. P3_L2 goes on to explain:

P3_L2 (Review Session): Like certainly when I started here, I'd say for the first three months I would still consistently ask for advice on my levels in case I had made a mistake. But again, it just takes a second for a staff member to tell you if you're right or wrong. So yeah, I think maybe after the first few weeks it would be fine, let them make their decision, but be sure that you're checking on their work. And also when you're QCing [quality control, *added zlk*], if there is... That's the whole point of our QC, is that we should be capturing any major, you know, errors, or you know, poor decisions that were made, essentially. So, I think that's one of the good benefits of QC is that even if a new staff member maybe made the wrong call, then a more experienced staff member will catch that before the file went out to the clients.

In this example, the use of a QC (Quality Control) stage in the workflow gives more experienced workers an opportunity to observe (and correct, if necessary) the results of the decision-making and technical skills of new workers. They defer to how things are already being done because existing institutional knowledge is given authority by the fact that it predated their arrival at the organization, and is thus seen as “the way things are done”:

ZLK (Interview): How did you learn how to do that sort of quality control in your current position?

P3_L5: Part of it was what was already being done here when I came on.

P3_L5 describes adopting the standards already in place when joining the institution. The original source of the institutional knowledge can sometimes be identified, particularly if the individual or group is still working for the institution. When asked about decision-making in terms of the adoption of standards at Site L3 (IQ14, see Appendix D – Interview Protocol), P1_L3 explained that they were put in place by the previous person

who carried out the digitization work, P2_L3, who has subsequently become the administrator for the project: “So, you should ask [P2_L3] why [P2_L3] selected these standards. I have tried to stick with continuity.” In this example, we can see how institutional knowledge is replicated by new workers trying to maintain continuity and replicate established methods of doing things in their own work.

In other institutions, the origin of local guidelines is unknown, having been handed down through multiple generations of workers, as suggested by P3_L5: “I was not around when our standards were origin[ally set up]... like the technical specs we created, were originally setup.” P2_L2, as well, suggests that key elements of institutional knowledge are passed down: “I mean, some of it was passed down from previous people, kind of, QC procedures.” Quality Control procedures are typically encoded in checklists or workflow software that are used by participants to structure the Quality Control procedures and make sure that all aspects of a digital copy are evaluated (including whether the audio is sync, any visual errors that have not been corrected or documented, proper aspect ratio, etc.). These checklists and workflow program becoming structuring elements of activity in the preservation lab, institutionalizing knowledge through incorporation into these aspects of the built environment that regulate the actions of digitizers working in the space. These examples suggest that personal knowledge is not constructed *ex nihilo*, but builds on knowledge that is handed down from one generation of workers to the next.

10.2.2 Equipment Presets and Defaults

The structuring of the built environment encodes institutional knowledge for the present and future generations of digitizers, because once defaults and presets become established

they may be difficult to change or will become accepted unquestioning by new workers as part of the digitization lab's infrastructure.⁹² The work of digitization can be shaped by the presets and defaults built into the signal chain and the digital software. By encoding institutionalized knowledge within the controls of the components of the signal chain as "defaults," they place constraints on the possibility for human intervention in the functioning of the system. By limiting decision-making in routine activities through constraining how the systems can function, less training or oversight is necessary for workers, since they can make fewer choices and act in a more limited range, which appears to run counter to artisanal imperatives. This use of presets resembles a form of *deskilling* in which the necessary mental skills of analysis and decision-making are shifted from the worker to the machine (Orr, 1996). In this case, this is accomplished through the restriction of digitizer action to the selection of a limited set of dropdown menus in software settings, or a limited range of adjustments on the video hardware. These presets may have been put in place by earlier digitizers or administrators, or digitizers themselves may add them. In the case of one site, L7, the TBC (time base corrector), an important tool for intervening in the video signal was completely black-boxed, having all of its controls (except for audio adjustment) locked to its preset levels. When asked if it was necessary to make a lot of adjustments to the equipment during digitization, P1_L7 explained:

P1_L7 (Interview): In terms of the actual stuff, like the hardware, not too much. It's pretty well set. I mean, you saw the TBC is just like a black box.

⁹² Susan Leigh Star and Karen Ruhleder (1996) identify two relevant attributes of infrastructure, among others, that suggest that presets and defaults may be difficult to change: Infrastructure becomes "transparent" with use and is often "learned as part of membership" when joining a particular community of practice (p. 113). This suggests that decisions made about how the physical space and technological components of a digitization lab are configured may develop some degree of inertia and resist change over time.

ZLK: Yeah, you don't have to, like...

P1_L7: It's got one set of inputs in the front. It's got, whatever, three outputs in the back.

The encoding of human knowledge into presets and default settings does have the benefit of reducing the cognitive load of routine-decision making, and helps to ensure easily-made mistakes in basic adjustments are not made. Furthermore, these presets are linked to preservation values of authenticity and consistency: "Uhm ... well we have our defaults set ahead of time, so there shouldn't be too much manipulation" (P1_L6). Using defaults and presets within the technological configuration limits the need for human intervention, reducing the risks of improperly manipulating the signal/image. This encodes institutional knowledge into the technical infrastructure and reduces the chances of human error or forgetfulness:

P1_L7 (Review Session): You setup something to try to make it simple so that you can, uh, you can adapt to the sort of laziness and forgetfulness of human nature, but we kind of, just as moss and mold will grow if you don't keep up with things, that kind of entropy enters into it as well I find.

Shaping material forms in order to shape practice fits with a practice theory perspective that acknowledges that the perceived affordances of a technology delimit what actions are possible with it. Andrew Cox explains how "man-made and other objects' uses or affordances are central to concrete practices" and that "[t]hey have a role in shaping practices, because of the way they prefigure what can be done" (2012, p. 179). Presets and defaults ensure that certain forms of knowledge cannot be forgotten, ignored or circumvented in practice. Digitizers are constrained by these configurations of the technical system, which they may put into place themselves, or have established by administrators or former digitizers. In effect, while creating a preset for a capture file format that has become the agreed specification for the entire organization can have

benefits to workflow efficiency, however, it also is a step towards automation and the deskilling of labor.

The nature of artisanal digital reformatting is in tension with automation and deskilling for mass digitization work, because each tape may need to be treated in very different ways. P1_L3 points out that because the tapes being worked with were produced by artists, each is very unique and needs to be treated on a case-by-case basis:

P1_L3 (Interview): It's different from doing a mass digitization situation, because every tape was so different. Every recording environment was different for every tape, for every artist. And so it's very, it's a very per-tape situation, even when the standard of the video was...*[trails off]*

By distinguishing this work from the work of “mass digitization,” P1_L3 is suggesting that the work of artisanal digital reformatting requires that special attention be paid to the unique properties of each tape. This indicates that there is limit to what can be encoded in the form of presets and defaults in this context.

10.3 Zone of Community Knowledge

The community consists of other media preservationists, and members of the archival community more generally. In their interviews, participants used the phrase “the community” in two distinct, but inter-related ways. First, they referred to “the community” as constituted by other preservationists working in other preservation institutions who are also doing the work of digital reformatting. For instance, in response to IQ13 (see Appendix D – Interview Protocol) P1_L1 discussed looking for standards and guidelines from other preservationists: “But also, just like, kind of like the community. Because there's best practices, but you just talk to everyone, you're like ‘what do you do?’” This sense of “the community” refers to other preservationists in the field whose opinions are well respected, as suggested by P3_L2: “other members of the

archival community that I know from different places, certainly people whose opinions I would respect.” These examples suggest that “the community” for participants includes their peers in other institutions who they consider also as “experts” in the sense that their opinions are well respected and trustworthy.

In addition, participants also identified “the community” with the more general group of archival practitioners, who they may or may not know personally and are members of professional archival organizations, such as the Association of Moving Image Archivists (AMIA). For instance, P1_L5 described the importance of maintaining connections to the community:

P1_L5 (Interview): I go to AMIA when I can. Uhm... though I don't know if that's really more... that's not really so much about practice as like, uhm, it's more just about like feeling more involved, more connected with the community, which I think is really important.

In this example, P1_L5 equates the professional organization AMIA with the community. This suggests that “the community” refers to the general field of other professional media preservationists who attend that conference. Participants also identified “the community” with large institutions doing preservation work.

From the perspective of participants, community knowledge is seen as both the source of the latest, legitimized knowledge applicable to their practice, as well as a site of contestation. Community “consensus” is provisional, open to evaluation and challenge, and also an important stabilizing force that establishes a stock of accepted knowledge that can be translated into local practice. Digitizers rely on community knowledge to offer legitimacy for particular decisions they make in their work, while at the same time they offer critical resistance to the community, questioning attempts to codify knowledge for action that contradicts their own experiences of doing the work of digitization.

10.3.1 Deferring to Community Knowledge

In their interviews, digitizers and administrators both stressed the importance of monitoring the latest knowledge being developed in the community. Since much of the practical knowledge about the best types of digital files to make and how to make them is still developing, it is seen as important to follow the current consensus. Administrator P2_L7 points to this constant flux of knowledge as a key motivator for monitoring ongoing changes in community knowledge:

P2_L7 (Interview): Of course, the methods for displaying the videos online is constantly changing. Right now it's H264 mp4, but in the future I'm sure there will be a different codec and wrap that will be utilized, and we'll have to transition to that. So, yeah, I guess just colleagues and professional organizations. **I try to just follow the discussion to make sure that we're a part of it** [*emphasis added, zlk*].

In a time of changing knowledge around digital file formats for encoding digitized video signals, P2_L7 perceives a real risk of losing track of what the current consensus is about digital file formats acceptable for preserving analog video recordings. P2_L7 stresses the need to monitor changes in the field so that the work being conducted at the institution stays in sync with community consensus in the field.

Digitizers and administrators acknowledge that there is a consensus of legitimized knowledge within the community and they think about their own local practice in terms of knowledge acknowledged as generally accepted in the community. For instance, administrator P2_L3 deferred to what was accepted knowledge in the community to legitimize how workers in the lab at Site L3 prioritized making digital copies over conservation treatments for the original, physical videotapes:⁹³

⁹³ Prioritizing the “essence” or content, rather than the “carrier” or physical tape, in the case of video recordings has been a controversial topic in the field of media preservation. The growing consensus appears

P2_L3 (Interview): You know, the carrier of the information is not the important thing, necessarily, to preserve, like to keep the videotape itself. You know, it's still playable into the future, but if you can get the information off of it in a reasonable way, and have it viewable on modern technologies, then I think that counts. **And I think that's a relatively widely-held view amongst people that work with video and stuff** [*emphasis added, zlk*].

Deferring to what is accepted knowledge in the community provides them with guidance and a rationale for local activities. It provides digitizers with the means to feel confident that their work is conforming to knowledge that is widely accepted by other members of their occupational community.

Standards also play a role in carrying knowledge from the community zone of knowledge into institutional and personal zones. They are created by institutions, circulate across the community, and become potentially adopted by other institutions and integrated into local practice. Just as they may translate knowledge into local practice, standards play an important role in helping to promote consistency in work processes across locations and legitimizing local choices. P3_L2 stresses the role that standards play in translating community knowledge into local practice:

P3_L2 (Interview): I believe very strongly in sticking closely to what the general consensus in the archival world is about how we are going to maintain our files and produce our files, and transfer footage. I certainly don't think that after a year out of school that I know any better than anyone else, you know? Not that there isn't always room for change, obviously, when necessary. **But standardization is the only way we can ensure that all of our files will be accessible in the same way, and be produced to the same quality** [*emphasis added, zlk*].

The application of standards ensures uniformity and consistency in the quality of the digital copies that are being produced. Following standards and other forms of knowledge endorsed by the community also enables digitizers to feel confident that they are carrying

to be that the physical tape does not have artifactual value in the same way that film does, and that once the content is captured in digital form, the original physical tape becomes less of a concern for preservation.

out their work in a way that is sanctioned by the wider preservation field and that their actions conform to what other organizations are presently doing. Quality control expert, P3_L5 suggests: “So, I just think it's more likely that preservation will be successful if we're using the, what is learned from other organizations, or doing things in a similar way.” Following community knowledge, particularly as codified in standards, is seen as a means of making digitization processes and products similar across organizations,⁹⁴ which is seen to enhance the likelihood that preservation, seen as a multi-organizational, community-wide effort, will be collectively successful. Deferring to community knowledge also makes decision-making easier. Administrators and digitizers acknowledge the usefulness of deferring to community knowledge when forming policies and guidelines for their own digitization labs. In making decisions about what file formats to use, administrator P2_L3 explained how they defer to decisions that have been accepted by the community:

P2_L3 (Interview): As far as making decisions like what file format is an archival quality file, I mean, that's pretty much established, and 10-bit uncompressed is what everybody says to use. And so that's what we started using and have used [*emphasis added, zlk*].

By basing decisions on community consensus, local decisions can be made with less consideration and greater certainty, with the work of researching and testing the precise settings for digital copies deferred to the work of leading experts and organizations in the community. Decisions related to artisanal digital reformatting that may reach community consensus include the selection of: archival file formats; methods of adjusting video signals within particular guidelines; how and when to clean tapes and machine; which

⁹⁴ This process resembles the concept found in organizational theory of *mimetic isomorphism* (DiMaggio and Powell, 1983), by which organizations tend to imitate other organizations because they believe doing so will be beneficial.

calibration tapes and signals to use; and which tools and software to use for evaluating digital copies in quality control.

In addition to offering rationale and legitimacy to local action and deferring the task of making decisions to community consensus, the expertise of the community can also help to fill in gaps in knowledge about complex processes that may be difficult to implement locally due to limitations in local resources. Digitizer P2_L2 describes the use of the technique of “baking” tapes⁹⁵ at Site L2:

P2_L2 (Interview): We do a lot of baking, particularly for the oldest and stickiest of formats. Those... The specifics of our baking procedures are, you know, kind of changing a little bit. They’ve changed since I’ve been here, **based upon insight that we’ve received from other people working in the field.** [*emphasis added, zlk*]

Local practice benefits from the collective knowledge of the community, and by deferring to this knowledge, digitizers and administrators can adopt decisions already fully researched, shaping how their work is conducted and developing trust that their actions based on those decisions will conform to what is generally accepted in the wider occupational community.

10.3.2 Questioning Community Knowledge

Even as deferring to community knowledge provides an important means for reducing the difficulty and uncertainty associated with developing *in situ* practical knowledge for dealing with complex sociotechnical systems, community knowledge can often times be seen as a barrier to local practice. In these cases, digitizers and administrators may question community knowledge, particularly in cases where it is carried by experts who

⁹⁵ “Baking” refers to placing magnetic tapes (video or audio) in warm, dry environments (such as inside a food dehydrator or a laboratory oven) for extended periods of time (from a day to several days) to make the tapes less sticky and prone to losing magnetic particles during playback.

may not be entirely trusted, and they will subsequently reject it if it does not appear to fit with their local experiences. This articulates tensions between local and global, i.e. “community,” levels of knowledge in the preservation community.

For example, at site L6, digitizers expressed concern over whether they were cleaning their VTRs in a way that conformed to community knowledge. They decided that they would clean their VTRs less frequently and see for themselves how the quality of the transfers changed because they were concerned that cleaning too frequently might damage the delicate tape heads:

P3_L6 (Review Session): ‘Cause I don't clean them after every time we do a tape, that's excessive and that risks damage, but **I don't know if you'd ever get anybody, you know, agreeing completely on how often you should clean the heads or not, and how to do it. That's another thing we all have to learn for ourselves, and look at the books and the videos.** [*emphasis added, zlk*]

In cases such as this, in which practical knowledge is not well established or can be contested, digitizers describe reverting back to drawing knowledge from their own experiences. In this example, concern over damage to the tape heads motivates digitizers to rethink community knowledge by doing their own analysis of their work practices and produce their own guidelines, verifiable through their own experiences of carrying out the actual work. This suggests that existing knowledge circulating in community knowledge may not translate well into local sites of artisanal digital reformatting, in which is characterized by a close engagement with the materiality of the equipment and the tapes that depends on the establishment of embodied knowledge through experience.

There is some variability across research sites in terms of how strongly each defers to or rejects community knowledge. Some sites are clearly more inclined to questioning and rejecting community knowledge. For example, participants at L2

questioned community in their interviews more so than those at L5. At site L2, P1_L2 explained that they “had moved away from the standard wisdom of watching a little bit at the beginning, a little bit in the middle, a little bit at the end.” At site L5, they still carried out a quality control process by doing this visual scanning through excerpts from the beginning, middle and end of the final digital files, which had been generally accepted by the community. When asked to explain what techniques were being applied in the quality control process, P3_L5 explained: “we watch a minute and a half at the beginning, middle, and end.” We can also see different degrees of deference to community knowledge in the case of selecting digital file formats for encoding the final digital copy. Participants at site L3 had voiced their commitment to following the consensus on what types of digital formats to use for archival master files. P1_L3 linked the rationale of choosing “uncompressed” as their video file format: “And so we’re trying to aim for continuity, but uncompressed is still widely accepted.” P2_L3 also explained that at Site L3, they adopted the “uncompressed” format because of community adoption. These statements suggest how community knowledge, if perceived by local preservationists as representing a widespread consensus on a particular file format or digitization process, can become institutionalized and enacted within local practice. Other digitizers may question the existing community consensus. For instance, at site L1, P1_L1 cast doubt on even these established standards for digital files:

P1_L1 (Interview): You know with file formats, **everyone** was like “uncompressed 10-bit, QuickTime.” But as we’ve kind of dug into file formats, uhm, it’s like “is that still the wise-- and mean like, why do we make that decision?”

[...]

Yeah, I feel like **everyone** is “10 bit uncompressed”, but then do you need 10-bit? 8-bit could be sufficient, because there is a lot equipment that are inside video decks that is 8-bit, so in a way you're just interpolating those 10 bits. **In certain cases, I should say.** [*emphasis added, zlk*]

In this quote, P1_L1 uses the word “everyone” to refer to the accepted knowledge in the field about digitization standards, and points out that this knowledge is only applicable in some cases. Questioning community consensus about established knowledge suggests that this consensus is provisional and that new knowledge may emerge from insights drawn from local practice and which could reshape community knowledge if encoded in locally-produced standards documents or discussed at professional conferences. When knowledge generated through experience at the local level begins to contradict the “received wisdom” offered by the community, tensions can develop, and as local work diverges from accepted practice, and community consensus on the practice may change to accommodate it.

Tensions between local practice and community knowledge can also develop around experts and the knowledge they carry. Experts are often important carriers for bringing community knowledge into local practice, as digitizers seek them out, contacting them via social media, visiting experts’ own digitization labs, or having them visit the digitizer’s digitization lab. At the same time, participants also reported that they could also become seen as untrustworthy, which may inspire the rejection of the knowledge they are trying to disseminate. Trust in experts and in community knowledge more generally, can be eroded if the advice of experts is seen to conflict with the local experiences of digital reformatting. In one case, administrator P2_L6 recalled an unpleasant experience at a professional conference in which P2_L6 felt that a group of

experts was trying to use their knowledge to undermine P2_L6's own local guidelines that had been developed based on local needs at Site L6:

P2_L6 (Interview): They, they did that to me at lunch in Portland, at AMIA. I was like, "So right now we're creating this, this, this. We're also making a [inaudible] AVI file." He's like, "First of all, why are you making an AVI file?" And everybody laughs. And I'm like, "Well, I'm at a library. I mean, would I hand an MOV to, you know, the curator of Southeast Asia programs on her PC? I can't guarantee that it's gonna play if it's an MOV. So, yeah, I mean, it's a PC-dominated world. So, AVI is a better insurance program, and if have the ability to put a script in it, why not?" Yeah, so... He was like, "Okay, I was just giving you a hard time."

This experience showed how trust in experts could be diminished if local knowledge is being challenged as valid, and instead "expertise" is imposed without consideration of local conditions. The tension between experts and local practitioners can produce passionate expressions of distrust. Experts are validated as "experts" by the trust they earn through their history of contributions to knowledge in the field or through examination of their own digital reformatting work. P3_L6, for instance, described developing trust for other digitizers' opinions by personally observing the work being conducted at their own labs:

ZLK (Review Session): What helps you to trust people and their opinions?

P3_L6: Uhm, I visit places, and talk to them. I see, you know, there's a certain amount of it is, well, how much work do they really do?

One digitizer interviewed, P1_L2 was highly distrustful of experts as carriers of community knowledge because they were perceived by P1_L2 to be offering knowledge that was not sufficiently evaluated by the community for adoption into local contexts:

P1_L2 (Interview): The more I learn myself, and the more I have these experiences, I'm kind of like, I can kind of see through the bullshit of other, of other so-called experts, uh better. Not that they're not experts, but I can kind of see when they're... I'm more confident in combatting some tried and true standards and best practices.

This passionate statement rejecting expert knowledge was not typical of the responses given in the interviews, but it does provide a compelling example of some of the tensions that may develop between the experiences of digitizers doing the work of digital reformatting and the experts promoting community knowledge. When the advice of experts conflicts with what experience has shown at the local level, digitizers can lose trust in the experts.⁹⁶ In another example of how tensions can develop between experts and local experience, P2_L2 even attributed the lack of common standards for digital files to the work of experts promoting complex digitization guidelines that smaller institutions could not practically implement:

P2_L2 (Interview): I think that it's both fascinating and frustrating that there hasn't been consensus in the archival community for a particular method of encoding and wrapping files. I wouldn't want the Library of Congress to dictate what everyone else should do. And they never have said that they are. But when James Snyder [Senior Systems Administrator at the National Audiovisual Conservation Center, *zlk*] gets up, and even if he says, "This is just for us," and then proposes this method of encoding and wrapping files that really makes no sense for everyone else, um, it's kind of bullshit.

The use of profane language suggests the affective response that experts can generate in digitizers who feel that their experiences drawn from their local practice are not being considered when developing expert recommendations and standards. In the process, they begin to doubt the expert, and by extension the community knowledge that the expert claims to be disseminating. These examples show how expert knowledge can be rejected if its carrier is not trusted or if the knowledge is seen to conflict with the experiences of digitizers doing the work "in the trenches." This shows how the position of experts, even if determined in part by their status as a professional authority (in this case, the power of

⁹⁶ In this case, the underlying cause of the conflict articulated by P1_L2 was not identified. Based on earlier statements concerning a bad experience with an expert at an earlier time, the loss of trust may be attributable to these interpersonal conflicts.

the expert stems from his senior role at a large government archive), can be questioned if their recommendations diverge significantly from the perceived realities of digitizers doing the actual work of digitization in smaller institutions. Given the importance of personal knowledge developed through local, situated experience within the practice of artisanal digital reformatting, it is not surprising that expert knowledge can be questioned if that knowledge is perceived by digitizers to diverge from what they know to be true through carrying out their work on a daily basis. This suggests that in the practice of artisanal digital reformatting, experts and expert knowledge is provisional and open to contestation within the economies of local best practices. Thus, questioning and rejecting, on one hand, and deferring to and accepting, on the other, are the two major orientations that digitizers and administrators expressed taking when they engage with knowledge in the community zone of knowledge.

In the following sections, experts (10.3.3) and standards (10.3.4) will be explored as important carriers of community knowledge that assist in its dissemination and translation across zones of institutional and personal knowledge.

10.3.3 Carriers of Knowledge: Experts

Institutional knowledge is also constructed through integrating new technical knowledge of the community carried into the institution by experts. Getting advice from experts is an important way in which community knowledge becomes integrated into practice. The subject position of “expert” is constructed based on their ability to fill in perceived gaps in digitizers’ personal knowledge, and their position of authority as experts is supported by their intimate understanding of the materiality of complex technical processes. Experts can be seen as carriers that bring the latest knowledge from the community into particular

organizational contexts, and experts are often involved in the initial formation of the digitization lab, as P2_L7 describes: “When we started, we were consulting pretty heavily with another trained archivist, Carolyn Faber, and she kind of taught me everything I knew.” In addition, experts are asked from time-to-time by institutional actors to solve technical problems that go beyond available institutional knowledge. P1_L2 explained how in Site L2 they needed to bring in an expert to deal with an electrical problem that was causing noise in the video signal: “We ended up having to get, I mean Erik came in and like, solved this whole ground loop thing.” Digitizers and administrators trust experts to bring accepted technical knowledge that has been developed through systematic assessment. The expert’s reputation as a trusted carrier of knowledge is sanctioned by the community, and enacted through their displays of in-depth knowledge about technical procedures. For instance, in the case of describing the lab’s guidelines for baking tapes in order to briefly stabilize their decay, P2_L2 discusses how the expert knowledge was delivered as a “long speech” about scientific concepts outside of the everyday discourse of the digitization lab, such as “polymerization”:

P2_L2 (Interview): Yeah, so we bake, typically it’s 55 degrees Centigrade—Celsius sorry—for, I think, 24 hours. So, Peter Brothers, who I think is, like, probably the best person on this subject, bakes, I think, closer to 51 for 72 hours. And he gave me a long speech one time about, you know, the breakdown of those molecules and the reforming into polymers, different types of chains, you know, and how that can only really occur in that 48- to 72-hour period.

This expert is known in the community as having special expertise in baking magnetic tapes as an effective conservation technique, and by displaying his precise and technical knowledge grounded in empirical research, he encourages trust in his recommendations. This knowledge emerges from the expert’s claims to ongoing experience with the technology and extensive research on the behavior of tapes under different storage

conditions. Similarly, the technician who fixes video decks and measurement equipment at L2 also has specialized knowledge that has been developed through many years of working directly with the internal components of video equipment, as explained by P1_L2: “When we went to Ken Zinns, he said ‘when you see that slope in the signal, in the waveform, that says to me that you're capacitors are burning out, they're going.’” The expert, “Ken Zinns” mentioned in this quote appears to occupy a different zone of knowledge from the digitizer relating the story: the expert possesses special technical knowledge about the inner workings of the video equipment, while the digitizer possesses the preservation knowledge for producing digital copies within the institutional constraints of Site L2. Experts are seen to have a special understanding of the equipment that abductively emerges over time from observed patterns of equipment behaviors.

At the same time, while digitizers typically trust what experts tell them, they also want to bring that advice into their own workplace and see if the efficacy of what the experts suggest is supported when put it into practice within the context of their own workplace. Even with expert knowledge communicated by trusted experts, digitizers still want to confirm the veracity of their claims through translation into local practice and seeing for themselves.

P3_L6 (Review Session): And there are people who have claimed, “yeah, I have a lot of experience with this, and I can make you a very firm recommendation on how to do it.” Which is great to hear from people I trust, or who have been doing good work, but at the same time we all want to feel like we've confirmed that with our own experience, we eventually do.

P3_L6 expresses feeling encouraged by the confident expressions of experts, but that this is always tempered by concern for seeing how their suggestions will play out in the context of local work. By translating expert knowledge into their own situated and

embodied knowledge, digitizers can see for themselves if new techniques will benefit their work or not. In this sense, the “truthfulness” of expert knowledge is dependent on how it fits into digitizers’ experiences of signal work. Before expert knowledge can be integrated into personal knowledge, it must be evaluated through real-world application.

From these examples, it is clear that experts can act as important carriers of knowledge that helps to circulate knowledge from the wider preservation field into institutional contexts. Once experts carry knowledge into an institutional context, local practitioners can translate it into personal knowledge at the site of signal work, which then can become institutionalized when it is communicated to other staff members, written in documents, or encoded in software presets or defaults. This shows how new technical knowledge can circulate across zones of community, institutional and personal knowledge.

10.3.4 Knowledge Carriers: Standards

Standards are also carriers that bridge zones of knowledge. Standards can be understood very broadly as codified forms of knowledge that specify products and processes (Fuller, 2007), and are intended to be put into practice outside of the initial site of creation. From this definition, standards in the context of artisanal digital reformatting can be seen to run the gamut from formal standards developed by international organizations (such as ISO), to local standards posted on organizational websites for other organizations to adopt. In this research, standards crop in a variety of places: As documents specifying digitization processes and products, which circulate throughout the workspace (in the case of P2_L6, who kept a bound copy of IASA guidelines TC-04 on the desk); as binders of guidelines in lab settings that digitizers can refer to as they need to throughout their work (as in the

digitization lab in Site L6); enacted within the micropractices of digitizers as they adjust video signals to match the guidelines specified by SMPTE (Society for Motion Picture and Television Engineers); and local workflow guidelines that structure the order of work tasks, and are often encoded into spreadsheets, databases or workflow software.

The key interest for thinking about the role of standards in the context of this dissertation research is in terms of how they act as knowledge carriers that translate legitimized and codified knowledge from the zone of community knowledge into a local site of practice. Standards that are endorsed by the community are evaluated by institutional actors and may be adopted by an organization and embedded in its institutional infrastructure through formal adoption. In this sense, standards bridge community knowledge and institutional knowledge. From the perspectives of digitizers, standards can inspire controversy if they are perceived as not fitting with local conditions and interfering with existing routines, or alternatively, they can be celebrated as key agents for establishing trustworthiness and consistency in their work. In the following sections I will reflect on digitizers' descriptions of (10.3.4.1) accepting standards and integrating them into their practice; (10.3.4.2) questioning and rejecting standards; and (10.3.4.3) being limited by standards in carrying out their work.

10.3.4.1 Accepting Standards

Standards may be used to encode complex technical knowledge into documents, and the documents can be referred to by shortened names that digitizers and administrators use to express their allegiance to those documents (for a complete list of standards and best practices documents identified at each site, see Appendix J). Institutional actors can thus use the names of standards, or their authoring agency, as markers of institutional

legitimacy, i.e. the organization in question is the type of organization that follows generally agreed upon standards. For instance when asked what standards they follow in the lab at Site L7, administrator P2_L7 explained “The Library of Congress and the National Archives publish digitization guidelines, so we, sort of, follow those,” and when asked the same question, administrator P2_L6, stated: “IASA specs. I read TC-04.” These are examples of standards that are developed by large, authoritative organizations (the Library of Congress in the first case, and the International Association of Sound and Audiovisual Archives, IASA, in the second case), which enable participants to describe their allegiance to authoritative community knowledge through condensed statements. By referring to Library of Congress or IASA standards, they can draw on an entire body of research and technical knowledge and absorb it into their claims to knowledge. Stating that they follow these standards can thus confer authoritativeness and trustworthiness onto their institutional context. Standards are not just “named,” but also reside as physical texts within the workspace of the digitization lab. In L6, digitizers there showed me a thick binder of what they called their “standards,” which consisted of photocopies of a variety of different guidelines and specifications produced by a range of organizations in the media preservation community (see Appendix J for a complete list of documents identified at each site). Digitizer P1_L6 explained how members of the lab at Site L6 collect new guidelines when traveling to conferences or visiting other labs:

P1_L6 (Interview): I think, when it comes to magnetic media, there’s a Specs Brothers [report]... And when we get back to the office [from conferences or visiting other labs], we put together, we collated all these things, especially about video, as far as how to handle it, how to assess its condition, how to, the care and maintenance of decks. Those types of standards.

Standards are used to ensure that their work is producing the highest quality digital copies

as possible and that they are following the current, community-approved methods. They act as reference guides that bring community-sanctioned knowledge into local practice. Digitizer P3_L2, working at site L2, pointed out that they follow the standards of site L5: “You know, we go by [L5’s] standards, and we certainly try to produce the best, you know, the best possible files that we can.” Standards are valued for the ability to ensure consistency in the ways that digitizers carry out their work from project to project, and are used as evidence that they are conforming to what is generally accepted in the community.

10.3.4.2 Questioning and Rejecting Standards

At the same time, digitizers can be very critical of standards if they find that the standards are becoming a hindrance to their work. They resist adopting standards blindly or treating them as one-size-fits-all solutions that can be applied to all tapes and all collections. For instance, P1_L1 pointed out that there needs to be a balance between the constraints imposed by standards and the needs of local practice:

P1_L1 (Interview): So you have to kind of balance like the standardization in your work, which is great, but also keeping in mind that these things were made outside- because I've heard so many times from people, like "oh, this like you could, you could make this look so much better". And it's like "oh, no". I know I could, but that's not what I'm supposed to do. I'm supposed to keep this as faithful, and bring it over using standards like SMPTE [Society for Motion Picture and Television Engineers] and things like that. But making sure it is what it is, on the other side.

There is also an acknowledgement by digitizers that standards help place constraints on practice to ensure that digitizers do not make adjustments beyond what is necessary to translate the video signal successfully into a digital copy; they must restrain themselves from trying to make the digital copy look “better” than the original. There is also the sense among digitizers that there are limits to how much standards can structure certain

aspects of practice. When asked to reflect on the process of digitization while reviewing the video recording in the review session, P1_L6 admits that certain activities go beyond what can be encoded in standards and that this must be taken into account when working within the particular material constraints (available resources, configuration of the signal chain, etc.) of their particular context of work:

P1_L6 (Interview): “Why did we do that?” I think it’s less about standards and more about our own internal practices, that the flow of, the workflow itself. It’s, like, what works best for us...?”

In other words, certain aspects of practice, because they involve site-specific infrastructures and micropractices that are difficult to document in a systematic way, are beyond the scope of what can be encoded in standards documents. This suggests the limits of what types of knowledge that can be encoded within standards. They may advise on what types of files to make and how to calibrate video signals, but standards are limited in how much advice they can provide on how to fit those recommendations into the material constraints of the site of signal work. For instance, learning to adjust video equipment and learning to see errors are not something that can be communicated solely through documents.

10.3.4.3 Standards as Limitations

Digitizers also run up against the constraints of standards when they are working with tapes that were made by video artists, who often intentionally (or unintentionally) adjusted their video recording equipment to produce signals that went beyond established standards for broadcast video signals. In these cases, digitizers must rely on their situated judgment and their historical knowledge of the tapes, as discussed in Chapter 8, to circumvent the rules imposed by standards. As P3_L2 explained:

P3_L2 (Review Session): Like there are some occasions, like at the moment I'm working on a collection for an artist who very diligently set bars and tones at the start of every tape, who has then intentionally crushed blacks and clipped his whites for aesthetic purposes. So obviously if I brought everything there to range, I would be completely distorting his image. So, it's important to make sure that, yes, of course that you're in broadcast range, unless there is a very definable reason why you would not be.

Standards – in this case the “broadcast range” standards of SMPTE (Society for Motion Picture and Television Engineers) – are used as guidelines that shape the micropractices of digitizers, but they acknowledge that their application should always be tempered by their own educated judgments in regards to the special requirements of artistic works. Digitizers acknowledge that deviation from standards is allowable if there is a good reason to do so. P1_L2 criticized another organization that is carrying out digitization work (not studied in this dissertation) for refusing to acknowledge the flexibility that is necessary for applying standards when working with some videotape formats:

P1_L2 (Review Session): We were talking to some people from Indiana University at AMIA, and they mainly use Betacam, and they were like, "broadcast range. Always stay within broadcast range. Do no harm. Just do no harm, do no harm." And it's just... you could dramatically... for 1/2", most people aren't going to be color correcting it later, right. So, and most of the original players are gone, or the original shooters, so I don't know. It's just... I like to keep it as much as possible as what's straight off the tape, as long as you aren't clipping anything. Uhm... It's arguable that you want to stay in broadcast range no matter, but if you do that, then you are talking about complete darkness at times. Or, it's too bright in some places where it shouldn't be. And I don't know. It's hard, it's definitely hard.

Knowing when to deviate from standards and when to follow them becomes a point of tension that pits the situated judgments of digitizers against community-sanctioned and institutionalized knowledge. P1_L2 defends this approach by pointing to the potential detrimental effects of blindly following standards; especially when doing so would likely produce a digital copy within which all for the visual information outside the “legal”

range was discarded. The larger concern is how much autonomy should be given to the digitizer to make decisions in the process. As the person referred to at Indiana University explained, their main imperative was to “do no harm,” which emphasizes a non-interventionist commitment to not manipulating signals at any point throughout the signal chain. This also connects back to the ways, identified in the analysis in Chapter 9, by which digitizers orient themselves in time, on one hand looking to the past in the hopes of reconstructing the historical videotape as it was originally recording, while on the other hand taking into account posterior uses of the digital copies when making decisions in the digitization process. Thus, the temporal orientation of preservationists identified in Chapter 9 also has a moral dimension, since it can be linked back to archival imperatives of respecting the integrity and authenticity of the original in the translation of analog video signals to digital copies for future use.

From these examples, it is clear that tension exists between the adoption of standards into institutional knowledge, and digitizers’ embodied perception and situated judgments. In some cases, digitizers may privilege their own judgment and adjust signals against the standards, adapting to the requirements of particular tapes and particular moments. In response to interview question IQ18 (See Appendix D – Interview Protocol), P3_L6 cautioned against following standards blindly: “Because it’s easy to get wrapped up in a document and say everything should be X, Y, Z, but then you go to put it into practice and it’s not quite suited to the situation at hand.” At the same time, some guidelines are needed to shape the work of artisanal digital reformatting and enable digitizers to form some certainty that their work is of a high quality, and judiciously following standards can help establish these guidelines. For instance, broadcast range

standards (produced by SMPTE, as noted above) give a baseline for digitizers that they can follow or deviate from as needed. P2_L2 explained during the review session: “Our goal in general is not to, it's to try and abide by the rules of broadcast range, but to acknowledge that for certain formats, occasional deviations are acceptable to us.” These “occasional deviations” define the point at which the personal knowledge of the digitizer is applied in order to judiciously apply institutional knowledge, codified as standards, guidelines, workflows, etc., to the unique digitization requirements of particular tapes.

10.4 Chapter Summary

In this chapter I have discussed the ways in which knowledge is constructed and circulates across three zones of knowledge that were identified through an analysis of participants’ statements. Participants define three zones of knowledge of decreasing relevance to their everyday work: (10.1) personal, (10.2) institutional and (10.3) community zones of knowledge. Each zone offers a site in which tensions, related to trust, credibility, and applicability of practical knowledge to the local contexts of practice, develop and can be resolved.

The (10.1) zone of personal knowledge is where digitizers engage in their local practice where “signal work” is carried out and they develop their expertise around the work of artisanal digital reformatting. In this zone, digitizers develop knowledge for identifying errors, making decisions and adjusting video signals to make digital copies by developing knowledge, through their experiences of carrying out the work and supplemented by four main sources of knowledge: (10.1.1) formal education; (10.1.2) manuals and atlases; (10.1.3) visual specimens; and (10.1.4) social media platforms.

In the (10.2) zone of institutional knowledge is the next relevant zone of knowledge for participants. Within this zone, existing stocks of institutionalized knowledge are (10.2.1) replicated through “mimetic” means, wherein new workers copy the actions of established workers within a site; and (10.2.2) the establishment of presets and defaults on equipment to limit the ways in which the equipment can be adjusted.

In the (10.3) zone of community knowledge, participants engage with new and established knowledge in the wider community of media preservationists, experts and representatives of other preservation institutions. Community knowledge is established and known throughout this wider community, but it is still evaluated by participants in terms of their own experiences engaging in the work of artisanal digital reformatting and their local institutional infrastructure (e.g. the compatibility of new techniques with existing equipment and other resources), and will at times (10.3.1) defer to community knowledge; or they will (10.3.2) question this community knowledge and potentially reject it. In addition, the knowledge carried by experts (10.3.3) and standards (10.3.4) is evaluated by digitizers and administrators who may accept this knowledge and integrate it into their institutional context (10.3.4.1); question and reject the knowledge (10.3.4.2); or find that the standard limits their work in significant ways when applied to their local context (10.3.4.3). Knowledge carriers such as texts, standards and experts can bridge zones of knowledge and help to translate practical knowledge into contexts beyond its initial site of production. This offers insight into the ways in which the practice of artisanal digital reformatting emerges out of local experiences of individual digitizers, but within a socially shared understanding of the practice.

Participants' concerns over following or resisting community consensus suggests the dual nature of the zone of community knowledge, as both stabilizing and legitimizing of practical knowledge, as well as always provisional, evolving and open to contestation. Disagreements about how best to carry out the work of digital reformatting develop when recommended practices are seen to be in conflict with what "makes sense" given the particular local conditions of practice. Efforts to make practical knowledge stable and transferable across space and time run up against the particularities of individual spaces and institutional contexts. Thus, for digitizers, the "truthfulness" of a particular preservation "fact," i.e., statements of practical knowledge, depends on how it fits with the actual work of digitization. New techniques or specifications that contradict knowledge from digitizers' experiences of carrying out the work of digitization or that are promoted by untrustworthy carriers of knowledge (such as experts) may be questioned or outright rejected. If practical knowledge is translated into local practice from institutional or community zones, it becomes routinized and added to the institutional knowledge of the organization. What this suggests is that practical knowledge, while closely linked to situated action in the context of digitizers' signal work, is constructed not solely as an individual practice, but one shaped by the influence of the zones of community and institutional knowledge. Statements of personal knowledge carried across these zones can be accepted or rejected by digitizers to various degrees, but ultimately their influence shapes how digitizers think about how they should conduct their work. In this sense, the power of statements of practical knowledge to enact particular conduct rests on their integration into regimes of normativity. The meaningfulness of a practice, if it is to be socially shared, hinges on the construction of

distinctions between normative and non-normative actions. To enter into the practice of artisanal digital reformatting requires developing knowledge about community expectations and preservation imperatives. Furthermore, normativity, while fundamentally linked to formal systems of ethics, beliefs and moral commitments, is also deeply epistemological; i.e., it depends on the modes by which practical knowledge can be generated, the structures within which statements about practical knowledge can be enunciated, and it becomes embedded within personal artisanal skill and mastery.

In the following chapter, Chapter 11, I will discuss the structure of moral codes in the context of artisanal digital reformatting by analyzing how preservationists distinguish between normative and non-normative action and how they articulate commitments to preservation values and put those imperatives into action in their practice. Of particular interest is how digitizers account for cases of system breakdown, uncorrectable errors, and other deviations from normative practice that could potentially call into question their commitments to preservation values. Through this process, I will integrate an analysis of the normative dimensions of the practice of artisanal digital reformatting, with the findings from the previous three chapters. Chapter 11 will help to link together the analysis of the material practices and epistemic techniques presented in Chapter 8, the analysis of the experiences of knowledge construction presented in Chapter 9, and the analysis of the social circulation and construction of preservation knowledge presented in Chapter 10. This will provide a complete picture of how preservation knowledge is constructed in the context of the artisanal digital reformatting of analog video recordings.

CHAPTER 11: NORMATIVITY OF ARTISANAL DIGITAL REFORMATTING

11.0 Chapter Overview

In previous chapters, I described the ways in which the technical knowledge required to carry out the work of artisanal digital reformatting is constructed through the cluster of epistemic techniques employed by digitizers in their “signal work” (Chapter 8), sensory-cognitive and situated practices through which they train their vision and become confident and competent in their work (Chapter 9), and the ways in which practical knowledge circulates across zones of decreasing relevance surrounding digitizers’ the contexts of artisanal digital reformatting (Chapter 10). In this chapter, I will consider how these processes of knowledge construction are shaped by the preservation imperatives of digitizers. In other words, this chapter will look at the structure of their moral codes and the ways in which the participants verbalize commitments to archival values and how they enact them within the work of artisanal digital reformatting. I will analyze participants’ statements as evidence of commitments to particular moral objects (i.e. values, ethical imperatives) and then link these back to the ways in which they enact these moral objects in practice. I will discuss how participants (11.1) distinguish their work from the labor of other types of workers in order to understand how they construct the meaning of their work as a particular type of cultural production; (11.2) consider the structure of moral codes, i.e. understand the particular moral objects participants commit to and how they enact these when carrying out their work; and (11.3) considering the techniques participants employ when accounting for deviations from these moral codes. The result of this analysis will provide insight into the role played by moral codes in the construction of knowledge within the practice of artisanal digital reformatting.

In his conceptualization of the structure of moral codes, Robert Wuthnow (1987) suggests that legitimacy “is not simply or primarily a matter of subjective belief but is an exchange relation consisting of expenditures of resources in return for moral rewards – a relation that has symbolic aspects containing an identifiable structure comprised of symbolic boundaries” (p. 81). In the case of artisanal digital reformatting, we can observe the ways in which participants’ statements make distinctions (“symbolic boundaries”) between normative and non-normative actions and enact those distinctions through the “real programs”⁹⁷ embedded within their daily workplace activities. As such, analysis of participants’ statements about their practice of artisanal digital reformatting will be used in the following sections to provide insight into the underlying moral codes that structure their work. The following table (Table 9) summarizes some of the key terms in Wuthnow’s (1987) framework and translates them into the context of this dissertation research on knowledge construction in the artisanal digital reformatting of analog video recordings.

Wuthnow’s (1987) Concepts	Examples from Research
Moral Commitments	“Preservation” “Integrity of documents”
Real Programs	“digital reformatting” “documentary practices recording all changes to original”
Distinction Between Inevitable/Intentional	“Adopting standards vs. having them forced from above” “imperfections in original format contains noise vs. noise being added by the signal chain of digitization technology”
Institutional Contexts	“cultural institutions that work to conform to particular codes of ethics and articulate certain values at different scales”
Ritual	“Cleaning the digitization site every time before each new document is brought into contact with the digitization equipment.”

Table 9 – Concepts Related to the Moral Order of Preservation Knowledge

⁹⁷ As discussed earlier, Wuthnow (1987) makes the distinction between the moral commitments that individuals make through their statements and the actions that they take in order to put those commitments into practice as “real programs.” The structural analysis of moral codes is focused on understanding the underlying structures by which moral commitments are discursively linked to ways of acting in the world.

In Chapter 8 we have already seen how participants negotiate tensions between the objectivity demanded by normative practice and the pragmatics and material contingencies that characterize signal work, which suggest larger tensions between normative expectations and the ways in which participants must account for deviations from those expectations.

The normative dimensions of artisanal digital reformatting are linked to ambiguity in how their labor is defined within social hierarches of work. In many ways, the practice of artisanal digital reformatting occupies a liminal space between mental and manual labor. The participants in this research project profess professional identities and have obtained advanced degrees, yet some of their everyday work tasks could be carried out as semi-skilled labor. The analysis in Chapter 8 showed how digitizers develop calibrated vision and skills of expert visual judgment, and the analysis in Chapter 9 showed digitizers engage their whole bodies into their work and develop cognitive-sensory abilities. Furthermore, in Chapter 10, we identified tensions between codified forms of knowledge circulating within the community and the practical needs of digitizers' contingent and situated work activities, across three zones of knowledge (personal, institutional and community knowledge). Through these analyses, we can see that digitizers position themselves as active agents in the production of knowledge within the practice, rather than pushing buttons and operating machines unthinkingly. Digitizers will admit that, for some tapes, just loading the tape and pushing a button could produce a digital copy of reasonable quality, which suggests that there are underlying commitments to archival imperatives that structure the work and make it meaningful beyond "just getting the work done." Thus, in addition to the knowledge necessary for the practical

execution tasks, “know how” has a cultural dimension, in that it is shaped by a set of values and social expectations that give structure and meaning to human activity (Wuthnow, 1987), maintaining distinctions between normative and non-normative actions. Understanding how to do something is only partially defined through its instrumentality (i.e. the successful enactment of particular tasks towards particular goals). Rather, knowing how to do something is always dependent on the knowledge of appropriate ways of comporting one’s self within a particular cultural context. Knowing how to act in a manner acceptable within the cultural context of a particular practice, in conjunction with practical competencies, is necessary for action to take place and be understood as legitimate action carried out by a legitimate actor.

The work of artisanal digital reformatting is structured in part by the practical requirements of getting analog videotapes to play in order to produce digital copies, yet moral codes of conduct also play a role. Through the analysis in Chapters 8 and 9, it became clear that developing knowledge of the technical requirements for getting the digitization system to work is only half the story. First of all, those affordances and goals have to be constructed as socially recognizable phenomena (i.e. what does it mean for a tape to “playback” correctly? What techniques are at the disposal of digitizers to carry out the work and interpret outcomes?); second, for the work to be construed as being more than an unskilled, rote process of loading a tape and pressing a button, it must be carried out with digitizers committing themselves to archival imperatives. Certainly, digitizers could “just” load a tape and “just” push a button, and an acceptable digital copy could emerge out on the other side of the system, but this approach would not support the moral commitments associated with digitizers’ professional identities. Thus, to structure their

work in a meaningful way, digitizers must operate with the guidance of implicit moral codes that give their practice legitimacy.⁹⁸

11.1 Distinguishing Between Types of Labor

An important element of the moral code of artisanal digital reformatting is the distinction between normative and non-normative labor. Participants differentiate between their work of artisanal digital reformatting and other forms of labor, such as unskilled and purely technical labor. They emphasize their personal interest in supporting the values of preservation and the pride that they take in their work regardless of task complexity. In particular, participants differentiate the interest they take in doing the work right from the mindless labor of unskilled production. For example, P3_L6 suggests, in referring to the people working in the lab at Site L6: “it isn’t just people turning the crank, right? They have an interest in the material.” The image caricatured by P3_L6 is one of an unskilled laborer unthinkingly operating a piece of equipment to crank out undifferentiated, mass produced products. Instead, digitizers have an interest in the materials they are digitizing and are engaged in the work and committed to producing the highest quality digital copies possible. They express the need to be careful and take enough time to do the work properly, resisting the urge to rush through the work to get it done as quickly as possible. Care is also necessary because tapes are often fragile, which can make it difficult to redo the work if the initial quality is poor. P1_L1 acknowledged needing to resist the urge to go quickly through projects or let outside pressures encourage P1_L1 to “cut corners”:

⁹⁸ In Chapter 10, we saw how participants discussed the shaping of their practice in regards to the general consensus of their occupational community, institutional and professional knowledge. In addition there is a degree of concern for conforming to the normative expectations produced beyond the boundaries of their organizational context.

P1_L1 (Interview): Like before I was just like, I gotta get it done, which is still part of it. but now, being more forceful that this needs to be considered, this needs to be ... like I was saying, everything's important. You can't really cut corners. When exhibitions come up, sometimes we're given a month to do something that should take three minimum. Uhm, so learning to push back and be like no, like, I need to do this right, I don't want to do this wrong. [*emphasis added, zlk*]

Doing the work “right” means acknowledging the difficulty of the work and taking the time necessary to exercise care and to develop the necessary know how. The risk posed by doing the work “wrong” suggests that by rushing carelessly through it they would be entirely unaware of any problems that might develop. Digitizers are aware of the consequences of how they carry out the work. P3_L2 points out that someone could do this work without thought and not even be aware that they were producing low quality digital copies:

P3_L2 (Interview): It can be really difficult. And, I mean, I certainly find it to be quite a big challenge. The more I learn, the more I understand about video. It is becoming easier. But I think it's good that it is a challenge. **If you think it's easy and you just capture it, you're gonna go, “It's fine,” then maybe you're capturing it incorrectly.** [*emphasis added, zlk*]

Participants acknowledge that the basic technical procedures of digitization could be carried out quickly by semi-skilled workers, but that it would not be up to the quality that is expected in their professional practice and could allow major errors to wind up in the resulting digital copy without being noticed. At the same time, digitizers emphasize that their work involves mental labor in the form of expert decision making and evaluation, and being able to detect and diagnose errors in the video signal. Their technical knowledge applied to getting the work done is applied within an understanding of the framework of institutional processes and archival values, including a concern for maintaining the authenticity and integrity of the digital copies they are creating. In this

capacity, digitizers distinguish themselves from the technicians who fix their equipment. While they may be able to adjust the components of the signal path and do basic repairs, digitizers do not see themselves as similar to repair technicians. While repair technicians enter the space of the digitization lab and have intimate knowledge of the inner-workings of the equipment, often beyond the knowledge of preservationists, they are outside of the preservation community. As P1_L7 explained about having limited technical knowledge about a malfunctioning VTR: “Or, like, okay, obviously I don’t know which millionth capacitor, which of the one of these million capacitors I need to replace to get things to work.” This lack of knowledge about the granular internal components (the capacitors on the internal circuit boards in this case) of the VTR is a frustration for P1_L7 and it also emphasizes the distinction between the labor of artisanal digital reformatting and the labor of video equipment repair. While digitizers seek to gain mastery of their video equipment, wanting to gain access to expert technical knowledge, their acquisition of this type of knowledge is limited by their primary focus on putting preservation values into practice. Whereas the repair technicians possess mastery over the internal workings of the video equipment, digitizers must integrate their limited understanding into their workflows.

11.2 Moral Objects

In their interviews and review sessions, participants expressed their commitments to important archival values. Archival values, such as *authenticity* and *reliability* are “moral objects” (Wuthnow, 1987), i.e. the abstract concepts that determine the worth of archival documents in the care of an archive (MacNeil, Eastwood and Duranti, 2002). In their statements, participants express commitments to these values, such that they make

decisions in their work that seek to maintain the authenticity and reliability of the analog video recordings that they are working with. Participants' commitments to maintaining the authenticity and the reliability of the original video recordings being digitized establishes an axiomatic moral object to which they link "virtues" that they use to assess their enactment of those values in their work.

In the following sections I will describe the structure of the moral codes that shapes the work of artisanal digital reformatting, linking the articulation of moral commitments and their enactment in practice. These sections will describe how participants form commitments to the archival values of (11.2.1) *authenticity* and *reliability*; how those values are supported through the virtues of (11.2.2) *consistency*, (11.2.3) *neutrality*, (11.2.4) *commitment to high-quality work*, and (11.2.5) *cleanliness* and *exercising care*. As we will see in the following sections, participants' form commitments to virtues such as consistency and neutrality in order to support the authenticity and integrity of the digital objects they re-create.

11.2.1 Authenticity and Reliability

Participants express commitments to maintaining the authenticity and integrity of the originals in the digital copies that they produce. *Authenticity* and *reliability* are identified in the archival theory literature as important values ascribed to records that are being preserved. Luciana Duranti (2002) suggests that a document can be seen as authentic if "it can be demonstrated that it is precisely as it was when first transmitted or set aside for preservation" (p. 27). A document's reliability then depends on "the trustworthiness it had at that moment" when it was first transmitted or preserved (p. 27). In the case of archival analog videos, authenticity and reliability are at risk precisely because the

translation from one medium to another is problematic in regards to maintaining authenticity and is prone to uncertainty. Uncertainty about how to adjust the video signal in order to produce an “accurate” copy has a moral dimension because it poses a risk to the authenticity and reliability of the original video recording that must be preserved. The authenticity and reliability of these documents depends on the careful translation between media formats, and values shape how the original is handled and how the resulting digital copy is evaluated. Since digitization technology and the expectations about the level of quality that can be achieved are changing, it can be difficult to know when the digital copy is as close to the original as possible, so digitizers must continue to develop their technical abilities, as one digitizer explained:

P1_L2 (Interview): We try to like, obviously **we’re very concerned about authenticity and integrity**, but uhm, technology changes so fast, and **different artists want different things** so it's just uhm... uh, so yeah, I mean. [*emphasis added, zlk*]

In this quote we also see the introduction of another archival value, a concern for the *integrity* of the originals. Duranti (2002) defines *integrity* as a higher-level value that depends on the maintenance of *authenticity* and *reliability*. In this quote, however, *integrity* appears to describe a concept closer to respecting the intentions of the creator and the visual work as a whole (as suggested by the reference to “artists want different things”). While considering how to maintain abstract values such as authenticity, reliability or integrity, participants acknowledge that producing digital copies also calls for an engagement with the materiality of the analog original so that it is not damaged in the process of digitization. P3_L2 describes how all the tapes handled are deserving of respect and careful attention, suggesting a moral commitment to the integrity of the work:

P3_L2 (Interview): But especially when I'm working with the physical tape itself, I'm always very attentive and very respectful, because, first of all, it's not mine. And often it's the only copy, you know, because we get a lot of masters in. Even if it's not, even if they have twenty copies, that's irrelevant. You know, you should respect other people's collections.

This concern for respecting the original, both materially and in terms of how its content is represented in the digital copy, supports the imperative of “doing no harm.” Analogous to medical professionals who deal with human patients, digitizers see themselves as responsible for ensuring the safety and well-being of those informational artifacts under their care. Participants extend this commandment from the domain of caring for human bodies to caring for videotapes and the visual content encoded on them. In the context of artisanal digital reformatting, “doing no harm” comes to mean respecting the meaning of the original documents and not distorting that meaning through the process of digital reformatting. P3_L6 reflected on how the idea of “doing no harm” fits into P3_L6's practice:

P3_L6 (Interview): There's a sense of responsibility [*inaudible*], but I can feel that... I mean, like we said earlier today, the archivist credo or whatever is “do no harm,” present anything that's on that tape or record, or whatever you wanna digitize and preserve. Don't lose any fidelity. You know, just at that level, my personality is well-suited. I'm very, very... I put a lot of care into what I do—more so than I probably should, some people would argue. You know, I'm really, really nuts about it. And, maybe that's another one of my qualifications that people liked, you know, that I'm not haphazard in my work. But, um, the... You know, that alone is a pretty good motivator. But, you know, to know that it's worthwhile work, and that somebody cares about it enough to say, “Let's get this done.” I take a sense of pride in that.

P3_L6 links this concern for respecting the tape to both caring for the physical tapes, by carefully handling the fragile originals, and ensuring that the resulting copies are “accurate” records of the original. P1_L7 expresses this concern of “not doing harm” by taking care to produce a digital copy that does not distort the original:

P1_L7 (Interview): Well, you know, this is the best I could get. Does it look like what I transferred? That's essentially what it looks like, and make sure I didn't make the problem worse.

The twin commitments to the original and the copy suggests a commitment to a conceptual entity that goes beyond the physical original or the digital copy yet is manifested in both. P1_L1 started to get at the core of the issue of “integrity” by explaining that the work of conservation, reformatting, and documentation is done in order to maintain the “identity” of the work:

P1_L1 (Interview): We're preserving or conserving that identity ... that, uhm, to try to be as faithful to the intent of the artists as well as the cultural kind of reception and understanding of an artwork, is kind of what I think about.

Maintaining the integrity of the work's identity thus also depends on documenting the context of reformatting, the intentions of creators, and any other contextual elements that could shape future interpretations. Artisanal digital reformatting then is not a rote copying from one medium to another, but an intellectual re-construction of the identity of these types of “visual documents” as they are put through a process of translation into a new medium that is as much a form of mental as it is manual labor. Archival values of authenticity, reliability, integrity, and identity are put into practice through the guiding virtues of *consistency*, *neutrality*, a commitment to *high quality work*, and *care*.

11.2.2 Consistency Applied to Processes and Products of Digitization

The commitment to authenticity and integrity is centered on concerns about respecting “visual documents” through processes of handling, copying and documenting. At the same time the virtue of *consistency* was identified as supporting this work, detected through participants' expressed commitments (in interviews) to using uniform and orderly processes. A commitment to consistency expressed itself in the selection of

digital file formats, choosing documentary techniques (e.g. metadata schemas), using software and scopes to produce calibrated results, and for managing projects by making the work of artisanal digital reformatting knowable and manageable. Producing digital copies in the same manner each day helped to make the work knowable and controllable. If the work processes conform to established plans, then any adjustments that need to be made can be made *en masse* and the copies produced will all have a duplicable visual appearance. The commitment to consistency is expressed through the use of standardized specifications for digital files, documentation guidelines and systematic work. For example, P1_L5 administers a digitization project that outsources the work of digitization, but in this organizational context they carefully assess the results of the digitization to assure that standards have been followed and maintain strict guidelines for documenting all aspects of the process. When asked about how standards get talked about in in Site L5 (in response to interview questions IQ17), P1_L5 explained:

P1_L5 (Interview): Not really. I feel like we've been very consistent in terms of our approach and our, I mean, our standards have not changed at all, really, in the past six years. I mean it's- our workflow has gotten better, uhm, we have extensive documentation, and uhm ... I feel like we've been very consistent, which is, I think, a good thing.

Following invariable standards for producing digital files and for documenting the process makes actions knowable and predictable, giving repeatable structure to the basic elements of practice. Because Site L5 makes its guidelines publically available through its website, these locally specified standards can circulate within the zone of community knowledge, as described in Chapter 10. As evidence of this, when P1_L2, a digitizer at Site L2, was asked about what standards are incorporated at Site L2 (IQ13, see Appendix D – Interview Protocol), P1_L2 explained that they used the guidelines developed at Site

L5. This shows how standards encourage consistency across sites through their circulation across zones of knowledge, and that standards have a normative function, in helping to what is accepted knowledge in the community.

Consistency enacted through standards also helps shape what information is recorded throughout the digitization process, conforming metadata standards to generally accepted guidelines. These standards are useful tools for ensuring that any non-professionals who may be helping out with the work (such as student interns) are also methodical in how they are carrying out the work:

P2_L7 (Interview): And I usually, for people who aren't trained in archiving, I sort of emphasize that maybe the rules may seem arcane, or they may seem odd, but that the purpose is that the data is consistent, and consistent with other organizations. It's not an arbitrary decision that we've made.

Consistency in documentation helps to ensure that metadata records created by one organization can be interpreted by another, and that the work being carried out in a particular digitization lab is made knowable and manageable, producing repeatable and expected results. This helps to reduce uncertainty about the quality of the digital copies being produced, and supports the archival values of authenticity and reliability of the digital copies.

Using measurement tools, such as video scopes and software, also helps to produce consistent and repeatable results, ensuring that the digital copies made are to the same specifications. Using models and guidelines for signal thresholds ensures that the signals being encoded to digital files are similar from day to day, and from collection to collection:

P3_L6 (Interview): We can get software that checks for the signal noise ratio. We have FFMPEG that gives us specifica-- you know, stats on this and that and

the other thing. And I wanna make use of stuff like that to make sure we do normalize recordings in a consistent fashion.

Consistency ensures that all of the digital copies being created are capturing the original video signals in knowable and repeatable way. Digitizers may not always know the best way to adjust a signal, but if they follow uniform techniques throughout their workday, they believe that consistency will make it easier to adjust the files in the future if a better way is identified. Consistency is employed as a heuristic for choosing suitable course of action within the limited knowledge of a problematic situation (e.g., a tape is producing signals that are not meeting standards). If the “best” way to carry out a task cannot be identified, applying a reasonable solution in an ordered and unchanging manner is seen to be an acceptable solution:

P1_L2 (Interview): When I am using one, it's because I have nothing better. Or, because **I'm trying to maintain consistency**. That's really where standards for me, it's about consistency, it's not about what's best, I guess, if that makes sense. [*emphasis added, zlk*]

Consistency is used as a means of systematizing the process of carrying out the work of digital reformatting and making the digital copies knowable and manageable, even if the best solution cannot be determined. Carrying out work in this manner supports participants' commitment to the values of authenticity and integrity. If digital copies are produced in a uniform manner and the types of files are limited to a select group of standard file formats, it makes future preservation management easier because the whole collection can be modified, “*en masse*.” As P1_L2 noted:

P1_L2 (Interview): Just thinking in future terms like, if we're going to be going to an entirely scripted world, the more consistent a file is, is good for that. I'm always saying with metadata, I'm always saying, even if sometimes it better, even if it's not the most correct way to enter data, at least it's incorrect in a consistent way. Because that way you can fix it *en masse*, if you need to later on.

This example offers another illustration of how consistency can be used to rationalize action even when the “best” course of action is not known. Following guidelines to produce digital copies that have similar technical characteristics ensures that they are amenable to future algorithmic management via computer scripts. In each of these examples, consistency is an underlying virtue whose enactment helps to maintain authenticity and integrity of visual documents and enhances their ability to be managed over time.

11.2.3 Neutrality: Balancing Subjective and Objective Judgments

The virtue of neutrality refers to the requirement that digitizers balance their own subjective visual judgments with the use of objective measurement tools, such as video scopes and computer software. On one hand, neutrality suggests that the work of digitization should not enhance or distort the content of the original in any way; but, on the other hand, each tape may behave in unique and unpredictable ways, and digitizers must use their situated judgments to make adjustments that will enable the production of an acceptable digital copy. Maintaining the authenticity of records is an important moral commitment that comes from the archival world. Authenticity means that the document in question is indeed what it claims to be.⁹⁹ In the case of artisanal digital reformatting this means that the copies that are made accurately reflect the original. Commitments to maintaining neutrality and producing high-quality copies can be seen to contribute towards the goal of ensuring authenticity. Digitizers invoke the virtue of neutrality to support authenticity and integrity. Working through the “balancing act” of neutrality

⁹⁹ Luciana Duranti (2002) suggests “authenticity is protected and guaranteed through the adoption of methods that ensure that the record is not manipulated, altered, or otherwise falsified after its creation, either during its transmission or in the course of its handling and preservation” (pp. 27-28). In the case of copying from one medium to another, authenticity means that the copy accurately depicts and does not distort the content of the original record.

relates back to the concern identified earlier as “do no harm,” in the sense that falsely adjusting the video signal while making a digital copy threatens the values of authenticity and integrity. P1_L6 reiterates that a balanced sense of neutrality is necessary to put preservation values into practice:

P1_L6 (Review Session): Well, as far as archival practices. We try not to change things too much based on our opinions. We kind of take it as it is and make just the most, kind of "do no harm," the first rule. So, we're not going to mess with the color too much, but we're using the scopes to monitor the baseline of... using a reference of the color bars to be calibrated.

Replacing the digitizers’ “opinion” with measurement tools such as video scopes helps to enact the concept of “neutrality” in practice, preventing degradation to the authenticity of the digital copy.

Thus, “being neutral” is a balancing act that involves drawing on embodied judgment and epistemic techniques to adjust their actions in the context of the contingent and indeterminate “signal chain,” while at the same time integrating standards and consistent processes into practice and using calibrated scopes and monitors to remove variability and uncertainty as much as possible.

11.2.4 Commitment to High-Quality Work

In addition to a commitment to neutrality, participants express a commitment to producing “high quality” digital copies. By setting a threshold for a minimum acceptable level of quality in their transfers, digitizers work to make the best copy possible that accurately reflects the analog original. This commitment to “high quality” is put into practice through acts of re-copying tapes that had already been copied once before. In cases where the level of quality is below expectations, digitizers will go through the entire process again to try to make a better digital copy. Digitizers perceive cases in

which it becomes necessary to re-do a project as a problematic situation, since this involves the expense of considerable extra work time and can be quite stressful for them. P2_L2 relates developing an improved technique and then deciding to go back and to re-transfer some digitization work that P2_L2 had recently completed:

P2_L2 (Interview): But I ended up having to go back and re-do, like, two weeks of work, and that was a complete and total breakdown moment. But ultimately, like, I got through it, as we always do. And I'm glad we went back and did that, and not just give someone something that was sub-par. Which easily could happen, you know? And so if that happens without my awareness, I suppose I'd be willing to accept it. I wouldn't be happy about it. But if I did it, knowing that I wasn't giving my best work; that would be upsetting.

In this case, the commitment to high-quality work motivated P2_L2 to overcome the stress of having to reproduce two weeks worth of digitization in order to re-do the work in order to meet the standards of high quality copies. Digitizers make calculations to balance the costs and benefits of spending additional time on particularly problematic tapes. Doing the work properly and achieving the best possible results is perceived as an imperative that is worth the added costs (labor time, mainly) associated with having to spend extra time on the work. Distinguishing the high-quality work of artisanal digital reformatting work from low-quality work plays an important role in constructing the normative dimensions of their practice and helping to define what it means to behave as a media preservationist who goes out of his way to produce the best digital copies possible. Digitizers stress that producing high quality work is important regardless of whether or not the users of the digital copies would ever notice the difference. At times, the users of digital copies will indeed understand this distinction and may demand high-quality work. Digitizers will often be asked to re-do work that had been done by other organizations that had lower standards of quality. Commitment to high-quality work offers rewards to

institutions in terms of prestige and greater demand by other institutions for their digitization services. P2_L7, an administrator at Site L7, emphasized the fact that the reputation of Site L7 hinged on the abilities of the digitizer to produce high quality copies, often making up for the shortcomings associated with the work of other institutions:

P2_L7 (Interview): I know that sometimes clients come to us, and they have us retransfer stuff they've had transferred somewhere else, because the place was very cheap, and they basically just like, **there's some operator that has a lot of machines, and they just put 'em in and press record, and, like, leave or something, and they don't watch.** And so, if the head clogs, you don't have any footage, or whatever. They don't check that it worked. That's the only thing I can think of. I mean, **I find it very important, just from, like, our reputation or whatever, that I want to make sure that everything was transferred perfectly.** [*emphasis added, zlk*]

In this quote, we can see P2_L7 caricaturing non-normative digital reformatting that diverges from the careful work of artisanal digital reformatting. P2_L7 distinguishes between the careful work of artisanal digital reformatting carried at Site L7 from the non-normative work of digitization labs more concerned with high-output. In P2_L7's description we see the inverted figure of the artisanal digitizer; a technician working with many tapes simultaneously, merely pressing the "play" button and leaving the room. By distinguishing normative from non-normative practice in this way, we can see how commitments to the values of authenticity and integrity are articulated through a commitment to producing high-quality digital copies, even if this limits the quantity of copies that they can produce in a day. These moral commitments are both situated at the level of the individual worker and at the level of the institution, since P2_L7 is quick to point to the impact that the quality of the work carried out at Site L7 on the institution's reputation.

Digitizers acknowledge that typically the users of the digital copies are unlikely to notice the quality issues that they painstakingly agonize over during the course of doing their work. The normativity of artisanal digital reformatting depends on distinguishing between artisanal and “mass” scales of digital production. Few viewers are aware of these distinctions when watching a digital copy. More typically, the normative dimensions of artisanal digital reformatting and the normativity associated with different modes of production are not evident to viewers of the digital copies. Regardless of whether or not the users notice, however, digitizers feel responsible for performing the work to the highest level possible. For example, P3_L2 reflected on feeling responsible for doing high-quality work and maintaining the integrity of the analog originals, even if no one else was likely to become aware of the amount of effort that was put into the work:

P3_L2 (Interview): I guess I just try to give it a lot of thought, and try to be ethical and aware of the fact that a lot of our clients don’t work in the archival community. So, we, for them, are, like, the reference point. So we should be giving them the correct information, and giving them the best quality reproductions of their work that we can. I think for me, that’s a big part that plays into it, that... **A lot of times we’re not going to be criticized, because clients don’t know any better, but that is all the more reason to do a better job, and to make sure that we are always doing this to the highest level, from a preservation point of view.** [*emphasis added, zlk*]

P3_L2 acknowledges the conditions of asymmetric knowledge between the preservationist and the users whom the work of digitization is serving. P3_L2 could do low-quality work and the users would not be likely to criticize it. Holding the work of digitizers to a higher standard, P3_L2 works towards the highest possible level of quality, expressing a moral commitment to preservation values. That standard is sustained by producing high-quality work. This commitment to high-quality work can also be enforced through perceived normative pressures from the preservation community and rewards for

the institution, i.e. more income or prestige. Digitizers may perceive risk that if word got out that an organization was doing low-quality work, that then the wider community would hold them accountable for their deviations from normative practice. P1_L6 reflected on personal concerns about doing high-quality work and the risk to the lab's reputation in the wider preservation community if their standards of quality were diminished:

P1_L6 (Interview): I feel—it's kind of weird to say—I feel proud of the work that we do. So maybe that's why I don't... **If we were to start really messing things up or something, being the laughingstock of the preservation community, I guess it could ...** [*participant trails off; emphasis added, zlk*]

P1_L6's pride in the work is founded on a commitment to following the high standards of practice and is confirmed in P1_L6's experiences by the apparent lack of negative feedback from the preservation community. P1_L6 is confident in the efficacy of personal abilities to produce high-quality work and maintain the authenticity of the originals being copied, and feels that the lack of critical judgment from the wider preservation community is evidence of the high-quality status of work that they are carrying out at Site L6. This shows how moral commitments are both enforced by the digitizer's own identity as a certain sort of digitizer committed to doing high-quality work, and through reference to the normative expectations of the community.

11.2.5 Cleanliness and Exercising Care

An important element of carrying out high-quality work is in exercising care in the handling and cleaning of equipment and tapes, which prevents damage to tapes and interruptions to playback, such as oxide or dirt flaking off and interfering with the video playback heads that read the magnetically encoded signal on the tape. Cleaning took an almost obsessive place in participants' rituals of care. These "real programs" support

digitizers' commitment to "do no harm," which directs archival values of authenticity and values of authenticity and reliability to the materiality of the physical tape and its playback. Before beginning work, tapes and video tape recorders (VTRs) are thoroughly cleaned by the digitizers. Cleaning helps to symbolically clear a space for carefully carrying out the work of artisanal digital reformatting. In terms of its practical impact on the material work, cleaning the tape and the VTR before digital reformatting reduces the risk that dust, dirt or pieces of decaying tape will come loose and clog the tape heads, thus disrupting the video signal and the digital transfer. Cleaning fits into a general regime of care in handling original analog tapes, and also supports the principle of "do no harm." Regimes of cleaning materialize this concern and care for equipment, tapes, and the digital copies produced directly into the work of digitization. P3_L2 describes an elaborate cleaning regime for problematic tapes:

P3_L2 (Interview): Making sure that, again, just that your equipment—even just making sure it's clean. Like, today I only transferred two tapes, and I spent about an hour and a half cleaning a new deck, because it was just in terrible shape. Because without that, I mean, you could have a perfect tape, but if there is a little piece of dirt you didn't notice, it's going to ruin your whole capture. So yeah, absolutely, ensuring that your setup is immaculate.

P3_L2 spends a significant amount of time making sure that the equipment is "immaculate." P3_L2 shows a commitment to producing high-quality copies by spending hours ensuring that the equipment is perfectly set. Cleaning is time consuming and needs to be carried out throughout the phases of the workflow, and must be coordinated with the other technical routines. P1_L3 emphasized the importance of maintaining a clean workspace throughout the workflow:

P1_L3 (Interview): Keeping everything clean. And that's beginning, middle, end. Yeah, as much as I possibly can. I know that the office is kind of a wreck, but I try to keep it clean, even if it's not tidy.

Keeping everything clean is critical to preparing the lab space for artisanal digital reformatting. The appearance of dirt coming off on the cleaning cloth or changes in the video signal right after the heads are cleaned provide visible evidence of the material effects of cleaning on the digital reformatting process. Cleaning can thus be seen to play an important role in determining the final quality of the digital copy. P1_L2 admits not always precisely cleaning the edge of the video head drum inside the VTR, but acknowledges that P1_L2 *should* remember to clean it, an indicator of an awareness of divergence from the normative cleaning regime:

ZLK (Review Session): How do you know when it's clean enough?

P1_L2: You can see it. uhm... if, usually we know if there's a tracking problem that we can't really resolve in the normal way, then I'll just do that. At least half the time, it's like "oh, there is this microscopic piece of gunk there kind of throwing the whole thing off track." I'll do it then. Really we should dig at it every time, but we don't really do.

This suggests the normative dimension of cleaning. P1_L2 suggests that cleaning is a necessary step and that it should be done every time a new tape is loaded, even though sometimes P1_L2 may deviate from that practice. Different degrees of cleaning can produce acceptable results and each digitizer differed slightly in how much they cleaned, suggesting that there is a symbolic dimension of cleaning beyond its practical effects.

Cleaning also materializes commitments to "being careful" throughout the process of digital reformatting. Being careful is distinguished from working towards greater efficiency. When asked about how many tapes can be digitized in a day, P3_L2 explained that it would be possible to do more than currently was being done if P3_L2 rushed through the work, but that it would be disrespectful to the tapes and would produce lower quality digital copies:

P3_L2 (Interview): I think more than that... It's certainly possible. They're half an hour long. It's possible to do more than that. I think doing more than that, though, would be slacking somewhere along the line. **I think that you would be rushing through your cleaning, I think you'd be rushing through your setups, and I don't think that's very respectful of the work itself**, or of the money that's going to pay us to do this, also. But yeah, I mean, normally it takes me, kind of, from the start of one tape to the start of another tape, if everything goes okay, about an hour and twenty minutes-ish, hour and a half, depending. And that's doing all of my notes as well, for one of the files. [*emphasis added, zlk*]

Being careful and “respectful of the work itself” by moving methodically through the workflow and rigorously cleaning everything that comes in contact with the tape distinguishes normative from non-normative practice, and distinguishes between those types of social actors who are committed to preservation values, and those who are not. Their work is externally validated, as noted above by participant P2_L7, through institutional reputation and prestige as a practitioner, and internally validated through the satisfaction that digitizers feel when they successfully complete a particularly difficult job. For example, when asked about what distinguished a good day from a bad day, P3_L6 explained how when difficult projects get accomplished, “that’s a pretty good day, to go home and say, ‘I made a little progress on one of our projects, or even finished one up.’” Digitizers also distinguish their work from mass digitization projects that produce much more digitized content on a daily basis, but sacrifice care and quality of the work to do so. P2_L6 suggests that high-quality and high-output may be mutually exclusive:

P2_L6 (Interview): But then I look at the peers in the field, and I’m like, good god, we can’t produce ten terabytes of data a day. You know, the quality and the quantity. Those two things are hard to line up.

Thus, while cleaning and applying care throughout the process is linked to high-quality digital copies, it requires slower work, producing less output, in comparison to the work of other organizations.

The significance of cleaning as an important symbol of the moral commitment of digitizers to archival imperatives is also observed in the configuration of the built-environment of the video digitization lab itself. Digitizers in each site have access to a set of cleaning tools, and the physical arrangement of components in the lab is designed so that the digitizers can easily access the internal workings of the equipment in order to clean it thoroughly. The administrator at site L6, for instance, discussed designing the lab so that it would be very easy to clean the video tape recorders (VTRs):

P2_L6 (Interview): We've got all the tops loose, so you can take the tops off. We've got, I ordered three more decks, so all of the decks can come straight out. And so we can take the tops off, and I can clean the heads on the drums and everything, or the bearings, if we need to. And then... So I'd clean the tapes. We'd clean the heads before each tape...

During observation sessions, participants at Sites L2, L3, and L7 were also observed removing the top covers from VTRs in order to clean them. Regimes of cleaning can thus be seen to be supported by the arrangement of equipment in particular ways that allow human bodies to access the internal components of machines. Cleaning and exercising care help materialize normative commitments to the authenticity and integrity of the originals in the everyday routines of artisanal digital reformatting. In the following section, we will see the ways in which deviations from normative practice are accounted for and rationalized.

11.3 Accounting for Deviations from Normative Practice

The previous section analyzed interview data and observation data in order to understand the moral codes of artisanal digital reformatting, that is how moral commitments are verbalized and put into practice as “real projects” (Wuthnow, 1987). Moral commitments to preservation values and the ways in which they are materialized in practice enable

participants to align their values with their actions by linking them with virtuous behaviors. Through this process, these moral codes help to enact the principles that guide digitizers' routines and decision-making judgments. This relationship between moral commitments and real projects provides a logical structure for normative practice that helps to give the work of digitizers meaning, differentiating it from examples of non-normative practice that may at first glance appear superficially similar. This identifies an important cultural dimension to their work, that fits with organizational sociologist, W. Richard Scott's (2003) definition of "cultural-cognitive" dimensions of institutional knowledge, as "taken-for-granted beliefs and shared conceptions and logics for action [that] are seen to underlie social order" (p. 881). In the case of the practice of artisanal digital reformatting, these moral codes become taken for granted, yet remain active as the underlying values that give coherence to the work of artisanal digital reformatting, shaping processes of decision-making and the incorporation of new knowledge into local practice.

Coherence within the structure of these moral codes can "break down" from time to time, which will require reaffirmation by digitizers taking action and accounting for any disruptions that impact their commitments to preservation values. Due to equipment breakdown, gaps in knowledge, or forgetfulness, digitizers do on occasion fail to meet their own moral commitments in their everyday work. Acts of a digitizer that deviate from normative expectations may call into question the strength of the digitizer's moral commitments and by extension his or her identity as a preservation professional. To restore their work to consonance with their moral codes, digitizers employ three tactics for accounting for their deviations from normative expectations: (11.3.1) acknowledging

limitations in carrying out their work; (11.3.2) differentiating between intentional and inevitable outcomes, i.e. distinguishing between those aspects of their work that they have power over and those that they are powerless to shape; and (11.3.3) documenting uncorrectable errors.

11.3.1 Acknowledging Limitations

Acknowledging their limitations, both in terms of personal knowledge and institutional resources, enables digitizers to rationalize their actions when discussing them during interviews and review sessions. For example, during the review session, P2_L2 acknowledged that there were fundamental limitations in personal knowledge about how the equipment functioned and that this helped to explain moments in which P2_L2's ability to rationally make decisions was limited:

P2_L2 (Review Session): They're complex devices, and so understanding how they operate is, definitely probably the most difficult part, I think. Knowing how to read them, knowing all the different things they can tell you. Like I, in terms of all of the stuff that a waveform monitor and a vectorscope can do, I probably know, I don't even know... half, maybe less.

Acknowledging limitations placed on personal knowledge by complexity of technology helps to limit criticism of action. By being self-critical, digitizers can prevent criticism from others. In his analysis of the rhetorical strategies employed in the communication of scientific knowledge, Bruno Latour (1987) has noted that the authors of scientific texts comprehensively enumerate the limitations of their studies in order to stave off any criticism of their methods or findings from readers. Similarly, digitizers are quick to acknowledge their limitations in order to inoculate their actions against expected criticisms and bring them back into alignment with normative expectations and reaffirming their moral commitments. For example, in response to IQ12 (See Appendix

D, Interview Protocol), P1_L7 rationalizes the limited use in Site L7 of scopes to analyze the signal (seen as a deviation from normative practice) by attributing it to the limited availability of measurement tools at Site L7 and their lack of financial resources:

P1_L7 (Interview): So, yeah, it's just more no-frills, more barebones. And, I mean, that's what the place is. It's a small organization, with... It's a small and simple organization. 'Cause it can get too, like, you know, "unfrozen caveman lawyer of video archives," but I'll take it, I guess.

P1_L7 acknowledges the ways in which the local workflow diverges from the prototypical workflow and is self-deprecating of P1_L7's labor, comparing it to a cartoon character doing work in an unsophisticated way. In the process of acknowledging these limitations, P1_L7 reaffirms a commitment to the values that P1_L7 indicates divergence from. Similarly, in response to IQ7 (see Appendix D, Interview Protocol), P1_L2 acknowledges personal shortcomings when it comes to working with the audio component of the video recordings being digitized:

P1_L2 (Interview): I definitely feel like I don't uhm, know enough, all the time, I feel like that. uh... So, especially with audio. Audio is a big problem. I just like, I just don't know how to adjust audio and video, I don't always know what to listen for. I don't really know if audio is wrong, I don't really know how- it's not like video, really, where I know how to adjust it, and you have that -0, -20, if that's what you want to hit, -20 mark, but you know, do I boost the audio that's really low? Naturally, do I boost that in order to make that weird standard. So, standards can be obstacles.

P1_L2 points to gaps in personal knowledge around the correct way of applying standards to audio signals. P1_L2 feels most confident working with the video component of the signal and attempts to account for these limitations in dealing with audio in order to reaffirm a commitment to doing high-quality work. These examples suggest some of the ways in which participants acknowledge their limitations in terms of personal knowledge or institutional resources in order to affirm their commitments to

archival values in the face of breakdowns (in the system, in the quality of digital copies, as unexplainable errors, etc.) that call into question their capacities as moral actors in the practice of artisanal digital reformatting.

11.3.2 Differentiating Between Intentional and Inevitable Outcomes

Another important technique that digitizers employ for accounting for deviations from normative expectations is differentiating between intentional and inevitable outcomes. They draw a symbolic line between outcomes in the digitization process that they have control over (intentional phenomena) and those that they have no control over (inevitable phenomena). In describing the symbolic boundary between the “inevitable” and the “intentional,” Wuthnow (1987) explains: “on one side of this boundary are forces that the individual cannot control; on the other side is a realm subject to the individual’s control, a realm in which intentions govern, rather than obdurate conditions” (p. 74). By differentiating between outcomes in this way, digitizers can reaffirm their affective and actionable commitments to moral objects when the outcomes of their real projects fall short. As discussed in earlier chapters, digitizers enact intentionality through the care they give to the work in the form of epistemic techniques such as patterned viewing (Chapter 8) and “developing an eye” for errors (Chapter 9). Distinguishing between intentional and inevitable outcomes ensures that these intentional aspects of artisanal digital reformatting are directed at aspects of the video signal that are in fact actionable. As P1_L6 explained:

P1_L6 (Interview): Well, **there’s certain things that you can mediate, and then there’s a lot of things that you can’t** that were just, like, in-camera processes that you, as the digitization expert, can’t have any control of. But at least you learn to recognize those things. So, using, relying on the knowledge of others, so using the knowledge of others in the field, going to conferences.
[emphasis added, zlk]

In this case, learning to distinguish between visual elements that are due to the original production of the tape and visual elements that are introduced by the process of translation into digital form is an important tactic for legitimizing their practice. That is, being able to distinguish those outcomes that are outside of their control and those that are within their control and to which they can be held morally responsible. In Chapter 8, it was shown that digitizers enact a range of epistemic techniques in order to establish certainty in diagnosing and correcting errors. Identifying errors that are “native,” or outcomes in their work that are “inevitable,” digitizers form knowledge about what they what is beyond their control to adjust. Digitizers draw on clues from the content and materiality of the videotape to come to an understanding of what the original recording looked like. They work to construct this as the absolute limit for their ability to intervene and adjust the signal. In the process they must come to accept that the digital copy they produce cannot be improved beyond the way in which the video signal encoded on the tape was originally recorded, which they establish through historicizing the video signal (8.2.4), and drawing on knowledge about the nature of errors and their nomenclature documented in atlases (10.1.2). One digitizer described reaching a point where it is not possible to go above a certain level of quality when adjusting the video signal due to the way the tapes were original recorded:

P1_L3 (Review Session): I notice that the lines aren't going out of range... that tells me that it was recorded very brightly and I brought it down in that capture window. Sorry, I'm losing my vocabulary here. Uh, so I know that there's nothing I can do to get more detail if it was never captured.

Distinguishing elements of the video signal that can be attributed to the original recording is complicated by the fact that the tapes are often in a state of decay and that this decay adds an additional layer of uncertainty about how the video signal should look that

digitizers need to account for.¹⁰⁰ Being able to distinguish between visual errors that can be corrected and those that cannot be corrected also shapes decision-making about whether the digitization process should continue or not. This decision-making is supported by the epistemic techniques identified in Chapter 8, such as *applying calibrated vision* (8.2.1), and through their experiences identified in Chapter 9, of *training their vision* to see errors (9.1.2). P3_L2 explained how it is through experience and applying trained vision that one is able to develop certainty in making decisions about whether or not to continue digitizing a particular videotape when errors appear during the process or whether the process should be stopped and retried:

P3_L2 (Review Session): Having the experience to know if it's something worth stopping the capture for it, because you will be able to get a better result elsewhere, having the knowledge to know that even though it does look bad, this is the best result your going to get, because sometimes it is. Sometimes the tapes are just in terrible shape, and there isn't anything else you can do. You have to be sure.

Digitizers are also quick to point out that it is very difficult to know whether a visual error is correctible or not, and that this assessment is partly made based on administrative assessments related to the time available to do the work, the availability of other resources, staff schedules, deadlines and the needs of other projects being carried out at the same time. Whether or not something is “correctible” is a relative judgment that depends on the context of digitization as well as the present condition of the tape. It is possible for an uncorrectable error to possibly be correctible if given unlimited amounts of time to try out different pieces of equipment and making special adjustments. Because time is limited, the assessment of whether or not it can be corrected is based on a consideration of the particular tape, and the amount of time the digitizer has already spent

¹⁰⁰ See section 8.2.4 for a discussion of the intellectual work digitizers engage in to reconstruct the history of a tape’s material transmission and present condition.

working to get the tape to work. P1_L3 points out that a certain degree of “due diligence” is necessary to ensure that every reasonable effort has been expended to correct visual errors:

P1_L3 (Review Session): But then, always trying, doing all of the adjustments that I know I can do, that have fixed things in the past, and then if those don't fix it, then I determine that it's recorded in, or that it is something that I cannot go beyond. And then, that's when I have to say, this is good enough. I've done the best I can for this tape, with all the tricks I know.

In this example, P1_L3 is describing the care taken when going through all reasonable solutions for dealing with a problematic tape, while at the same time acknowledging personal limitations in technical knowledge, in order to reaffirm a moral commitment to the integrity and authenticity of the video recordings. In this case, P1_L3 describes running out of “tricks” for getting a tape to playback, suggesting that someone more experienced, with greater artisanal mastery could conceivably produce a better outcome. At the same time, in the first part of this quote, P1_L3 expresses confidence that by exhausting all of the known possible adjustments, P1_L3 is able to develop sufficient certainty about the nature of the errors that are being encountered. By distinguishing between those outcomes that are intentional and those that are inevitable, digitizers can identify which aspects of the resulting digital file they can be held morally accountable for and which aspects are beyond their ability to control. Being able to distinguish between the two categories of phenomena in this regard is integral for enabling digitizers to evaluate their own work and determine if they are acting morally or not. It enables them to know when to hold themselves accountable and when to accept those outcomes that are beyond their abilities to control.

11.3.3 Documenting Uncorrectable Errors

Fully documenting all aspects of the work of digital reformatting is also seen as important technique for maintaining moral commitments, particularly when uncertain or uncontrollable circumstances threaten to derail real programs. It can bring everyday work back within the bounds of normativity when deviations occur. Digitizers discuss a range of levels of documentation: documenting the decisions they make in their work, documenting aspects of their digital copies that need to be reviewed and perhaps re-done at a later date, documenting errors that cannot be resolved, and documenting the condition of the original tape for future viewers. P3_L6 pointed out how documenting the decision-making that shaped the process of digital reformatting was particularly helpful for refining policies and best practices guidelines, especially when the best way to carry out the digitization work in a particular lab had not yet been completely established:

P3_L6 (Review Session): Just knowing when something is funky, that having more confidence that we did all the right things. Or at least we know what we did. Like sometimes you might realize "that wasn't the best thing to do" but at least we.. "we've got to go back now and look at some tapes because we clearly did it this way", whatever it might be, and uh, on these tapes or in this project, and we should go back and take another look at some stuff to see if we can get a better job done. It's just documenting, for knowing what you did is important, even if it isn't the perfect thing. And maybe even more important when you're not doing the most optimal process, it may be more important [to] document what you did, because you are probably going to get less than ideal results.

Documentation of all decisions made allows for knowledge about the decisions that were made to be evaluated at a later date. Documentation also enables future preservationists to know how to adjust the video signal at a later date if the outcome turned out to be less than ideal. Documentation also enables digitizers to communicate to future users that they did the best possible transfer given the current condition of the videotape:

P1_L7 (Review Session): I always make sure to yeah, take note of, if there's damage we can't fix, or if like audio drops out, just to sort of, if audio drops out and that's just the way the tape is, I also make a note of that, so people know when they're reviewing this five years in the future that, you know, it's there for that reason, not because I screwed it up.

Documenting those aspects of the tape that are “inevitable,” that cannot be corrected, both communicates to future viewers (9.3.2.2) about how the work of digitization was carried out, as discussed in Chapter 9, and brings the work back in line with the moral commitment to maintain the values of authenticity, reliability, and identity. By documenting which errors in the visual image they could not correct, they provide a full accounting of their actions that is intended to leave no doubt in the minds of future viewers that the digital copy accurately reflects the video recording, taking into consideration the physical condition of the tape at the time the digital copy was made. By fully documenting the digitization “event” (as a documented historical event in its own right), indicating any deviations from expected practice and providing rationale for those inevitable phenomena that they have no control over, digitizers can reaffirm their commitment to preserving the authenticity and integrity of the digital copies that they produce. Documentation supports their efforts at acting with neutrality, by balancing their subjective decision-making with providing an accountable record of their actions. This enables them to reaffirm their identities as careful, “neutral” professionals (11.2.3) who exercise due diligence and expert judgment in working with the archival videotapes, and dutifully documenting all aspects of their work.

11.4 Chapter Summary

In summary, this chapter has offered a glimpse into an important cultural dimension of artisanal digital reformatting, examining the ways in which the moral codes of artisanal

digital reformatting, i.e. their expressed moral commitments to archival values, and the enactment of those values in their work as “virtuous” actions and “real projects,” are constructed and put into practice. Artisanal digital reformatting is perceived by participants not as the rote copying of information from one medium to another, but an intellectual re-construction of the identity of these types of “complex visual documents” that operates under certain moral commitments to preservation values. By distinguishing themselves from the technicians that fix their equipment (11.1), participants see their work as a special form of technical labor that is carried out with commitments to archival values. In conjunction with their expert decision-making and trained vision (discussed in Chapters 8) that enables for the diagnosis of errors and the construction of digital copies as legitimate knowledge forms, participants express commitments to archival values and can be observed putting them into practice within their work.

Participants expressed moral commitments to archival values of authenticity and integrity (11.2.1), and brought these values into practice through the virtues of consistency (11.2.2), neutrality (11.2.3), commitment to high-quality work (11.2.4), cleanliness and care (11.2.5), which act as guiding principles for everyday routines and decision-making. When actions and outcomes were perceived to be unsuccessful or problematic, diverging from normative expectations, participants employed techniques that enabled them to account for their actions, offering a rationale to reaffirm their moral commitments, including acknowledging the limitations of their knowledge and institutional resources (11.3.1), distinguishing between intentional and inevitable outcomes (11.3.2) and documenting any uncorrectable errors (11.3.3). By accounting for their deviations from normative practice, participants reaffirm their moral commitments

to archival values and make their work accountable within the practice of artisanal digital reformatting. The links that participants form between moral commitments and real projects provides a logical structure for normative practice that helps to give their work meaning. At the same time, the techniques they employ to reaffirm their commitments help to maintain the coherence and integrity of these links, and maintain their identities as preservation professionals, not the least of which is the “cleaning” rituals that express the preservationist’s devotion to preservation values. The techniques they employ for maintaining moral commitments offers insight into the cultural dimensions of artisanal digital reformatting and their role in shaping the construction of knowledge in the work of artisanal digital reformatting. The links they forge between “moral objects” and “real programs” (Wuthnow, 1987) allow participants to distinguish between their practice and non-normative forms of digital labor. The contingent and technologically complex nature of their work produces unexpected and often times unexplainable phenomena that impede the systematic application of technical knowledge. The contingent and situated nature of artisanal digital reformatting makes the construction of normativity a project that requires ongoing discursive and practical maintenance throughout the process of carrying out the work of artisanal digital reformatting.

This concludes the final of four chapters of analysis (Chapters 8-11) in this dissertation. In the next and final chapter, I will link the key findings drawn from these four chapters of analysis to the research objectives defined in Chapter 4 and explore theoretical and practical implications, discuss future research directions, and reflect on the original impetus for this dissertation project.

CHAPTER 12: DISCUSSION OF FINDINGS AND CONCLUSION

12.0 Chapter Outline

In the following chapter I will (12.1) summarize key findings drawn from the analysis presented in Chapters 8 through 11 and relate them back to the research objectives of this dissertation outlined in Chapter 4; (12.2) discuss implications of this research for archival practice and pedagogy; and (12.3) discuss future directions for this research. In (12.4) I conclude with a reflection on the original impetus for this dissertation and how the experience of carrying out this research has provided new understanding of the historical, cultural, and epistemological aspects of the practice of artisanal digital reformatting of analog video recordings.

12.1 Findings and Research Objectives

The main research objective for this dissertation was to gain an understanding into the processes of knowledge construction and the underlying epistemic practices and assumptions of media preservationists who work in the artisanal mode of preservation to produce digital manifestations of complex visual documents, specifically analog video recordings. The expression “artisanal digital reformatting” was used in this research to focus the design of this study on cases of small-scale, highly-skilled activities of digital reformatting in institutions that are committed to preserving the aesthetic and documentary properties of these types of complex visual documents. It helped to conceptualize the topic and identify a set of participants engaging in a shared practice that was constituted by common patterns of activities and epistemic techniques across participants and sites. The time period in which this dissertation research was conducted, 2015-2017, is characterized by increasing scales of digitization of texts, images, and

complex visual documents. Bounded in its data collection and analysis by a shared understanding of a type of technical work – an emergent type of work historically situated following the experimental days of digital library work (late 1990s to early 2000s) and the routinization of mass production (in the second decade of the 21st Century) – the objective of this research was to better understand how knowledge was constructed in the emergent practice of artisanal digital reformatting of complex visual documents, in particular analog video recordings.

This research identified a pattern of epistemic techniques, embodied micropractices, and moral commitments shared by preservation professionals engaged in this work when carried out by educated professionals. In the following sections I will reflect on how the findings drawn from the analysis chapters (Chapters 8-11) of this dissertation contribute to addressing research objectives outlined in Chapter 4, and discuss theoretical and practical implications. This discussion is broken down into four thematic sections: (12.1.1) constructing knowledge in the work of artisanal digital reformatting; (12.1.2) experiences of digitizers constructing visual knowledge; (12.1.3) social circulation of preservation knowledge; and (12.1.4) enacting commitments to preservation imperatives.

12.1.1 Constructing Knowledge in the Work of Artisanal Digital Reformatting (RO1)

Research Objective RO1 was to understand the epistemic techniques and processes of knowledge construction of preservationists engaged in the work of artisanal digital reformatting. The analysis in Chapter 8 helped address this research objective by offering insight into the epistemic techniques participants were observed enacting, and the ways in which they formed knowledge in their work. As discussed in Chapter 8, the video signal

that digitizers work with is an invisible signal that, unlike photochemical imaging technologies, cannot be verified with the unaided eye, but rather requires an electronic apparatus to decode and display the visual information encoded in the video signal. This adds to debates in visual and media studies around the ontological distinction between analog and digital forms of visual representation (see Furstenau, 2010 for a collection of film studies essays relevant to this debate). Analog video problematizes this distinction because while it is “analog” in the sense that it uses continuously varying signals to encode visual information, unlike photochemical systems of representation (i.e., still photography and motion picture film), it requires playback equipment to form any knowledge about the image encoded in the medium. To translate the analog video signal into digital form, digitizers must first playback the tape on a video tape recorder (VTR) to even see what images, if any at all, are recorded on the videotape. As one digitizer explained: “video is, it's complex, I would say. Compared to film, you don't need a machine to see what's on a film, while a video, you have, you're required to use a machine” (P1_L6). Because of the nature of the analog video medium, digitizers must perceive and rationalize their work in order to resolve uncertainty about whether a visual error detected on the CRT screen or on the video scopes is part of the original video signal or is due to the decisions they have made in their technical work. To form knowledge in their task, digitizers must integrate objective and subjective forms of evaluation. Working with analog video signals and making decisions about how they will appear within the representational system of digital encoding is best characterized as an interpretive act of visual translation, rather than a transfer of signals that can be resolved through objective measurements and blackboxed equipment. Unlike Shannon and

Weaver's (1949) transmission model of information transfer, the video signals that digitizers encounter in the form of measurable electronic signals and as perceivable visual representations, cannot be transferred unproblematically from one medium to another. Instead, these video signals require interpretation by digitizers in order to translate the analog originals to "legitimate" digital copies. In interviews and observation sessions, I found that digitizers often exercised their own aesthetic judgments in the final adjustments they made to the quality of the encoded digital copy, which suggests that the practice of artisanal digital reformatting relies on visual interpretation and analysis that goes beyond machine-readable transfers of encoded information from one storage medium to another.

In Chapter 8, I discussed the central focus of digitizers as centered around "signal work," or an array of micropractices that integrated manual and mental forms of labor. Central to carrying out participants' "signal work" are epistemic techniques that integrate embodied and situated knowledge with typified and historical knowledge about video phenomena. In my analysis of interviews, video observations, and review sessions, in Chapter 8, I was able to identify the following six epistemic techniques: (8.2.1) applying calibrated vision; (8.2.2) patterned viewing; (8.2.3) matching and comparing visual representations of signals; (8.2.4) historicizing the tape; (8.2.5) investigating the nature of errors; and (8.2.6) constructing copies. Each of these epistemic techniques draws on participants' cognitive processes in concert with their engagement with the materiality of video signals and the errors that may emerge from it. Developing the ability to diagnose errors depends on building up a personal stock of typifications in the form of experientially derived recognizable visual phenomena and their associated nomenclature,

which can be supplemented by visual atlases of errors. This “training” of vision can only be accomplished through the experience of the doing the work of digitizing tapes, over and over again. In the process, digitizers compare and evaluate image quality across multiple screens and instruments by integrating knowledge from their formal education about videotape technology and production histories, and their commitments to archival imperatives, such as authenticity, reliability and identity of archival documents. They train their eyes to keep moving and to constantly scan elements of the image without stopping, so that they are observing the materiality of the image rather than the representational image this is being displayed, i.e., the integrated totality of the visual, aural, and narrative structures that constitutes the “content” of the video. These systematic ways of watching are constrained within typifications of errors that grow through digitizers’ personal experiences and through referencing compilations of errors in visual atlases. Digitizers work to make their visual knowledge standardized and repeatable, even though some of this knowledge is difficult to codify and must be developed through personal experiences. Thus, the epistemic techniques that digitizers put into action in their daily work help them to form cohesive and coherent knowledge in the face of the indeterminate video signal. Developing and enacting these epistemic techniques helps digitizers to become confident in their work, which are incorporated into micropractices of detecting, identifying, diagnosing, correcting, and documenting errors. It is within these intellectual processes that the construction of digital objects emerges as a knowledge outcome, a product of artisanal processes.

The work of artisanal digital reformatting can thus be carried out by preservation professionals enacting an integrated array of epistemic techniques that together enable

their construction of knowledge around visual errors, they observe what the best copy is possible to produce given the tape's history of production and storage. Artisanal digital reformatting, understood as a form of work has material, mental, manual and moral dimensions involved in its enactment. It contrasts with mass digitization modes of digital production that are concerned with rapid throughput through automation and technical means only. This suggests that the work of translating between analog originals and digital copies is not merely a matter of copying signals from video tapes to digital systems, but that it is better characterized as interpretive work with these mental and manual dimensions that enable digitizers to observe and intervene in the "invisible" video signal in order to produce "legitimate" digital copies of analog video recordings.

These findings have several implications for theory, offering insights into (1) questions about the nature of technical work in information institutions; (2) questions about the role played by processes of typification in the construction of preservation knowledge; (3) insights into the nature of digital labor as an epistemological process; and (4) understanding other types of modern labor that involve processes of visual knowledge construction carried out under conditions of uncertainty.

First, these findings give insight into a typically blackboxed (Latour, 1999) context of digital production that provides new understanding of the complex relationship between "mental and manual" dimensions of technical labor (Barley and Orr, 1997) in an emergent context of preservation work oriented towards visually encoded forms of knowledge. The picture of artisanal digital reformatting that is presented in this research is one of productive labor that constructs new digital objects and relies on physical activities such as loading tapes, cleaning equipment, adjusting knobs on equipment and

swapping cables. At the same time, the work involves aesthetic and historical judgments in the capacity of expert decision-making that aligns the work closely with definitions of “knowledge work” in some of the sense that Alan Liu (2004) reviews in his survey of the idea of knowledge work that has been historically seen as “non-productive labor” that forms knowledge, rather than shaping matter into useful goods. In fact, artisanal digital reformatting does both: it forms knowledge and it forms new matter, as digital copies. Understanding the manual and mental labor of artisanal digital reformatting extends Stephen R. Barley and Julian E. Orr’s (1997) characterization of technical work as taking place “between craft and science,” or more recent debates in the digital humanities field around “invisible labor” (see, for instance, the 2018 special issue in *Digital Humanities Quarterly*¹⁰¹ that asks, among other things, “What is the nature of invisible work in the digital humanities, to whom is this work invisible, and why might they not see it?”). The findings of this dissertation research raise important questions about the intellectual labor of digital reformatting, its status as a hybrid of knowledge production and object construction, and its typically blackboxed status in the context of scholarly labor.

Second, considering the shaping of epistemic techniques in regards to the development of personal and community knowledge within this particular emergent occupational community (discussed in Chapter 10) provides understanding about the role played by processes of typification in constructing preservation knowledge in the work of artisanal digital reformatting. Alfred Schütz (1970) discussed the importance of typification and naming of things in the world for establishing the capacity to recognize similar phenomena in everyday experience. From a phenomenological perspective, every

¹⁰¹ The call for papers was recently issued for this special issue, and is available here: http://iwdh.cci.fsu.edu/dhq_cfp.pdf This special issue is edited by Tarez Samra Graban, Paul F. Marty, Allen Romano, and Micah Vandegrift.

repetition is an entirely new experience, so typifications produce a generalized knowledge of typical phenomena that enables the recognition of recurrence:

Strictly speaking, each experience is unique, and even the same experience that recurs is not the same, because it recurs. [...] If I recognize this particular cherry tree in my garden as the same tree I saw yesterday, although in another light and with another shade of color, this is possible merely because I know the typical way in which this unique object appears in its surroundings. [...] And the type “this particular cherry tree” refers to the pre-experienced types ‘cherry trees in general,’ ‘trees,’ ‘plants,’ ‘objects of the outer world.’ Each of these types has its typical style of being experienced, and the knowledge of this typical style is itself an element of our stock of knowledge at hand. (Schütz, 1970, p. 118)

In the case of digitizers working to digitally reformat analog videos, being able to recognize and name typical errors becomes essential for fully engaging with the stock of knowledge relevant to this occupational community in the context of an emergent practice. From the perspective of Schütz’s phenomenology, each error encountered is a unique phenomenon that needs to be linked to a particular type of error. As digitizers gain experience in artisanal digital reformatting, they learn more and more to recognize additional types of errors.

Third, by analyzing the material and discursive practices of preservation practitioners as they digitally reformat visual documents in the context of preservation knowledge, this dissertation research offers insight into the complex relationship between knowledge production in a community and its materialization within the practices of making. Silvia Gherardi and Manuela Perrotta (2013) develop the concept “formativeness,” to describe “the linkage of meaning and matter” (p. 227) in practices of material production. The use of this concept draws attention to epistemological tensions in information research between defining information as an “activity or process of endowing some material entity with form” (Peters, 1988, p. 12), and defining information

in terms of the communication of knowledge through the shaping of mental structures. Rafael Capurro and Birger Hjørland (2003) have traced the etymology of “information” from its medieval definition as the ordering of matter in the world, through its modern empiricist and later cognitivist definitions as the shaping of the human mind via sense perception. Applied to the findings of this research, *formativeness* draws attention to the iterative interplay between the unfolding of human meaning-making and the practical work of engaging with the world in order to materialize digital manifestations of visual documents. For preservationists engaging in the practice of artisanal digital reformatting, they are both actively forming knowledge about their work and forming new digital objects in the world as digital translations of analog originals.

This has implications for thinking about how knowledge is managed in information institutions and for conceptualizing the “knowledge work” of information professionals. Andrew Cox (2012) suggests “knowledge is often embedded, transitory, local and owned by a particular group, not something that can be unproblematically or apolitically ‘extracted’ or ‘encoded’ in a database” (pp. 182-183). This can be seen to make problematic efforts to codify workplace knowledge and transport it beyond the original site of construction. It also calls into question the hierarchies that work to delineate knowledge work from productive forms of labor and contributes to ongoing debates in digital humanities communities about the scholarly status of the work of assembling digital scholarly productions, such as databases, websites, etc. Concerns about changing forms of intellectual labor and credit for scholarly output in the development of scholarly tools within humanities research emerged in digital humanities projects. The distinction between artisanal and mass-produced digital reformatting echoes

these tensions in distinguishing between “productive labor” and non-productive “knowledge work.” These findings suggest that artisanal digital reformatting of video recordings, while a very niche and emergent phenomenon, is enmeshed in broader historical and cultural tensions that exist across other domains of knowledge and labor in which traditional distinctions between mental and manual labor are breaking down or need to be reconceptualized.

Fourth, these findings offer insights more generally into contexts of visual knowledge construction in which workers make decisions and act under conditions of the uncertainty related to the hidden video signal. These insights can be transferred to other emergent communities dealing with knowledge production involving “invisible” phenomena, and the translation between analog and digital representational systems. Considering this array of micropractices as a particular cluster of cognitive and embodied micropractices under the category of social action as “signal work” follows Phaedra Daipha’s (2010; 2015) research on the “screen work” that meteorologists enact within their practices of knowledge construction using video monitors to display weather simulations. For digitizers, the analysis in this dissertation suggests that “signal work” is a means for both knowing phenomena in the world and for reducing uncertainty in digitizers’ work shaping digital copies. However, in the case of digitizers, artisanal digital reformatting is seen as a blending of manual and mental labor. This dissertation research reveals these as sites of “artisanal” production, which blend intellectual labor, such as expert decision-making under conditions of uncertainty (i.e. in relation to the “invisible” signal and constructing the nature of errors), as well as embodied judging, including trained vision and engaging all of the senses to observe and intervene within the

materiality of video tapes and the playback system as a technological ensemble. Thus, artisanal digital reformatting of analog video recordings can be understood as an interpretive practice of visual knowledge construction that is both mental and manual, engaging multiple forms of epistemic techniques and, as summarized in the following section, physical activities and sensory-cognitive understanding.

12.1.2 Experiences of Digitizers Constructing Visual Knowledge (RO2)

Whereas Research Objective RO1 was concerned with how visual knowledge became typified and constructed in terms of abstract principles and epistemic techniques to support decision-making, RO2 aimed to interpret the phenomenological experiences of digitizers as they train their embodied perceptions to carry out the work of producing digital copies perceived to be legitimate in their institutions (see Chapter 4 – Research Objectives). The analysis in Chapter 9 gave insight into: (9.1) digitizers’ experiences engaging their bodies and training their vision in order to learn to carry out the work of artisanal digital reformatting; (9.2) digitizers’ experiences of reducing uncertainty in cases of breakdowns or other unexpected events; and (9.3) the ways in which digitizers temporally orient their work of artisanal digital reformatting by constructing the history of a particular video tape, while simultaneously apperceiving the posterior uses of the digital copies by future users.

All participants described a common experience of “learning through doing,” in which they described learning to train their eyes, developing the ability to detect and diagnose errors through watching images and visualizations of video signals by repetitively doing the work of digitization, through feedback from co-workers, and through references to collections of visual specimens. Digitizers characterize their

experiences of (9.1.1) “entering the field” as a process of (9.1.2) “learning how to see errors” and developing (9.1.3) “embodied judgment,” in which they engage their senses of hearing, smell and touch in concert with sight, to understand, evaluate and take action to adjust video signals in order to produce “legitimate” digital copies. Learning to see errors and engaging visual forms of knowing are supplemented by other dimensions of embodied judgment, through learning to use the other senses, such as hearing, touch and smell, to form knowledge about analog videotapes and make decisions about how best to digitize them, distinguish errors from non-errors and learning to recognize non-visual signs of tape decay. This shows how the work of artisanal digital reformatting is not purely “ocularcentric” (Metz, 1975), but that it engages the other senses in contributing to knowledge about the materiality of tapes and how they are behaving in conjunction with knowledge gained through the visual plane.

Digitizers also identify negative affective dimensions; particularly stress and anxiety that can be experienced when they first develop competence and may reemerge throughout the course of their everyday work. These affective dimensions include stress associated with experiences of uncertainty due to inexperience with particular tape formats, limitations in knowledge about tapes and video recording technologies or emergence of unexpected problems and breakdowns. Participants discussed these affective dimensions in terms of (9.2.1) distinguishing between good days and bad days; (9.2.2) fear of making mistakes; and (9.2.3) experiences of “bad tapes.” Their artisanal work can become particularly stressful when the videotapes are unique and fragile with the added pressure of knowing that this may be their last chance to digitize a particular

tape. Digitizers work to overcome anxiety and establish confidence through repeatedly doing the work of digitization and increasing personal knowledge over time.

Digitizers also make their actions meaningful by orienting them temporally. They guide their decision-making process by reconstructing the past while simultaneously looking to posterior events. By (9.3.1) “looking to the past,” digitizers apperceive the tape as an object that moves through time, accumulating traces of past events, including the conditions of its production, use and storage. As described in Chapter 8, digitizers “historicize” (8.2.4) the tape and direct their minds towards the time when the tape was recorded and the tape’s emergence in the present moment via earlier events of storage, copying and archiving. Digitizers also describe (9.3.2) “preparing for the future,” in which they direct their intentionality towards future events and people, constructing future users and uses and articulating archival imperatives of accountability and documentation as commitments to the future.

In describing their experiences of (9.3.2.1) “constructing future users and uses” participants acknowledged the inherent indeterminacy of these future users, and referred to institutional commitments (as articulated in mission statements and policies) as guiding their expectations of future users. Practices of producing written documentation of their work also plays an important role in directing their attention to the future, and is an important means of (9.3.2.2) “communicating knowledge to the future.” Through producing copies and documenting their work, digitizers see themselves as communicating across time, as stewardship work in the “knowledge continuum” (Upward, 1996), expressing their adherence to the values of accountability and transparency in the execution of the work for unknown future viewers. Within digitizers’

descriptions of how they temporally orient themselves when carrying out their work is a tension between respecting the authenticity of the “original” recording (i.e., orienting to the past) and the needs of future users (i.e., orienting to the future). In this manner, the experience of artisanal digital reformatting can be seen to be shaped by the need to balance preservation commitments to posterior users with efforts at respecting the authenticity of the “original” video recordings. This orientation is not atypical for archival work in general, but particular to artisanal digital reformatting is the fact that digitizers must engage their epistemic techniques and embodied judgments in order to construct the “original,” since it cannot be observed without the mediation of playback equipment.

The analysis in Chapter 9 offers new insights into studying visual forms of information and knowledge construction. This research shows how the use of phenomenology, in concert with ethnographic techniques of data collection, can help to give new insights into how visual knowledge is constructed as a critical component of workplace activities. This provides a unique approach for combining analysis of discourse and material practice, in order to understand the meaning of visual practice. As the insights drawn from this analysis suggest, focusing on the visual dimension of practice in these expanded dimensions offers new opportunities for considering the social construction of ways of seeing the world and their materialization in practice within the production of visual information. Phenomenology can give insights into visual and sensory-cognitive dimensions of information practice from the perspective of participants, which are otherwise difficult to capture.

The findings of this research also help to emphasize the fact that the work of artisanal digital reformatting is not solely visual, but rather also engages the other senses in significant ways. In particular, the perception of sound can be an important means for constructing knowledge about problems occurring in the tape. The perception of sound can be seen to unfold over time in a different way when compared to the video image. Whereas the video image is presented to the viewer in a rapid series of discontinuous images, the audio signal is continuous; making any problem that disrupts the continuous sound more easily detectable by the digitizer. Thus, the mental and manual work of artisanal digital reformatting depends for its competent execution on digitizers learning to fully engage their sensory capacities and trained vision with decision-making skills supported by epistemic techniques, standards, and “objective” measuring devices.

12.1.3 Social Circulation of Preservation Knowledge (RO3)

Research Objective RO3 was to understand how preservation knowledge circulates and becomes integrated into the practice of artisanal digital reformatting (See Chapter 4). Chapter 10 presented analysis of data generated from semi-structured interviews and observation sessions, which offered insight into how participants integrate knowledge drawn from community and institutional zones of knowledge into their personal knowledge in order to carry out the work of artisanal digital reformatting. Participants identify (10.1) the zone of personal knowledge as the site of their local practice where “signal work” is carried out and where they develop expertise and technical ability and they see it as the stock of all of their accumulated knowledge that they can integrate into their decision-making and evaluations of analog video signals. Understanding participants’ views on how they acquire preservation knowledge and the ways in which

they interact with it offers insights into how knowledge circulates from the perspective of local sites of practice.

From the perspectives of participants, knowledge circulates across three zones of relevance to their everyday life: (10.1) personal, (10.2) institutional and (10.3) community zones of knowledge. Within each zone, participants identified tensions between trust, credibility and the applicability of new practical knowledge into contexts of local digitization work. The circulation of knowledge across these three zones contributes to the establishment of common practices across sites as technical knowledge and ways of understanding the problems of digital reformatting are shared.

Within the zone of (10.1) personal knowledge, participants discussed drawing on four main sources of knowledge: (10.1.1) formal education; (10.1.2) manuals and atlases; (10.1.3) visual specimens; and (10.1.4) social media platforms. Preservationists use these other sources of knowledge to complement their ongoing work of learning through the experience of constantly doing the work of digitization.

The (10.2) zone of institutional knowledge is the next relevant zone in which participants describe engaging with knowledge. Within the zone of institutional knowledge, existing stocks of institutionalized knowledge may be (10.2.1) replicated through “mimetic” means, in which new workers at a site describe copying the actions of more experienced workers; or through (10.2.2) the establishment of presets and defaults on equipment to constrain action within specified limits. Knowledge is carried into the zone of institutional knowledge through (10.2.3) experts and (10.2.4) standards. These carriers of knowledge help to circulate new practical knowledge evaluated by the occupational community into contexts beyond the initial site of production. Digitizers and

administrators describe evaluating emergent standards and they may (10.2.4.1) accept and integrate this knowledge into their institutional guidelines or they may (10.2.4.2) question and reject it. In addition, digitizers discuss occasionally (10.2.4.3) being limited in how well they can carry out their work due to the constraints of standards that have been already adopted at their site, in which case digitizers may reject or actively work against the requirements of the standard.

In the (10.3) zone of community knowledge, participants describe engaging with new knowledge that is emerging in the wider community of media preservationists in the form of published reports on new digitization techniques, standards documents and the recommendations of experts, at conferences and posts on social media platforms and listserves. The zone of community knowledge consists of practitioners working in the field, as well as institutions and experts who develop and promote new practical knowledge. In this zone, preservation knowledge may become stabilized within the wider community of media preservationists. However, digitizers still evaluate this knowledge in terms of their own experiences and the conditions of their local institutional infrastructure, suggesting that even when technical knowledge has been widely adapted in the community, digitizers will evaluate that technical knowledge in terms of their local conditions before introducing any new tools, techniques or standards into work. At times participants will (10.3.1) defer to this established community knowledge and adopt it in their local work; or at other times will (10.3.2) question this community knowledge and possibly reject it. Within this evaluation of preservation knowledge in the zone of community knowledge can be detected a tension between local experience and the authority of community-wide, codified forms of knowledge. At the same time,

community knowledge may be questioned if there is still some controversy about the best way to carry out a particular preservation technique. This suggests tensions between knowledge developed through experience with socially sanctioned, “appropriate” methods, i.e. between community consensus and local understandings of what knowledge is appropriate for enactment in practice. These tensions can develop when knowledge offered by the community is seen to run counter to the experiences and expectations of digitizers in their local practice. In cases where practical knowledge may not be well established or is open to contestation, this can involve calibrating their equipment or adjusting signals *against* what the standards recommend, and instead employing their subjective judgment, integrating historical knowledge about the particularities of a tape into their final adjustments to shape the quality of the resulting digital copy.

These tensions between personal and community knowledge point to the difficulties inherent in establishing universal standards that are applicable across all sites of practice. One digitizer, P2_L2 acknowledged in the review session that it is easy to establish guidelines that say “never do this, never do that,” i.e., establishing clear prohibitions and requirements for action, but that this can never fully capture the many contingencies or unexpected events related to working with the technology that a digitizer may encounter on the job. This emphasizes the ways in which the work of artisanal digital reformatting constitutes situated action (Suchman, 1987) that cannot be fully specified and planned out in advance. This suggests there are limits to the ways in which knowledge related to artisanal digital reformatting can be codified, and that efforts at standardization and systematization will likely be in tension with the situated nature of artisanal digital reformatting.

The implications of this research can also be transferred to other contexts of emergent practical knowledge, research in digital humanities research, and other experiential forms of knowledge. It offers new understanding about the workplace knowledge of an emergent practice situated within the history of preservation knowledge, and adds to research in workplace studies. Copying from one medium to another has been used as a preservation strategy since the earliest days of recorded knowledge. In the context of the historical trends of *systematization* and *standardization* (outlined in Chapter 2), the embodied and situated practice of artisanal digital reformatting can be seen to operate at the limits of what types of knowledge can be systematized and standardized. Studying artisanal digital reformatting of analog video recordings offers a rich context for studying how specialized knowledge circulates, is managed and integrated into a complex practice of visual knowledge construction within a community of practitioners.

12.1.4 Enacting Commitments to Preservation Imperatives (RO4)

Research Objective RO4 was concerned with understanding the moral commitments and real programs of preservationists within the ‘moral order’ of preservation, particularly in terms of how the incorporation of standards and other forms of codified knowledge shapes and is shaped by institutional and professional values. The analysis in Chapter 11 addressed RO4 by integrating the analysis of participants’ statements drawn from semi-structured interviews and review sessions with data about their workplace actions by observing their work, in order to gain insight into how preservationists put their values into practice.

Analysis of digitizers' statements and actions in terms of how they articulate moral commitments and materialize them in their work suggests that the practice of artisanal digital reformatting is shaped by normative considerations that operate alongside the practical requirements of creating digital copies of analog videotapes. While their work is highly technical, digitizers (11.1) distinguished their work from other workers who engage in other types of technical labor such as equipment repair, or "non-normative" digitization work, including digitization technicians who "just push a button" and walk away and technicians engaged in mass digitization projects that focus more on speed and throughput in the production of digital copies. Digitizers made statements that emphasized their personal interest in supporting the values of preservation and the pride that they take in their work, their skills of expert decision-making and evaluation, and their trained vision that enables them to diagnose errors in the video signals. While participants in their interviews at times questioned the appropriateness and applicability of emergent community knowledge, at other times they acknowledged the power of community knowledge to shape their understanding of what it meant to act correctly in carrying out the work of artisanal digital reformatting.

The commitments of preservationists to acting within the normative constraints of the wider occupational community can be understood as forming a (11.2) link between "moral objects" and "real programs" (as defined by Wuthnow, 1987). This relationship between stated commitments to moral objects and the real projects that put those commitments into action, provides a logical structure for normative practice that helps to give the work of digitizers meaning. This provides insight into the important cultural dimensions of the work of artisanal digital reformatting. In their interviews, digitizers

expressed moral commitments to the preservation values of (11.2.1) the *authenticity* and *integrity* of documents. Commitments to authenticity and integrity are put into practice through the guiding virtues of (11.2.2) *consistency*, (11.2.3) *neutrality*, (11.2.4) a commitment to *high quality work*, and (11.2.5) *exercising care*, which is articulated through *regimes of cleaning* tapes and machines.

The efforts of participants to act “properly” within the constraints of these values and virtues can be frustrated by problematic situations that may come up. Because the work that defines this practice is contingent and technologically complex, it can produce unexpected and unexplainable outcomes that can disrupt workflows and call into question a digitizer’s expertise and commitment to preservation imperatives. When this happens, digitizers (11.3) work to account for deviations from normative practice, making their actions accountable to the moral commitments they perceive that they are deviating from. Digitizers employ three tactics for accounting for their deviations from normative expectations: (11.3.1) acknowledging limitations; (11.3.2) differentiating between intentional and inevitable outcomes; and (11.3.3) documenting uncorrectable errors.

When they perceive that their work deviates from normative expectations, digitizers (11.3.1) acknowledge their limitations both in terms of personal knowledge (e.g., a lack of experience with a particular types of video tapes) and institutional resources (e.g., a lack of video scopes within an institutional context) enables digitizers to rationalize their actions. In interviews and review sessions, digitizers were quick to acknowledge their limitations in order to inoculate their actions against expected criticisms and bring them back into alignment with normative expectations to reaffirm their moral commitments.

In order to reaffirm their moral commitments, digitizers also (11.3.2) distinguish between *intentional* and *inevitable* phenomena that they encounter in their work, particularly in terms of the uncertain nature of the invisible video signal. This gives digitizers an important way of maintaining confidence in their work even when the quality of the resulting digital copies is below their expectations. By being able to differentiate between those aspects of a particular video recording that they have control over and those that they cannot correct because they are inherent or “native” to the tape, they draw a line between errors in the video that they see themselves accountable for and those that go beyond their ability to intervene in the video signal. Being able to distinguish between intentional and inevitable phenomena is essential for digitizers to be able to evaluate their own work and determine if they are acting in conformance with their moral commitments to preservation values.

To reaffirm their moral commitments, digitizers also (11.3.3) document uncorrectable errors in order to bring their work back within the bounds of normativity. By documenting their work when it deviates from normative practice, they create a record that both communicates to future users the rationale for the choices they made under conditions of uncertainty and breakdown, and provides evidence that they did everything in their power to overcome the errors.

Together these three techniques – acknowledging limitations, differentiating between intentional and inevitable outcome, and documenting uncorrectable errors – help digitizers to return their practice within the constraints of normative action when unexpected phenomena and equipment breakdowns interfere with their best efforts to respect the authenticity and integrity of the analog video recordings they are translating

into digital form. By working to account for these deviations from normative practice, digitizers seek to reaffirm their moral commitments to preservation values. Thus, the “moral order” sustained through the work of artisanal digital reformatting, the construction of the normativity that shapes action and defines the professional and moral status of social actors enacting it, is a project that requires ongoing maintenance through actions and statements that account for deviations and reaffirming their moral commitments over time. By expressing their moral commitment to the integrity of their work, digitizers are able to re-establish themselves as particular types of subjects, preservation professionals. Understanding how digitizers articulate and enact their commitments to preservation values, especially when disruptive events in the course of their everyday work call their commitments into question, offers insight into the cultural-cognitive dimensions of knowledge construction in the work of artisanal digital reformatting.

The analysis in Chapter 11 also helps to contextualize the findings from Chapter 8 that establish the practice of artisanal digital reformatting as an interpretive form of knowledge work that blends mental and manual labor, giving insight into the cultural-cognitive dimensions (Scott, 2003) of knowledge construction in the practice of artisanal digital reformatting. This offers insight into cultural factors that shape the movement of preservation knowledge across personal and community zones, indicating that the commitments of preservation professionals to preservation values may play a role in shaping the degree to which practitioners will integrate new knowledge into their local work. This research contributes to scholarship in archival studies that is concerned with cultures of preservation in institutional contexts.

Chapter 11 also offers understanding of some of the ways in which preservation professionals put their values into action, as well as into the construction of practitioner identities as preservation professionals. While much of their work involves the application of highly technical forms of practical knowledge, they distance themselves from other technicians, such as the repair technicians who come to their video preservation labs to fix malfunctioning equipment. Instead, digitizers characterize their work as a form of expert decision-making and evaluation.

Understanding the construction of archival identity and the enactment of archival ethics through empirical analysis of participants' statements and actions makes an important contribution to cultural research in archival studies (e.g., Heather MacNeil, 2011, provides an analysis of the changing ethics of preservation professional under conditions of emergent record-keeping technologies). In particular, this dissertation presents new understanding of the material, cognitive, and moral dimensions of how preservation knowledge is integrated into material practice. In the work of artisanal digital reformatting, digitizers were observed expressing commitments to both the original analog video tape that is the source of the video signals they observe and adjust as well as the resulting digital copy, which suggests a larger commitment to the integrity of a conceptual entity beyond any particular material manifestation, the "identity" of a work. Artisanal digital reformatting is thus not merely a rote copying of signals from one medium to another, but a re-construction of the identity of visual documents.

12.2 Implications for Archival Practice and Pedagogy

The findings of this dissertation research also have implications for archival practice and pedagogy. It provides new understanding about (12.2.1) the limitations of standardization

efforts; (12.2.2) the importance of experiential and visual knowledge in the education of moving image preservationists; and (12.2.3) the work of preservation professionals.

12.2.1 Limitations of Standardization Efforts

This research suggests that there may be practical limitations to the efforts of institutions and experts in the preservation community to encode practical knowledge into standards and best practices documents. The complex array of epistemic techniques participants were observed enacting and the central role played by personal experience in developing competence in their work can be seen as barriers to codifying knowledge about artisanal digitization practices for widespread adoption. When contextualized within the historical trends in the field of preservation knowledge that were identified in Chapter 2, processes of *centralization* and *standardization* developing over the last half of the 20th century and continuing into the 21st century, these findings suggest that the practice of artisanal digital reformatting may be in tension with these broader historical trends in the preservation field. Since the 1980s, large institutions in the preservation field, such as the Library of Congress, and international standards bodies, such as ISO (International Organization for Standardization) have worked intensely to establish standards and guidelines for a range of preservation processes and formats, including standards for guiding digital reformatting efforts. This dissertation research suggests that because there are embodied and experiential dimensions to the work of artisanal digital reformatting there are limits to what aspects of it can be codified in “universal” standards documents that can be used across all sites of practice. Furthermore, while certain aspects of digitization such as particular settings on equipment or methods of calibration of equipment may be easily transmitted by documents in this way, the total integration of those techniques into

meaningful practice requires learning from experience and situated judgment on the part of the digitizer that cannot be codified into totalizing “plans” (Suchman, 1987) and encoded as standards documents. This also contributes to debates in digital humanities research about the movement from discourse-centered humanistic scholarship to an “epistemology of doing” in which, according to Natalia Cecire (2011), “not only have *signs* lost the power to *do*, but *doing* has also lost its power to *signify*” (para. 8, *original emphasis*). When work cannot be signified it risks becoming invisible labor. Given the ways in which the work of artisanal digital reformatting is concerned with resolving uncertainty and integrating multiple forms of material and historical knowledge to re-construct a legitimate version of the original signal, there may be limits to what aspects of this practice can be standardized.

12.2.2 The Role of Experiential and Visual Knowledge in the Education of Moving Image Preservationists

The analysis of this dissertation research also has implications for moving image preservation education. These findings indicate that the work of artisanal digital reformatting draws on digitizers’ sensory, physical and cognitive abilities. The initial development of those abilities, when digitizers enter the field and begin doing the work of digital reformatting, is characterized by anxiety and uncertainty. If experiences of anxiety and uncertainty are common throughout the community of media preservationists when first entering the field and as well as throughout their work, then educators and managers could take steps to manage anxiety and stress at the critical points of entry into the practice, such as offering reference materials that identify common problems with accompanying visual illustrations, or providing opportunities for digitizers to gain more experience in educational programs through extended apprenticeships in digitization labs.

The findings also suggest the usefulness of atlases of collections of visual errors and other visual specimens that can be used by digitizers as references for developing typified knowledge of visual errors they may encounter in video signals. These collections of visual specimens of errors encode a lifetime of observations and experiences of video errors into a mobile form that can be used as a reference by digitizers with different levels of experience in the field. These visual guides are necessary for developing the requisite knowledge for detecting, identifying, and diagnosing errors in the video signal. Learning through these visual examples, coupled with historical knowledge of media production practices and the particularities of how certain media formats behave, are important elements of knowledge construction of artisanal digital reformatting that could be supported through formal education programs.

The analysis provided in Chapters 8, 9 and 10 indicated the important role that “learning by doing” and hands-on experiential learning play in the successful development of educated perception and expertise necessary for digitizing analog video recordings. At the same time, the analysis in Chapter 11 indicates that the development of cultural understanding, being able to distinguish between normative and non-normative actions, also plays an important role in constructing knowledge necessary for competence in the practice of artisanal digital reformatting. In this case, formal education could likely play a significant role in the process of enculturation that introduces and internalizes preservation values and concepts for students and other novices to the field. Formal education in preservation concepts and values helps to establish a foundation for digitizers to integrate practical knowledge into the normative expectations of their occupational community.

12.2.3 Implications for Preservation Professionals

Studying artisanal digital preservation work, a practice that is typically blackboxed in information institutions, provides a better understanding of how the work of digitization is actually being carried out. This offers insights for managers, experts and organizations responsible for teaching digitizers to do the work of artisanal digital reformatting. As was observed in this research, digitizers and administrators evaluated the applicability of new preservation knowledge to their local context by drawing on their personal experiences and through assessing how the standard might fit into their local context. If new knowledge is to emerge from the zone of community knowledge and successfully become integrated into institutional and personal zones of knowledge, it will likely need to be perceived by local digitizers as able to fit with the personal knowledge that they have developed over time by doing the work of digitization and within the bounds of the institutional resources (e.g., compatibility of a new technique with existing equipment) at their sites. Since this may impact the adoption of their recommendations, managers and experts may find it helpful to consider these aspects when making a particular recommendation for the community or in attempting to produce standards for widespread adoption. This research also suggests that it may be helpful for managers and experts to differentiate between types of knowledge that can be codified in standards and those that cannot; i.e., that not all forms of knowledge can be codified into standards, and that some forms of practical knowledge can only be learned through the experience of carrying out the work. Within the zone of institutional knowledge, existing stocks of institutionalized knowledge may be (10.2.1) replicated through “mimetic” means, in which new workers at a reformatting site describe copying the actions of more experienced workers.

There are many tacit and embodied aspects of the knowledge of artisanal digital reformatting that resist being fully learned in a classroom setting. The findings of this research support the use of internships and apprenticeships to gain the “on the job” knowledge necessary to train their vision and “develop an eye” for errors and the embodied skills necessary to competently carry out the work of artisanal digital reformatting, even as formal education provides the concepts and values necessary for understanding the moral imperatives of the practice of artisanal digital reformatting.

12.3 Limitations and Future Research Directions

There are several limitations of this dissertation research and possible directions for further research. First, the context of artisanal digital reformatting limits the transferability of the findings of this research. In order to study the practice of artisanal digital reformatting of analog video recordings, the context of this research was limited to a particular set of institutions (i.e., those concerned with preserving the aesthetic and documentary qualities of analog videotapes) that were engaged in a particular mode of digital reformatting (i.e., artisanal digital reformatting) and were digitizing a particular format of complex visual document (i.e., analog videotapes). Future research could study knowledge construction in other types of organizations, other modes of digital production, such as in mass digitization projects that rely on higher output and lower skilled labor to product their digital products, or other types of complex visual documents, such as multimedia museum installations. The research sites studied each place significant value on the documentary and artistic attributes of visual documents, while other organizations that collect complex visual documents, such as large film and television archives may focus more on their value as entertainment or as objects of

cultural heritage.

A significant methodological limitation of this research is that it studied each of the six research sites for a short period over 1-2 days, effectively capturing slices in the time of the work being conducted at each site. Future research could employ more longitudinal, ethnographic research methods, focusing on one site over several months rather than multiple sites for brief periods of data collection. This method would help generate richer data and make it easier to study the interpersonal activities of knowledge construction across the entire group of people at one site, not just individuals working alone carrying out the work of artisanal digital reformatting. This research would look at how knowledge is constructed through intersubjective interactions, in order to understand how knowledge is actively debated between preservationists interacting within their sites of digital production. Because the work tasks that were the focus of this dissertation research were typically carried out by digitizers alone, and the primary focus of this research was on the work of individual digitizers doing their work, analysis of digitizers' interpersonal interactions was not fully captured in this research. To fully understand the circulation and construction of knowledge of artisanal digital reformatting and its integration into the larger work of organizations and the general occupational community, using additional qualitative methods (for instance, long-term ethnography) conducted at additional research sites could help better understand the interpersonal dimensions related to the social shaping and transmission of preservation knowledge. Furthermore, expanding the methodology in this way could help to answer other questions about other institutional factors shaping the work of digitizers. For instance, the doubt and lack of confidence that participants sometimes expressed in their interviews and review sessions

could be attributed to the complex technical and often indeterminate structure of their work and the lack of consensus in their occupational community about the adoption of standards. However, their doubt and uncertainty could be related to their positions within the hierarchy of their institutions. Further research that expands data collection to examining digitizers' relationships and institutional positioning within the wider contexts of their organizations could provide some insight into this area.

The methodology of this dissertation could be applied to other contexts in which information professionals translate visual information from one form to another. This is particularly relevant to other institutional contexts, such as museums in which digital artworks are being acquired and need to be conserved under the risks posed by technological obsolescence and decaying media formats. Further, the methodology used in this dissertation research could be applied to looking at the embodied practices, epistemic techniques and practices of knowledge construction of museum conservators as they work to construct the meaning of digital works of art in which the concept of "the original" is problematized by the dynamic, complex and technologically-dependent materiality of the artistic medium.

12.4 Conclusion

I conclude this dissertation with some reflections on its original impetus. As I had mentioned in the introduction to this dissertation, my initial concern for examining artisanal digital reformatting as a context of knowledge construction was tied to my interest in gaining clarity about the ways in which codified forms of knowledge are integrated into preservation practice in the field of moving image preservation. The big mystery for me was why standards played such a large role in the construction of

professional practice for novices in the field, drawn from anecdotal evidence from my experiences working with students in a moving image archiving educational program. I had assumed that standards would function as unambiguous sources of authoritative knowledge guiding digital reformatting work, but what I found instead was that standards were sometimes contested, debated and/or resisted by media preservationists. The clamoring of first year preservation students for knowledge about the correct standards to implement could then be imagined as a logical quest to reduce uncertainty in their role as neophytes in a new and overwhelming field of practice. Standards likely appeal to first-year students because they purport to offer easy “recipes” to follow for the choosing of digital formats and the carrying out of digitization techniques. In fact, as this dissertation research has shown, before adopting any standard, media preservationists will often evaluate the standard’s suitability in terms of their previous experiences of digital reformatting and their institution’s existing technical infrastructures. In addition, standards can be seen to be in conflict with the unpredictable nature of this work. As explored in Chapter 11, the contingent and technologically complex nature of the work can produce unexpected or unexplainable phenomena that impede the systematic application of technical knowledge. From these findings, students might be advised to consider standards as provisional, contestable in some contexts and acceptable in others.

In addition to these insights into the role of standards in the artisanal digital reformatting of analog videotapes, taking a phenomenological perspective on this practice allowed me to examine the statements of digitizers as their interpretations of the lived experience of carrying out the work of artisanal digital reformatting. The resulting analysis draws attention to the embodied aspects of this work, and the ways in which

digitizers engage their sensory abilities in developing knowledge about the phenomena they encounter. At the same time, adopting a phenomenological perspective gives insight into different sites and carriers of knowledge that present different degrees of relevance to digitizers when they construct knowledge for carrying out their work.

Within the context of the history of preservation knowledge (reviewed in Chapter 2), we can situate the work of artisanal digital reformatting within traditions of copying as a means of preserving recorded knowledge, alongside such historical contexts of copying as scribes copying manuscripts in the medieval period or the microphotography used in libraries to preserve newspapers in the 20th century. As one link in the chain of custody between the originary moment of document creation to its consumption, storage, copying, and future re-use, the particular actions of a digitizer in the process of carrying out the work of digital reformatting becomes part of the history of these visual documents. Through this process, digitizers not only make a new copy but also their work can be seen to reconstruct the identities of the complex visual documents themselves. From the perspective of textual studies, parallels can be found between the work of digitizers and the work of scholarly editors attempting to recover an ideal text from corrupt extant materials. Digitizers must account for “corruptions” in the copies they produce, noting any errors that they detect but cannot correct. Notably, the errors they are working with are often “machine” errors produced by the interactions of the videotape, the video deck, and the various mediating video components. These errors are in many cases related to the often unpredictable functioning of the medium itself (the videotape and all of the technological components of the signal chain), rather than solely due to intentional or unintentional “scribal deviations” from the text being copied. Thus,

digitizers are not only worried about making mistakes that embed visual errors within the copies that they produce, but are also worried about the possibility of failing to properly manage and account for errors through the course of their signal work. Furthermore, their abilities to examine the evidence at the level of image and signal, contextualized within their knowledge of production technologies and techniques, enables them to correct for errors, adjust video signals without distorting them, and account for any errors that could not be corrected for. They are concerned with communicating their work to the future users of the digital copies that they create, and in this sense they are fully aware of their roles in the shaping of the social and technical conditions in which these complex visual documents are transmitted to future generations.

While the work of digitizers similarly contributes traces of their human activity to the copies they produce, the work of artisanal digitizers diverges in significant ways from the work of careless scribes and compositors. In particular, digitizers articulate commitments to preservation imperatives and in light of these they take steps to document the uncorrectable “corruptions” that they may detect in the final copy as well as any deviations they make from professional norms. Professional preservationists feel the import of their work in terms of the expected impact on the future of recorded knowledge, and as has been observed in the analysis drawn from participants’ statements and activities, they take great pains to ensure that their work does not embed human error in the copies that they produce and that they account for all errors that are “native” to the complex visual documents that are entrusted into their care. Documenting the “event” of copying enables digitizers to record details of the moment of translation from the analog to the digital worlds of representation and works to communicate to future viewers/users

about the context in which the tapes were copied (the choices made, equipment used, errors that could not be corrected, etc.).

Based on a thorough analysis of the material practices and discourses of digitizers in this study, this research shows that the work of artisanal digital reformatting should not be characterized as the simple, unproblematic transferring of signals, but instead understood as an interpretive activity that works to reconstruct and recreate the material as well as the intellectual identities of the complex visual documents that analog video tapes constitute. While the mainstream discourse in information studies conceives of digitization as a problem of verisimilitude predicated solely on the “truthful representation” of information content, this research shows that the work of digitization also constructs the identities of these complex visual documents through documentary practices, by reconstructing their identities from indeterminate electronic signals, and by positioning them in time. Furthermore, this research shows that this work requires cultivated methods of visual interpretation. It is carried out with digitizers’ trained vision, which draws on particular ways of watching visual representations and reconstructing clues of historical moments of production and storage. The structure of these practices becomes similar across sites because the work of artisanal digitizers is structured by a common problem space and set of technical requirements for constructing knowledge of the indeterminate video signal, and by the circulation of technical knowledge across zones of knowledge (personal, institutional, and community knowledge), which enables a shared understanding of the current knowledge and preservation imperatives of their occupational community. Furthermore, the labor of digitizers is both mental and manual, as it involves constructing meaning from diverse visual phenomena, evaluating the visual

“data” available for them on the scopes and monitors in order to properly adjust tape decks, swap cables to shape the signal chain and the hidden flow of signals through different components, and calibrate equipment in order to carry out the work in a “legitimate” way, i.e., in a way that conforms to their commitments to preservation imperatives.

Analysis of the artisanal digital reformatting work of my participants can also be used to reflect on larger issues of digital labor and knowledge work in the present historical and cultural moment. Within recent research in information studies, there is a growing recognition that the particular ways in which the work of digitization is carried out shapes the ways in which digital copies will appear and how they can be used. For instance, Bonnie Mak (2014), in her analysis of how practices of digitization shaped the meaning of the *Early English Books Online* (EEBO) database, points out that methods of copying play a role in shaping the meanings of reformatted documents; and Paul Conway (2013), in his analysis of the prevalence of errors in the digital images of books stored by the HathiTrust, showed how techniques of digitization embed new errors in the resulting digital copies. There is also growing popular recognition that the mass-produced digital reformatting of the Google Books projects is adding many “errors” to the digital scans that are filling up the Google Books corpus. The fingers, distorted text, and mutilated images seen throughout the Google Books corpus (Goldsmith, 2013 refers to these as “artful accidents”) dramatically shows the difference in the care and quality of the work of the digitizer in this mode of unskilled mass production, in comparison to the work of artisanal digital reformatting. The mode of digital production clearly has an impact on the quality and meaning of the resulting digital copies.

In this dissertation, focusing on the practice of artisanal digital reformatting of analog video recordings as my context of study allowed me to examine the ways in which small-scale digitization work reveals tensions between the historical trends of *systematization* and *standardization*, as identified in Chapter 2. In this research, the practice of artisanal digital reformatting was found to have a complex relationship with standards, with participants at times embracing them as necessary for constructing a legitimate practice, and at other times rejecting them as contradicting experiential knowledge or not fitting with the capabilities of local infrastructures. Reviewing the history of preservation knowledge and practice leading up to the present moment in which digitization has been widely embraced as a preservation strategy reveals overarching trajectories in the field of research in preservation knowledge towards greater systematization and standardization, which can be seen to contribute to efforts to professionalize preservation practitioners working in specialized subfields (e.g., video preservation). While I have identified some of the theoretical implications of this research that may have some applicability outside of this research context, it is important to stress that artisanal digital reformatting is an emergent phenomenon. The multi-faceted holistic picture of the practice of artisanal digital reformatting provided through the analysis of research data generated with my participants through semi-structured interviews, observations, think aloud, and review sessions is dependent on a particular historical configuration that could shift over time. As new techniques of preservation develop and videotape playback equipment becomes increasingly rare and difficult to repair, artisanal digital reformatting of analog videotapes could become less common. Indeed, at one of the sites studied in this dissertation research (Site L1), it was revealed that they rarely

carry out digitization projects any more because nearly their entire collection of analog tapes had been digitized over the last few years. Thus, over time, artisanal digital reformatting will likely become increasingly rare, especially as recent projects by such organizations as the Smithsonian Institution (2016) and Indiana University (Lacinak and Dunn, 2016) move forward with *mass* digitization projects of complex visual materials.

The findings of this research also support social practice theory approaches to information that conceptualize information as something that can never be fully extracted from its context and codified in a standard or in a database structure (Cox, 2012). These findings draw attention to the extensive practical and theoretical knowledge, and the moral commitments to preservation values, necessary for competently engaging in the practice of artisanal digital reformatting. From this research we can see that digital reformatting is not a mere pressing of a button, but that in the hands of professional digitizers working within the constraints of artisanal digital reformatting, it becomes a meaningful practice. Furthermore, the manifestations that are produced are better understood as interpretive translations rather than neutral transmissions of information encoded in signals. The history of recorded knowledge is characterized by such interpretive moments of translation. In the case of analog video recordings, these moments are punctuated by video errors and unexpected technological breakdowns that shape the appearance and meaning of recorded visual knowledge. Like the layers of “head-switching”¹⁰² that video preservationists see accumulating along the bottom edge of the video image with each new act of analog duplication, each moment of copying

¹⁰² See footnote 40 for a definition of “head-switching.”

leaves its trace and becomes part of the history of the document's transmission (see detail of head-switching in Figure 15 below).

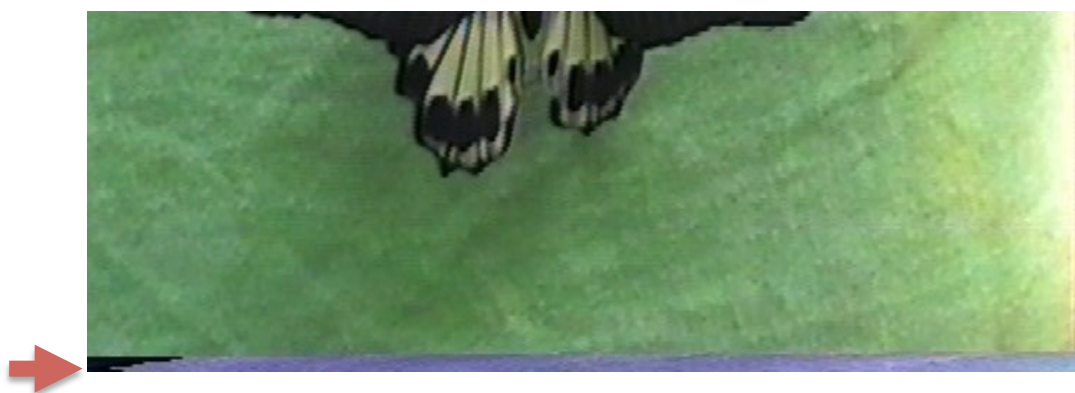


Figure 15 – Detail of Bottom Edge of Video Frame Showing Head-switching
(From *The A/V Artifact Atlas*)¹⁰³

In closing, this dissertation set out to investigate the complexities of a practice that translates visual information from one medium to another in order to preserve it for future generations. By better understanding how the work of digital reformatting is carried out, we can better interpret the resulting digital copies, both in terms of why they appear the way they do and the cultural context from which they emerge. By studying the discourses and material practices of the typically blackboxed video preservation lab, we can better interpret the vision of the past that these documents provide for us. By knowing the particularities of the epistemic, embodied and moral dimensions of the social activities that produce these digital manifestations of analog videotapes, we can begin to see the tapes through the eyes of those who copied them.

¹⁰³ https://bavc.github.io/avaa/artifacts/head_switching_noise.html

Appendix A – Emails to Site Administrators

Dear [site administrator's name]:

My name is Zack Lischer-Katz and I am a graduate student at Rutgers University. I got your contact information off of the AMIA Member Directory. As part of my research on how knowledge is constructed around digitization practices in cultural heritage institutions, I am hoping to conduct interviews/observations with any of your staff members who are currently involved in preservation projects digitizing film and video collections.

I am also including a full description of my research project below so that you will have a better idea of how the project will be conducted.

If you would be willing to conduct these interviews onsite at your institution, please send a letter of permission and a list of possible interviewees that I may contact in order to set up interview sessions.

Please feel free to call me at 413.522.2636 or email me at zack.lischerkatz@rutgers.edu to discuss this further

Thank you very much for your consideration. I look forward to hearing from you.

Regards,

Zack Lischer-Katz

Project Title: *Epistemologies of Artisanal Digital Reformatting*

Purpose of Study:

The proposed research seeks to explore the ways in which standards, professional discourses and epistemic assumptions shape, and are shaped by the practices of preservationists engaged in digitizing complex visual materials in information institutions (i.e., libraries, archives and museums). To do this, organizations engaged in small-scale, “artisanal” digitization activities involving complex visual media, such as film and video, have been selected to understand how visual knowledge is constructed in preservation practice.

Data Collection:

Interviews and observations will be scheduled from February 15 to April 30, 2016. Observation sessions will involve observing and recording participants carrying the various stages of the digitization process, and will be conducted at the locations where participants are engaged in digitization practices. Observations will take place over two days: Day 1 will involve visiting the site and observing the overall workflow. Day 2 will consist of one-on-one observation sessions with preservationists involved in digitization projects, asking him or her to reflect on the physical and visual dimensions of the experience and the role of standards in carrying out these techniques, which will run 1-3 hours depending on the complexity of the digitization project. Interviews will take place off-site (either in-person or over the telephone) and will run from 2-3 hours.

Confidentiality:

All responses, practices and any internal documents provided by the organization will be kept confidential and stored securely, and will be destroyed within a year of completion of the project.

If you would be willing to let me conduct research at your site, please provide a letter directed to the Rutgers University, Office of Research and Sponsored Programs, on your company's letterhead, stating that you are giving me permission to interview and observe employees in spaces that you oversee. I can send a form letter, if it would be helpful. Once I receive a letter from you, I will ask you to send out my recruitment letter, which will stipulate how confidentiality will be maintained and provide information about informed consent procedures, so that employees may be fully informed about the project and may choose to participate or not.

Appendix B – Participant Recruitment Letter

Call for Participation

Epistemologies of Artisanal Digital Reformatting

Objectives of the Study:

In the age of mass digitization, more and more of our access to preserved documents is mediated by standardized digitization technologies. However, the digitization of visual media still often involves skilled, small-scale digitization techniques. How do preservationists construct knowledge around these skilled, “artisanal” practices of digitization? The proposed research seeks to explore the ways in which standards and guidelines, professional discourses and epistemic assumptions contribute to the constitution of preservationists’ practices of digitizing visual materials for small-scale projects in libraries, archives and museums.

Participant Characteristics:

I would like participation from those who work in preservation institutions (libraries, archives or museums) that engage in digitization for preservation of visual materials. Any employee in these organizations involved in the planning, implementation and/or execution of digitization projects is welcome to participate. I hope to talk with participants who have a range of educational and professional backgrounds and hold various roles and responsibilities in their organizations.

The Interview Procedure:

The questions to be asked will be presented to the participants prior to the interview. The interviews will last 1.5-2.0 hours. Interviews will be conducted by the investigator in person and will be audio-recorded and transcribed. In addition to interviewing, this research also employs participant observation methods to better understand the role of embodied forms of knowledge and educated perception of participants in engaged in the physical techniques of digitization. The observation procedure will involve videorecording the participant as he or she carries out digitization tasks, and asking him or her to reflect on the kinesthetic and visual dimensions of the experience of digitization. The length of observation sessions will run from 1-3 hours depending on the complexity of the digitization project.

All data collected will be kept confidential. There are no expected risks or benefits associated with your participation in this research.

When? Where?

Interviews and observations will be scheduled from February 15th, 2016 to May 31st 2016. Observations will be conducted at the locations where participants are engaged in digitization practices and interviews will be conducted off-site, either in person or over the telephone.

Outlets for Distribution of Research Results:

I plan to report on the preliminary results of this research at the 2016 Association for Information Science and Technology annual conference in Copenhagen, Denmark, and publish several papers in library and information science journals (Journal of the Association for Information Science and Technology (JASIST), Library Quarterly, and Journal of Documentation). In reporting on the research, the confidentiality of the participants will be assured. Any information obtained in connection with this study that can be identified with you will remain confidential and will be disclosed only with your permission.

If you would like to participate:

Please contact Zack Lischer-Katz via email at zack.lischerkatz@rutgers.edu, or at the address provided below. Once the date/time is set for the interview and observation, you will receive the questions and the consent form that includes information as mandated by the university. I will talk to you about the process and answer any questions you may have about the study.

Zack Lischer-Katz
PhD Candidate
PhD Program in Communication, Information & Library Studies
School of Communication & Information
Rutgers, The State University of New Jersey
4 Huntington Street
New Brunswick, New Jersey 08901-1071
Phone: 413.522.2636
Email: zack.lischerkatz@rutgers.edu

Appendix C – Participant Informed Consent Form

INFORMED CONSENT FORM *Epistemologies of Artisanal Digital Reformatting*

You are invited to participate in a research study that is being conducted by Zachariah Lischer-Katz, who is a PhD student in the School of Communication & Information at Rutgers University. The purpose of this research is to understand how preservation knowledge is constructed around digitization practices in small-scale digitization projects involving visual formats.

Approximately 12 participants will participate in the study, and each individual's participation will last approximately 3-6 hours.

The study procedures include an on-site observation session (1-3 hours) followed by an off-site interview session (2-3 hours). The observation session will involve asking you to carry out and reflect on your everyday digitization tasks and describe each step in the process as you carry it out. The interview will ask you to describe the work tasks you carry-out in the process of conducting digitization projects and the training you received that enabled you to do this work, and will ask you to reflect on your experiences of digitizing visual materials.

This research is confidential. Confidential means that the research records will include some information about you and this information will be stored in such a manner that some linkage between your identity and the response in the research exists. Some of the information collected about you includes educational background, work training and your experiences working on digitization projects. Please note that we will keep this information confidential by limiting individuals' access to the research data and keeping it in a secure harddrive within password-protected folders.

The research team and the Institutional Review Board at Rutgers University are the only parties that will be allowed to see the data, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. All study data will be retained for three years and then destroyed.

There are no foreseeable risks to participation in this study. There are no expected benefits of taking part in this study.

Participation in this study is voluntary. You may choose not to participate, and you may withdraw at any time during the study procedures without any penalty to you. In addition, you may choose not to answer any questions with which you are not comfortable.

If you have any questions about the study or study procedures, you may contact me by phone at 413.522.2636, by email at zack.lischerkatz@rutgers.edu, or by mail at School of Communication & Information, 4 Huntington Street, New Brunswick, NJ 08901. You may also contact my faculty advisor, Dr. Marija Dalbello by phone at 848.932.8785, or by email at dalbello@rutgers.edu.

If you have any questions about your rights as a research subject, please contact an IRB Administrator at the Rutgers University, Arts and Sciences IRB:

Institutional Review Board
Rutgers University, the State University of New Jersey
Liberty Plaza / Suite 3200
335 George Street, 3rd Floor
New Brunswick, NJ 08901
Phone: 732-235-9806
Email: humansubjects@orsp.rutgers.edu

You will be given a copy of this consent form for your records.

Sign below if you agree to participate in this research study:

Subject (Print) _____

Subject Signature _____ Date _____

Principal Investigator Signature _____ Date _____

Audio/Visual Addendum to Consent Form

You have already agreed to participate in a research study entitled: *Epistemologies of Artisanal Digital Reformatting* conducted by Zachariah Lischer-Katz. We are asking for your permission to allow us to video and/or audio record your interview and observation session as part of that research study. You do not have to agree to be recorded in order to participate in the main part of the study.

The recordings will be transcribed by the primary investigator and used for analysis by the research team.

The recordings will be labeled with an assigned participant identification number, which will be linked back to your identifying information only through a codebook stored in a password-protected folder by the principal investigator. If you say anything that you believe at a later point may be hurtful and/or may damage your reputation, then you can ask the interviewer to delete that section of the recording OR you can ask that certain text be removed from the dataset/transcripts.

The recordings will be stored as files in a password-protected folder on the principal investigator's laptop. The recordings will be kept until the project is completed, at which point they will be destroyed.

Your signature on this form grants the investigator named above permission to record you as described above during participation in the above-referenced study. The investigator will not use the recording(s) for any other reason than that stated in the consent form without your written permission.

Please select which format of recording you consent to:

Video (sound & image): _____ **Audio Only:** _____

Subject (Print) _____

Subject Signature _____ Date _____

Principal Investigator Signature _____ Date _____

Appendix D – Interview Protocol

Interview Questions

1. Please briefly introduce yourself in terms of your background, work experience and position within your organization.
 - a. How would describe your professional identity?
 - b. How do you define “preservation”?
2. Tell me about the history of your job and the role you play in your organization.
 - a. How long have you held this position?
3. Please briefly describe the digitization initiatives and projects you have been or are currently involved with in your organization.
 - a. What role do standards and guidelines play in digitization projects at your organization?
 - b. How would you describe your involvement with digitization initiatives at your organization?
4. What background preparation do you (or other preservationists) receive in order to carryout digitization projects?
 - a. How did your organization determine that you (or other preservationists) were qualified to do this work?
 - b. What types of activities did you need to practice in order to feel confident in carrying your job out?
5. How would you describe the types of materials that you digitize?
 - a. Who do you expect will use the copies you create?
 - b. How does this shape your work?

6. Please describe the key steps in your digitization process.
 - a. Which steps involve the most attention?
 - b. Which have become “automatic” and require less attention?
7. What were the major obstacles you encountered in the most recent digitization initiative?
 - a. How might this differ from your expectations?
8. How has your professional practice changed in the process of carrying out the most recent digitization initiative?
9. How do you evaluate the quality of the digital copies that you create?
 - a. How did you learn how to do that?
10. Please describe the experience of conducting your work on a typical day.
 - a. What would constitute a “good day”?
 - b. What would you consider a “bad day”?
 - c. Can you give me an example?
11. Please describe the steps you carry out when calibrating your equipment.
 - a. How do you monitor the process of digitization?
 - b. What types of tools do you use in carrying out these tasks?
12. How does the approach to digitization in your organization compare with the work done in other organizations?
13. What specific standards or guidelines have been important for carrying out digitization projects? What standards have been a barrier to your work?
14. How do you make decisions in your organization about what procedures, standards and technology to use?

- a. How do you evaluate the effects of your decisions?
 - b. Please describe the process of decision making.
15. How does the adoption and/or use of standards shape how you understand your professional identity?
16. In what ways has your organization's use of standards impacted its access to funding (from granting agencies, donors, government agencies, etc.)?
17. How do standards get talked about in your organization?
18. What sources of information are used to make and evaluate decisions about digitization?
- a. How do you evaluate the impact of decisions you make about digitization projects?

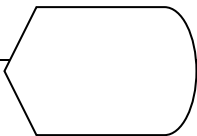
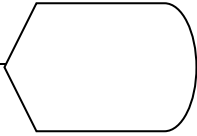
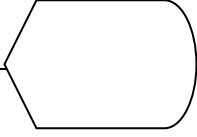
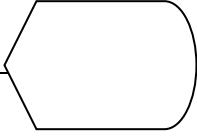
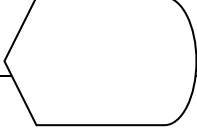
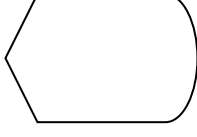
Appendix E – Observation Guide

Each participant will be asked to show the range of typical digital reformatting tasks that they engage in. Ideally, the observed tasks will be the actual work that they would be conducting if the researcher were not present. During the course of the task, they will be asked what “stage” of the task they are entering. Video will be recorded during the session on a digital camera. The following guidelines will structure the observation sessions:

1. Ask the participant to “think aloud” through the process and describe what they are thinking and their visual and kinesthetic experiences.
2. Ask each participant to identify the stages of the digital reformatting process as they work through them.
3. Each stage identified by the participant should be added to the form below to create a flow chart of the digital reformatting process from the perspective of the participant. This chart will be used to organize notes about the stages in the process of digital reformatting.
4. The video recording and the chart will be used in the interview session to aid in participants’ post hoc reflections and interpretations for their practices of digital reformatting.

Stages of Digital Reformatting

Date: _____ Participant ID: _____ Location ID: _____ Page# ___ / Materials Digitized: _____

Artifacts:	Stage:	Practices:	Documents:
			
			
			
			
			
			

Appendix F – IRB Exemption Letter

RUTGERS

Office of Research and Regulatory Affairs
Arts and Sciences IRB
Rutgers, The State University of New Jersey
335 George Street / Liberty Plaza / Suite 3200
New Brunswick, NJ 08901

orra.rutgers.edu/artsci
732-235-9906

July 10, 2015

P.I. Name: Lischer-Katz
Protocol #: E15-834

Zachariah Lischer-Katz
School of Communication & Information, Library and Information Science
Library and Information Science
4 Huntington Rd.
College Ave

Dear Mr. Lischer-Katz:

This project identified below has been approved for exemption under one of the six categories noted in 45 CFR 46, and as noted below:

Protocol Title: "Epistemologies of Artisanal Digital Reformatting"

Exemption Date: 7/7/2015

Exempt Category: 2

This exemption is based on the following assumptions:

- **This Approval** - The research will be conducted according to the most recent version of the protocol that was submitted.
- **Reporting** - ORSP must be immediately informed of any injuries to subjects that occur and/or problems that arise, in the course of your research;
- **Modifications** - Any proposed changes **MUST** be submitted to the IRB as an amendment for review and approval prior to implementation;
- **Consent Form (s)** - Each person who signs a consent document will be given a copy of that document, if you are using such documents in your research. The Principal Investigator must retain all signed documents for at least three years after the conclusion of the research;

Additional Notes: None

Failure to comply with these conditions will result in withdrawal of this approval.

Please note that the IRB has the authority to observe, or have a third party observe, the consent process or the research itself. The Federal-wide Assurance (FWA) number for the Rutgers University IRB is FWA00003913; this number may be requested on funding applications or by collaborators.

Sincerely yours,



Acting For--
Beverly Teppa, Ph.D.
Professor, Department of Food Science
IRB Chair, Arts and Sciences Institutional Review Board
Rutgers, The State University of New Jersey

(MW:ck)

cc: Dr. Marija Dalbello

[NOTE: The glitch in the scan is within the document sent by Rutgers IRB]

Appendix G – Initial Coding Schema

1.0 Legitimization	5.0 Constructing Visual Information
1.1 Acknowledging Limitations	5.1 Calibration
1.1.1 Application to Contexts	5.2 Matching
1.1.2 Application to Formats	5.3 Defining Visual Variables
1.1.3 Evolving Characteristics	5.4 Assigning Visual Qualities
1.2 Active Updating of Standard	5.4.1 Limitations of Source Material
1.3 Presenting Supportive Evidence	5.4.2 Recognize of Artifactual Features
1.4 Documenting Changes	5.4.3 Rare and Valuable
	5.5 Defining human-computer vision
2.0 Narratives	5.5.1 Comparing Vision to Computation
2.1 Culmination of Cumulative Research	5.5.2 Establishing Neutral Viewing Conditions
2.2 Institution as Ethical Actor	5.6 Establishing Visual Trust
3.0 Classifications	6.0 Phenomenal Structure
3.1 Current/Obsolete	6.1 Risks to Objects
3.2 Clean/Dirty	6.2 Potential Failures of Digitization
3.3 Significant/Non-significant information	6.3 Expected Benefits of Digitization
3.4 Accurate/Inaccurate	
3.5 Appropriate/Inappropriate	7.0 Establishing Moral Commitments
3.6 Manual/Automated Processes	7.1 Do No Harm
3.7 Materiality of Document Formats	7.2 Follow Standards
3.7.1 Reflective/Transmissive	7.3 Limit Digital Image Manipulation
3.7.2 Size	7.4 Maintain Values of Documents
3.7.3 Physical Composition	7.4.1 Trustworthiness
3.7.4 “Special” Materials	7.4.2 Provide Evidence of “full capture”
3.7.5 Components of Documents	7.4.3 Evidence of Color Accuracy
	7.4.4.1 Embed Color Profiles
4.0 Establishing Agency of Document	
4.1 Argument from Authority	8.0 Defining Normative Practice
4.2 Referring to Former Texts	8.1 Defining routines
4.3 Scoping Influence of Standard	8.2 Warnings Against Inappropriate Actions
4.4 Model of Institutional Practices	8.3 Accountability to standards
4.5 Model for Institutional Practices	8.4 Imperative to scan anomalous materials

Appendix H – Final Coding Schema

1. Zones of Knowledge Construction	3. Experiences of Digitization
1.1 Constructing Personal Knowledge	3.1 Entering the Field
1.1.1 Knowing Through Doing	3.1.1 Experiencing Uncertainty
1.1.2 Knowledge from Formal Education	3.1.2 Learning to See Errors
1.1.3 Conferring with Co-Workers	3.1.3 Gaining Confidence
1.1.4 Referencing Texts	3.2 Affective Dimensions
1.1.5 Lacking Specialized Knowledge	3.2.1 Stressful Moments
1.1.6 Developing Confidence	3.2.2 Distinguishing Good Days from Bad Days
1.2 Constructing Institutional Knowledge	3.3 Embodied Judging
1.2.1 Making Decisions about Workflows	3.3.1 Hearing
1.2.2 Changing Institutional Guidelines	3.3.2 Smell
1.2.3 Using Presets and Defaults	3.3.3 Touch
1.2.4 Legitimizing Institutional Knowledge	3.4 Temporal Orienting
1.3 Engaging with Community Knowledge	3.4.1 Orienting Towards the Past
1.3.1 Engaging with Experts	3.4.1.1 Reconstructing Tape History
1.3.1.1 Deferring to Experts	3.4.1.2 Reconstructing Production History
1.3.1.2 Questioning Experts	3.4.1.3 Reconstructing Format History
1.3.2 Comparing Local Practice to Other Organizations	3.4.1.4 Reconstructing the Original
1.3.3 Questioning Community Consensus	3.4.2 Orienting Towards the Future
1.3.4 Defining Role of Codified Knowledge	3.4.2.1 Constructing Future Users
1.3.5 Negotiating Standards	3.4.2.2 Constructing Future Uses
1.3.5.1 Deferring to Standards	4. Structuring of Moral Codes
1.3.5.2 Questioning Standards	4.1 Expressing Moral Commitments
1.3.5.3 Enacting Standards	4.1.1 Authenticity
2. Signal Work	4.1.2 Integrity
2.1 Epistemology of the Video Signal	4.1.3 Consistency
2.1.1 Coping with Indeterminacy	4.1.4 Neutrality
2.1.2 Limits of Knowledge	4.1.5 Preservation
2.1.3 Subjective Measures	4.1.6 Historical Value
2.1.4 Objective Measures	4.1.7 Originality
2.2 Epistemic Techniques	4.1.8 Reliability of Copies
2.2.1 Applying Calibrated Vision	4.2 Enacting Real Projects
2.2.2 Patterned Looking	4.2.1 Applying Consistent Techniques
2.2.2.1 Reading Scopes	4.2.2 Following Local Guidelines
2.2.2.2 Reading Monitors	4.2.3 Committing to High-Quality Work
2.2.3 Comparing and Matching Visual Representations	4.2.3.1 Quality Control
2.2.4 Historicizing the Tape	4.2.3.2 Redoing Work
2.2.5 Investigating Errors	4.2.4 Exercising Care / “Being Careful”

2.3 Describing the Signal Chain	4.2.4.1 Cleaning Machines and Tapes
2.3.1 Points of Observation	4.2.4.2 Handling Carefully
2.3.2 Points of Intervention	4.2.5 Documenting Work
	4.2.6 Documenting Uncorrectable Errors
	4.2.7 Documenting Decision Making
	5. Legitimizing Practice
	5.1 Acknowledging Limitations
	5.2 Distinguishing Between Normative and Non-Normative Actions
	5.3 Distinguishing Between Inevitable and Intentional Phenomena
	5.4 Acknowledging and Documenting Deviations from Normative Practice

Appendix I – Key Events in the History of Preservation Knowledge

1824-1910: Early Experimental Era of Preservation Research

1824

- John Murray publishes a pamphlet in 1824 in Britain detailing his experiments exploring the chemical makeup of paper, seeking to find the roots of the rapid decay of some paper stocks (Grove, 1966; Cloonan, 2015).

1839

- John Benjamin Dancer begins experimenting with microphotography, but the usefulness of the process for efficiently storing documents was not appreciated at the time (Perrault, 2005).

1843

- The British scientist Michael Faraday, in an April 7, 1843 lecture at Royal Institute in London links the degradation of leather bindings to the smoke of the illuminating gas (Faraday, 1843).

1876

- American Library Association (ALA) is founded.

1877

- ALA's Cooperation Committee develops book binding standard (Higginbotham, 1990).

1880

- A series of experiments with the use of photography as a means of preservation are conducted in Europe to preserve the works held by European archives, ending around 1909 (Higginbotham, 1990).

1887

- C.J. Woodward experiments show that “acidic residues of illuminating gas are the chief cause of leather decay” (Higginbotham, 1990, p. 196).

1888

- First laboratory devoted to conservation of cultural heritage materials is opened in Berlin (Cloonan, 2015).

1904

- Guido Biagi experiments with photographing rare books in Italy as a preservation technique (Higginbotham, 1990).

1905

- ALA Committee on Bookbinding is formed (Higginbotham, 1990).
- Charles Mills Gayley experiments with photography as a form of preservation at the University of California, Berkeley in 1905 (Higginbotham, 1990).

1906

- Paul Otlet and Robert Goldschmidt suggest the use of microphotography for making books more widely available (Cloonan, 2015).

1909

- ALA’s Committee on Bookbinding releases book binding standards (Higginbotham, 1990).

1920-1956: Microfilm Experimentation in Libraries

1920

- Businesses begin to adopt microfilm technology to streamline their record-keeping systems (Stewart and Hickey, 1960).

1924

- Harry Miller Lydenberg publishes *Paper or Sawdust: A plea for Good Books*.

1925

- George McCarthy patents his Checkograph machine for making microfilm copies of bank records (Cloonan, 2015).

1928

- Eastman Kodak purchases Checkograph patent and markets it to businesses and libraries through its Recordak division.
- The Library of Congress, Harvard University Library and the New York Public Library start microfilming projects (Cloonan, 2015).

1930s

- Microfilm technology becomes recognized as important information technology for storage and retrieval in libraries (Buckland, 1992).

1931

- Harry Miller Lydenberg and John Archer publish *The Care and Repair of Books*

1935

- Recordak begins publishing *The New York Times* on microfilm.
- Library binding institute is established as a joint commission formed between Book Manufacturers' Institute and American Library Association (ALA), publishing "Minimum Specifications for Class 'A' Library Binding" standards for library bindings (Cloonan, 2015).

1938

- Eugene Power founds University Microforms (later to become University Microfilms International) and begins publishing microform editions for academic libraries (Cloonan, 2015).
- Harvard begins microfilming its collection of foreign newspapers (Cloonan, 2015).
- First archives course taught at Columbia University by Solon J. Buck, National Archives Director of Research (Cloonan, 2015).
- International Federation of Film Archives (FIAF) is founded.

1940

- William Barrow establishes a research laboratory to systematically study techniques of deacidification for paper (Higginbotham, 1990).

1942

- Herman Fussler publishes *Photographic Reproduction for Libraries*, the first guide to reprography.

1944

- Fremont Rider promotes the use of microfilm for saving space in libraries in his book *The Scholar and the Future of the Research Library* (Cloonan, 2015).

1945

- Vannevar Bush discusses his influential idea of the Memex machine presented in his article, “As We May Think” published in *The Atlantic Magazine*.

1956-1980: Era of Preservation Professionalization

1956

- Council on Library Resources (CLR) is founded and a special issue of *Library Trends* is devoted to the topic of preservation.

1960

- First graduate program in art conservation is founded at New York University (Cloonan, 2015).

1963

- Smithsonian Institute forms the Conservation Analytical Laboratory for scientifically researching conservation issues, in Washington, D.C. (Cloonan, 2015).

1964

- Newberry Library starts preservation program.

1965

- National Endowment for the Arts (NEA) and the National Endowment for the Humanities (NEH) are founded and begin funding preservation projects (Cloonan, 2015).

1966

- The National Historic Preservation Act protecting historical buildings is signed into law in October and less than three weeks later, between November 3 and 4, the Arno River flooded and submerged many of Florence's collections of rare books and art work under layers of mud (Ogden, 1979).

1967

- Library of Congress begins to centralize its preservation activities and forming the Preservation Office (Cloonan, 2015).

1970

- Preservation Research office is founded at the Library of Congress (Cloonan, 2015).

1971

- Yale University's Library starts preservation program.

1973

- Harvard University's Library starts preservation program, the National Conservation Advisory Council (NCAC) is established.
- Northeastern Document Conservation Center is founded.
- Preservation Research and Testing Office is founded at the Library of Congress.
- National Conservation Advisory Council is founded (Cloonan, 2015).

1974

- Columbia University's Library starts preservation program, and the Research Libraries Group (RLG) is founded.

1976

- Institute of Museum Services is founded, begins funding conservation projects.

1980-2004: Digital Library Research

1980

- The Society of American Archivists (SAA) receives a National Endowment for the Humanities (NEH) grant for the "development of manuals and an extensive series of workshops" (Darling and Ogden, 1981, p. 23), which contributes to the systematization of preservation knowledge and encouraged adoption by the archives community.

1982-1987

- Library of Congress conducts its Optical Disk Pilot Project making digitized books and images available through CD-ROMs.

1984

- International Standards Organization (ISO) and the National Information Standards Organization (NISO) publish an international standard for defining permanent paper quality.

1985

- The Image Permanence Institute is founded (Reilly, 2013), which continues to follow scientific approaches to developing preservation knowledge about physical decay of materials.
- The National Endowment for the Humanities establishes its Office of Preservation

1987

- Nancy Gwinn publishes *Preservation Microfilming*, a manual for librarians to produce preservation-quality microfilm of their collections.

1991

- Project Open Book at Yale University begins studying how to convert its microfilm collection to digital format (Cloonan, 2015).

1992

- The Association of Moving Image Archivists (AMIA) is founded.

1993

- National Science Foundation (NSF), Defense Research Projects Agency (DARPA) and National Aeronautics and Space Administration (NASA) form the Research in Digital Libraries Initiative (Griffin, 1998).
- The Librarian of Congress publishes *Film Preservation 1993: A Study of the Current State of American Film Preservation*.

1994

- Digital Libraries Initiative – Phase 1 begins, continues through 1998.

1995

- Library of Congress begins its National Digital Library Project, continues through 2000.

1996

- Northeast Document Conservation Center holds its first *School for Scanning* seminar to teach digitization techniques.

1997

- The Librarian of Congress publishes *Television and Video Preservation, 1997: A Report on the Current State of American Television and Video Preservation*

1999

- Digital Libraries Initiative – Phase 2 projects begins, continues through 2002.

2000

- Congress passes legislation to found the National Digital Information Infrastructure and Preservation Program (NDIIPP).
- Library of Congress develops its American Memory digital library prototypes.

- Research Libraries Group (RLG) publishes *Moving Theory into Practice: Digital imaging for Libraries and Archives* (by Anne R. Kenney and Oya Y. Rieger).

2002

- Moving Image Archive Studies program at The University of California, Los Angeles is founded.
- OCLC launches its Digital Archive project.

2004-2015: Emergence of Visual Digital Reformatting and Mass Digitization

2004

- The Association of Research Libraries (ARL) formally endorses digital reformatting as a preservation technique (Arthur, et al., 2004).
- Google Books project is announced.
- National Archives and Records Administration publishes *Technical guidelines for digitizing archival materials for electronic access: Creation of production master files - Raster images*.
- Media Matters and the Dance Heritage Coalition publish the report *Digital Video Preservation Reformatting Project*, which offers recommendations for digitizing analog videotape.
- Moving Image Archiving and Preservation founded at New York University.

2005

- Selznick Graduate Program in Film and Media Preservation, at the University of Rochester and the George Eastman House is founded.

2007

- The Federal Agencies Digitization Guidelines Initiative (FADGI) begins publishing digitization specifications for documents ranging from text to moving image materials, drawing on over 100 national and international imaging, metadata, data storage and documentation standards.¹⁰⁴
- Rutgers University Library publishes *Recommended Minimum Standards for Preservation Sampling of Moving Image Objects*.
- Library of Congress publishes *Technical Standards for Digital Conversion of Text and Graphic Materials*.
- The Packard Campus of the National Audiovisual Conservation Center (PACV) opens, becoming the world's largest repository for moving image and sound materials.

2008

- HathiTrust Digital Library project is founded by a group of American research universities.
- Bibliographic Research Center publishes *BRC's Collaborative Digitization Program: Digital Imaging Best Practices, Version 2.0*.
- Online Computer Library Center Publishes *Preparing Digital Surrogates for Research Library Group Cultural Materials*.
- The Council on Library and Information Resources publishes
- *The Seamless Cyberinfrastructures: The Challenges of Studying Users of Mass Digitization and Institutional Repositories*.

¹⁰⁴For a complete list of the standards that they follow that Library of Congress, see: <http://www.digitizationguidelines.gov/guidelines/digitize-standards.html>

2009

- Federal Agencies Digitization Guidelines Initiative publishes *Still Image Group Guidelines*.
- University of Southern California publishes *USC Digital Library Audiovisual Digitization Overview*.

2010

- Federal Agencies Digitization Guidelines Initiative publishes *Technical Guidelines for Digitizing Cultural Heritage Materials*.
- The Metropolitan Library Council publishes *Digitization in the Real World*.

2011

- Online Computer Library Center publishes *Rapid Capture: Faster Throughput in Digitization of Special Collections*.

2012

- National Archives and Records Administration publishes *Digitization Services Products and Services*.
- New York University Publishes *Stewardship Issues Facing Moving Image Collections in Academic Libraries*.
- The National Recording Preservation Board of the Library of Congress publishes *The Library of Congress National Recording Preservation Plan*.

2013

- The American Library Association - Association for Library Collections and Technical Services Preservation and Reformatting Section publish *Minimum Digitization Capture Recommendations*.

- New York University Library publishes *Digitizing Video for Long-term Preservation: An RFP Guide and Template*.

2014

- The Library of Congress publishes *Guidelines for File Format Comparison*.
- The Smithsonian Institute publishes *The Smithsonian Interview Project: Questions on Technical Standards in the Care of Time-based and Digital Art: Ten Insights from Artists and Experts in the Field*.

2015

- Federal Agencies Digitization Guidelines Initiative publishes *Technical Guidelines for Digitizing Cultural Heritage Materials* (Revised).

Appendix J - Standards and Guidelines Documents Identified and Collected at Each Site

Site L1:

Federal Agencies Digitization Guidelines Initiative. (2014, Dec. 4). *Digital file formats for videotape reformatting*.

http://www.digitizationguidelines.gov/guidelines/video_reformatting_compare.html

Site L2:

California Audiovisual Preservation Project. (2014, Nov. 20). *Target audio and video specifications*. <https://calpreservation.org/projects/audiovisual-preservation/>

Site L3:

Independent Media Arts Preservation. (2009). *Preservation 101*.

http://imappreserve.org/pres_101/index.html

Site L5:

Federal Agencies Digitization Guidelines Initiative. (2014, Dec. 4). *Digital file formats for videotape reformatting*.

http://www.digitizationguidelines.gov/guidelines/video_reformatting_compare.html

California Audiovisual Preservation Project. (2014, Nov. 20). *Target audio and video specifications*. <https://calpreservation.org/projects/audiovisual-preservation/>

Site L6:

Association of Moving Image Archivists (?). *Videotape preservation fact sheets*.

http://www.amianet.org/sites/all/files/fact_sheets_0.pdf

Cornell University Library. (2012, April 3). *Cornell VHS Video Preservation Lab - Standard operating procedures*.

International Association of Sound and Audiovisual Archives. (2014). IASA Publication.

<http://www.iasa-web.org/iasa-publications>

Specs Bros. (2011). *Tools for collection assessment and determining preservation priorities*.

Texas Commission on the Arts. (2004). *Videotape identification and assessment guide*.

<http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf>

New York University. (2013, Oct.) ViPrs Video Survey Instructions. *Visual & Playback Inspection Ratings System*.

<https://web.archive.org/web/20141203222828/http://library.nyu.edu/preservation/moving-image/vipirshome.html>

Site L7:

Blood, G. (2011, Oct. 1). Refining conversion contract specifications: Determining suitable digital video formats for medium-term storage.

https://dl.dropboxusercontent.com/u/81562888/George%20Blood%20Library%20of%20Congress%20IntrmMastVidFormatRecs_20111114.pdf

National Archives and Records Administration. (n.d.). *Digital moving images from video source material*. <https://www.archives.gov/preservation/products/reformatting/video>

Appendix K - Prototypical Workflow and Participants' Idiosyncratic Steps

Prototypical Steps	P1 L1	P1 L2	P2 L2	P3 L2	P1 L3	P2 L3	P1 L5	P3 L5	P1 L6	P2 L6	P3 L6	P1 L7	P2 L7
Research/Planning	Research and scope project						Prioritizing and planning	Identification and prioritization	Asking partners to nominate recordings for transfer Review nominations and select final list		Selection	Enter metadata and create inventory	[P2 L7 no longer involved in digitization anymore, so didn't provide responses]
In-Take	Communicating with Vendors (if necessary)		In-take Process (barcode and log tapes into system; inspect tapes for potential problems; identify format)					Gathering Metadata Delivery of Originals to Org Process originals (check metadata, inspection, add additional metadata)	Ask partners to send recordings Process originals (check metadata and fill in any missing fields)	Making sure that we have all the appropriate metadata	Bring content over	Ingest (check metadata and contents of box)	
Tape Assessment							Assessing the tape and the quality of the tape.		Condition reports of the tapes	Inspect and spot-check		Condition Assessment of tapes	
Conservation Treatments			Pre-transfer conservation treatments				carrying out prep if necessary (cleaning tapes, etc.)						
Digitization	Sending out Materials (if necessary)		Digitization Period		Cleaning Machines			Ship to vendor	Send things in batches to vendor				
Record metadata										Logging information on the tape			
Setup		Monitoring Adjusting Levels	Calibrating Equipment Checking Signal Chain	Checking Equipment and Tape			Assessing Image quality and make adjustments Assessing Image quality and make adjustments Fine Tuning of equipment			Clean the heads on the deck Use test tape to check calibration Inspect tape for decay Repack tape if necessary			

<u>(cont.)</u>	<u>P1 L2</u>	<u>P1 L2</u>	<u>P2 L2</u>	<u>P3 L2</u>	<u>P1 L3</u>	<u>P2 L3</u>	<u>P1 L5</u>	<u>P3 L5</u>	<u>P1 L6</u>	<u>P2 L6</u>	<u>P3 L6</u>	<u>P1 L7</u>	<u>P2 L7</u>
Prototypical Steps													
Capture	Capture (vendor OR in-house)	Capture	"Introduce tape" to system	Transfer, Watching for Problems	"Monitoring"	Capture	Vendor digitizes and creates files		Capture	Capture	Capture	"Transfer and log content"	
Post-Capture	Receive Files	Trimming Files Checking files for consistency			Reviewing work	Backing-up file Cataloging	Files are returned on harddrive	Vendor sends back digital files		Embed Metadata	Embed Metadata and name files		
Quality Control	Review Files Communicate any changes needed back to the vendor		Quality Control	Quality Control			Quality Control	Quality control			Evaluate Quality Adjust audio in file if necessary	Quality control, document any errors	
File Management			Post Quality Control, Moving Data			Keep track of files File naming Data management						File Management	
Create Access Files	Get ready for exhibition (if being exhibited)			Post Processing, Making Derivative Files			Upload Access files to Internet Archive Have partner perform Quality Control on access files	Upload files to Internet Archive Add metadata to Internet Archive Let vendor redo file if something isn't right			Create Derivative Files		

Appendix L - Example of *A/V Artifact Atlas* Entry

[AVAA Home](#)
[About AVAA](#)
[Browse Artifacts](#)
[Contributor's Guide](#)
[AV Preservation Glossary](#)
[News/Resources](#)
[FAQ](#)
[Copyrights](#)

Browse by category

[BAVC](#) • [GitHub](#)

IMAGE LAG

Also known as:

[Ghosting](#)
[Smearing](#)
[Burn-in](#)
[Comet Tails](#)
[Luma Trails](#)

[Ghosting](#)

[Smearing](#)

[Comet Tails](#)

[Tape Error](#)

[Analog](#)

[Video](#)

Image lag occurs in video recorded or displayed using certain types of pick-up devices and cameras, including the Vidicon picture tube, among others. This type of camera tube captures light radiating from a scene through a lens and projects it onto a photoconductive target, creating a charge-density pattern which is scanned using low-velocity electrons. The resulting image can be amplified and recorded to tape or output to a video monitor. The electrical charge remains present on the target until it is re-scanned or the charge dissipates.

The time delay in establishing a new signal current in the camera to follow the rapid changes in the target illumination is called 'image lag' or simply 'lag'. In the photoconductive camera tubes this occurs in two forms: (i) photoconductive lag determined by the properties of the target materials, and (ii) capacitive lag or beam lag attributed to the storage effect of the pixel capacitance and the beam resistance. The image lag causes smear or comet tails following fast-moving objects in the scene, and the prolonged exposure of a bright stationary object results in a slow decaying after image of x-ray type appearance. This long-term but faint after-image is called burn-in or picture sticking.¹

In instances where comet tails or luma trails are visible, the visual artifact is sometimes referred to as "ghost" or "ghosting." Ghost also refers to an artifact of video transmission when there is a difference in primary and secondary radio frequency signals.

Can it be fixed?

Image lag is not a fixable artifact, but rather a result of the inherent limits of vintage picture tube technology.

Example(s)

Comet Tails are visible when the camera shifts, and a white aura appears around the head of the singer as he moves. (Walter Steding Concerts 1980s, *XFR STN Project*; [Internet Archive](#), 2013).

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