THE HABS CULTURE OF DOCUMENTATION WITH AN ANALYSIS OF DRAWING AND TECHNOLOGY

A Dissertation

by

SERRA AKBOY

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2011

Major Subject: Architecture

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Drawing and Technology

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Approved by:

Chair of Committee,	Robert Warden
Committee Members,	David G. Woodcock
	Kevin Glowacki
	Sorin Popescu
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ABSTRACT

The HABS Culture of Documentation with an Analysis of

Drawing and Technology. (December 2011)

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Chair of Advisory Committee: Prof. Robert Warden

The Historic American Buildings Survey (HABS) is one of the oldest federal programs in the United States. In 1933, the HABS culture of documentation started with the mission of creating a permanent record of the nation's architectural heritage. Since the inception of the program, the formal documentation methodology has been measured drawings, large-format photographs, and written histories. HABS documentation accentuates the act of drawing as a mediating conversation between the documenter and the historic environment. In a typical HABS project, the documenter is immersed in the historic setting by hand measuring the structure and creating field notes. The documenter's intimate access to the artifact develops his awareness of cultural heritage and helps cultivate an appreciation for the compositional sensibilities of the architectural precedents. However, the HABS culture of documentation has been fine-tuned to incorporate a number of digital technologies into documentation projects. When projects involve issues of logistics, time, and cost, HABS professionals utilize a host of digital methodologies to produce measured drawings. Although HABS prepares deliverables to

meet the archival standards of the Library of Congress, the hardware and software necessary to recognize digital files have a limited lifespan that makes them unacceptable for use in the Library. Only measured drawings that use archival ink on stable translucent material, accompanied by negatives on safety film, can be submitted to the Library. Thus, if HABS pursued only digital technologies and deliverables, the effects of this approach on the quality of the documenter's engagement with cultural heritage would pose a significant question.

This study addressed the question of how the HABS culture of documentation evolved in regards to drawing and technology, and how this relationship might be transformed in the future. Using HABS as a focus of inquiry is important in order to illuminate similar dynamics in heritage projects that utilize digital technologies. The methodology used in this study included a literature review, participant observations, and an analysis of documentation projects, as well as in-depth interviews with HABS staff, project participants, private practitioners, and academicians. The outcome of the study will be recommendations to heritage professionals for a future that resides in digital means without compromising the qualities that the HABS experience has offered to generation of documenters.

DEDICATION

To my Mom

ACKNOWLEDGEMENTS

I perceive this study as a journey that started on the first day I set foot on the Texas A&M University campus. During this journey, I was privileged to work with astonishing people who not only guided me in my studies, but also helped me to flourish as a young scholar. I do not see my graduation as an end to my mesmerizing journey, but rather as the beginning of a new phase in my life in which I will continue to pursue new ideas, projects, and methodologies with my family at Texas A&M.

I owe a big thanks to Bob Warden. Every time I got lost in the passion of working on my dissertation, he put me back on the right track with his insightful remarks. He introduced me to the amazing world of research and ceaselessly guided me in each step. He showed me that a good scholar is not only a rigorous researcher, but also a conductor who must orchestrate a wild world of agencies, professionals, students, and more.

Words are not enough to define David G. Woodcock's influence on me. I could never find enough words to thank him for all he has done. David has been a great mentor, a fantastic professor, and a true friend. I have been privileged to be his graduate assistant for more than four years. In all these years, he has been pivotal in shaping my dissertation study as well as my abilities and skills to teach historic preservation to student architects.

I am indebted to Kevin Glowacki for his critical remarks of my study. He has opened my eyes to the power of academic expression in the field of historic preservation.

With his guidance, I was able to elevate my initial ideas to systematically defined scholarly content.

I am grateful to Sorin Popescu for all his support of my dissertation. From the first day that I knocked on his door to explain my work, he has been deeply interested in the intersection of the use of technologies in ecosystem studies and historic preservation. His critiques have been elemental to my efforts to utilize digital technologies effectively in heritage projects.

I was honored to meet amazing academicians and professionals during my journey who did not hesitate to share their contrasting perspectives on heritage recording and documentation. Without their input, I could not have accomplished this work. I would especially like to thank S. Elizabeth Valenzuela, Justin Edgington, Catherine E. Lavoie, James Rosenthal, Dana Lockett, Mark Schara, Taylor Browne, Kevin Smith, Eugene Cisek, Mark Cowan, Elizabeth Lee, Bob Brinkman, and Christine Whitacre for their input.

Finally, I would like to thank my family for their ceaseless support and encouragement. They are the inspiration for all my work. Without them, I could not have done it.

NOMENCLATURE

AIA	American Institute of Architects
APT	Association for Preservation Technology
ASCII	American Standard Code for Information Interchange
CADD	Computer-Aided Design and Drafting System
CHC	Center for Heritage Conservation
CRGIS	Culture Resources Geographical Information Systems
DSM	Digital Surface Model
EDM	Electronic Distance Measurement
GIS	Geographical Information Systems
GPS	Global Positioning System
HABS	Historic American Buildings Survey
HAER	Historic American Engineering Record
HALS	Historic American Landscape Survey
ICOMOS	International Council on Monuments and Sites
LIDAR	Light Detection and Ranging
NCPTT	National Center for Preservation Technology and Training
NHPA	National Historic Preservation Act
NPS	National Park Service
OSU	Ohio State University
REDM	Reflectorless Electronic Distance Measurement

SHPO	State Historic Preservation Office
TST	Total Station Theodolite
TxDOT	Texas Department of Transportation

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CHAPTER I

INTRODUCTION

Research Problem

This study examined how the utilization of technologies is transforming the cultural perception of heritage in the United States. In particular, it has examined the relationship between the act of drawing and digital documentation technologies. In documentation projects, the typical deliverable is an accurately measured drawing of the historic structure. Hence, the documenter is responsible for collecting field data using different documentation technologies and then translating this data into architectural drawings. Even though the documentation process seems quite straightforward with a series of actions to delineate the measured drawings, the modus operandi is embedded with implicit values and meanings. The documentation project itself becomes a means to engage with the historic environment. It puts participants in unequivocal communication with the project's cultural heritage and the values associated with the historic structure. Furthermore, the act of drawing becomes an education tool. By taking a building that has already been created and making drawings of it, the documenter develops an understanding of the design, form, construction, and materials of the building's architecture. However, digital tools can offer a seamless process of data gathering and

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This dissertation follows the style of *APT Bulletin: Journal of Preservation Technology*.

production with minimal human intervention in data transcription and translation.[1] In this context, the utilization of digital technologies as a means to automate the documentation process could obstruct the contiguous relationship between the documenter and the cultural heritage of the structure. The non-intrusive character of digital tools allows the documenter to collect the field data without the need of any physical access to the historic structure. Furthermore, the digital applications drastically reduced the time the documenter spends in the field. For example, using digital tools a documenter could acquire all the heritage data within a couple of days compared to several weeks and long hours in the field using a tape measure and plumb bob to take measurements. Consequently, in most projects digital tools have already been recognized as a necessity due to their ability to rapidly capture date, their instant ability to input that same data into a computer, and their capability to record large amounts of data for massive structures. However, while heritage professionals today increasingly rely on digital tools to define, treat, and interpret the past usage of structures with digital tools, the quality of their direct engagement with the historic environment has also been altered. Thus, this study seeks to discover an understanding of the how the digital documentation media transform the act of drawing and hence documenter's bond with cultural heritage.

The discussion of heritage documentation in the U.S. requires the study of the Historic American Buildings Survey (HABS) within this context. HABS is one of the oldest federal programs. In 1933, the HABS culture of documentation began and was

[1] R. Warden and D. Woodcock, "Historic Documentation: A Model of Project Based Learning for Architectural Education," *Landscape and Urban Planning* 73, no. 2-3 (2005): 113.

charged with the mission of creating a record of the nation's built history for posterity in case these historic artifacts vanished. Over the years, HABS teams have adopted both analog and digital documentation technologies, including hand surveys, digital photography, photogrammetry, three-dimensional laser scanners, and computer-aided-drafting to produce measured drawings of historic structures. However, HABS architect Mark Schara stated that while HABS enjoys a rich repertoire of recording methodologies from hand measuring to laser scanning in diversified projects, the organization "focuses on a very basic end-product."[2] The deliverable is a formulaic two-dimensional plan (section and elevation plotted on Mylar) that should meet the archival standards of the Library of Congress. Therefore, HABS intensive efforts to utilize diverse documentation technologies while focusing on the production of two-dimensional measured drawings makes HABS a unique case study to use to address the issues between drawing, technology, and cultural heritage. Hence, the current study addresses the research question: how has the HABS culture of documentation evolved in regards to drawing and technology, and how this relationship might be transformed in the future?"

The study of the HABS culture of documentation derived from several important reasons. First, the history of the HABS culture of documentation demonstrates the evolution of approaches, methods, and technologies used to record the historic fabric for the last eighty years in the United States. Even though large-format photography has remained the official documentation, Catherine C. Lavoie, current chief of HABS, stated

[2] Mark Schara (HABS architect) in discussion with the author, August 18, 2010.

that HABS recording methods have always been relevant to the current data gathering methodologies, as well as experimenting with innovative technologies.[3]

In the 1950s, HABS expanded its surveying methodologies with architectural photogrammetry. In this context, the program was one of the first organizations in the U.S. to experiment with photogrammetry to record historic structures, including the Plum Street Temple in Cincinnati and the early skyscrapers in Chicago. During the 1970s, HABS carried out projects using aerial photogrammetry to record historic sites such as Native American villages in Arizona and New Mexico[4]. The 1980s witnessed the introduction of computer-aided design and drafting systems (CADD) to produce measured drawings[5]. In this era, HABS explored the adaptation of photogrammetric data with CADD in projects such as the Washburn A. Mill project in Minneapolis, Minnesota, Mesa Verde National Park in Colorado, and Charleston Battery in Charleston, South Carolina[6]. In 1991, HABS completed the documentation of the Lincoln and Jefferson memorials in Washington DC using CADD. It was the first comprehensive in-house CADD project undertaken by HABS.[7] The 1990s saw the introduction of laser technologies to HABS projects. During the 2000s, HABS experimented with the feasibility of the utilization of laser scanning technologies in a

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[3] Lavoie also suggests that if laser scanning and other digital methodologies were available in the 1930s, HABS would have definitely used them. Catherine Lavoie (Chief of HABS) in discussion with the author, August 17, 2010.

[4] Perry E. Borchers, "Photogrammetry of the Indian Pueblos of New Mexico and Arizona," *Photogrammetria* 30, no. 3-6 (1975): 191.

[5] J. A. Burns, "Measured Drawings," in *Recording Historic Structures*, ed. J. A. Burns (Wiley, 2004), 20.

[6] Historic American Buildings Survey/Historic American Engineering Record. and United States. National Park Service., "HABS/Haer Review," (Washington, DC: U.S. Dept. of the Interior, National Park Service, Cultural Resources, Historic American Buildings Survey/Historic American Engineering Record, 1994), 19.

[7] Mark Schara, "Recording Monuments," in *Recording Historic Structures*, ed. J. A. Burns (Wiley, 2004), 226.

series of projects such as the Statue of Liberty in New York City (2001) and the Bodie Island Lighthouse in South Carolina (2002). Following the purchase of a Leica laser scanner, the National Park Service (NPS) now conducts in-house scanning campaigns such as Castle Pinckney in Charleston (2011).

The program field-tested many of the preservation strategies still in use today such as the surveying, listing, and compiling of documentation on historic properties, the development of comprehensive, contextual information, and the establishment of standards for documentation.[8] In fact, over the years, the HABS methodology has become the de-facto documentation strategy in the States. Under Section 106 of the National Historic Preservation Act (NHPA), any federal structure that is subject to historic preservation must be recorded based on the HABS norms. The 1980 amendments to the NHPA of 1966 dictate that historic sites, structures, or objects already on or eligible for the National Register of Historic Places that are about to be demolished or substantially altered because of federal agency action must first be recorded to HABS standards.[9] Along with this same line, state agencies such as the Texas Historic Commission also utilize HABS documentation standards as the benchmark for their historic preservation projects. Mark Cowan, project reviewer at Texas Historic Courthouse Preservation Program, asserted that the commission "expects to see HABS level of documentation [from the architectural firms] before the

[8] Catherine C. Lavoie, "Laying the Groundwork, Prologue to the Development of HABS," in *American Place: The Historic American Buildings Survey at Seventy-Five Years* (Washington, DC: Historic American Buildings Survey, 2008), 1.
[9] R. J. Kapsch, "HABS/HAER: A User's Guide," *APT Bulletin* 22, no. 1 (1990): 23.

[preservation] work starts."[10] Furthermore, Bob Brinkman, coordinator of the Historical Markers Program, said "when a county wants to put a historic resource on the list of the National Register, the Texas Historic Commission shows them examples of HABS documentation to conceptualize the scheme of nomination." [11]

The second reason for studying HABS documentation methods stems from the way the program cultivates drawing as a means to connect with cultural heritage. HABS teams have recorded 40,000 historic structures represented with 600,000 measured drawings, along with later additions from the Historic American Engineering Record (HAER, 1969) and Historic American Landscape Survey (HALS, 2000).[12] These drawings constitute a permanent record of the American built heritage for the future. However, the significance of HABS lies in how the program utilizes the act of drawing as well as the product, two-dimensional measured drawings, for (a) educating students and young architects, (b) preserving the historic fabric, (c) cultivating public awareness of cultural heritage, and (d) for scholarly purposes.

HABS documentation tradition acknowledges the production of measured drawing as a tool for learning and thinking. Measured drawing is not merely a skill devoid of content; use of this tool always involves the acquisition of some degree of knowledge and understanding. In a typical HABS project, a young architect or architecture student is immersed in the context of a historic structure in order to develop an intimate knowledge of it. He will learn how the structure was originally constructed,

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[10] Mark Cowan, (Texas Historic Courthouse Program project reviewer) in discussion with the author, May 13, 2011.
[11] Bob Brinkman, Historical Markers Program coordinator) in discussion with the author, June 10, 2011.
[12] Catherine C. Lavoie, "The Role of HABS in the Field of Architectural Documentation," *APT Bulletin* 4/4, no. Special Issue on Documentation (2010): 19.

trace the sequence of building campaigns and changes over time, understand how the structure should be delineated, and develop an appreciation of and passion for architectural heritage as an area of professional focus and specialization.[13]

Since the end of WWII, students have been actively participating in HABS documentation projects as interns. They undertake all the recording and drawing under the supervision of professors and agents. In this context, Schara informs us that the focus of HABS is the twelve-week summer recording programs, in which interns are hired. [14] In fact, Schara considers HABS to be a "training program." Many students get their introduction to historic preservation through these HABS summer programs and for most of the students, the HABS summer recording program is their first job. Thus, Schara explains, HABS priority is and should be to provide an educational setting for the students where they can learn about the historic fabric. The HABS system encourages the students to "get out to the field, get close to the building, and learn the building."

In architecture schools such as Texas A&M University, Tulane University, Texas Tech University, and the University of Texas at San Antonio, the HABS methodology approach has been formalized in heritage documentation courses. Eugene D. Cizek, Ph.D., FAIA, a professor at the Tulane University and the current director of the Masters of Preservation Studies Program, uses the HABS documentation methodology as a teaching tool in his classes. He stated "documentation of existing structures is an excellent way of teaching an understanding of materials, how they go together, how they

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[13] George C. Skarmeas, "From HABS to Bim: Personal Experiences, Thoughts and Reflections," *APT Bulletin* 4/4, no. Special Issue on Documentation (2010): 47.
[14] Schara, *Interview*.

work over time, how they last over time, what can you should do for maintenance, and how can you develop in a conservation plan."[15]

HABS measured drawings are used extensively for a vast multitude of preservation purposes. For example, when Franklin Roosevelt's birthplace in Hyde Park, New York was damaged in a fire in 1982, the National Park Service architects maintained the repair work according to the HABS documentation dating 40 years earlier.[16] In 1981, when a fire destroyed the west unit of the Grisamore House built in 1837-38 in Jeffersonville, Indiana, the local preservationists undertook the rehabilitation and restoration project based on the HABS drawings and photographs that were made in 1934.[17] HABS drawings have been put to lighthearted use as well. In 1966, HABS provided a set of drawings of the Ebenezer Maxwell Mansion in Philadelphia to Princess Grace of Monaco as the basis for construction of a replica for her children.[18]

HABS uses measured drawings to cultivate awareness for cultural heritage. In this context, Lavoie said that HABS unfortunately is unable to record every historic asset due to limited resources. However, the documentation projects can and should be used to create awareness for the preservation of the historic fabric.[19] Similarly, Brinkman advocated that "cultural heritage should definitely be publicized, celebrated, promoted… HABS is a great value for the public to access cultural heritage… [HABS] is a great gift

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[15] Eugene D. Cizek (Professor at Tulane University) in discussion with the author, May 7, 2011.
[16] Kapsch, "HABS/Haer: A User's Guide," 22.
[17] Thomas M. Slade, *Historic American Buildings Survey in Indiana* (Bloomington: Published for Historic Landmarks Foundation of Indiana, Indianapolis, by Indiana University Press, 1983), 2.
[18] Elise Vider, "The Historic American Buildings Survey in Philadelphia, 1950-1966: Shaping Postwar Preservation" (Thesis (MS in Historic Preservation), Graduate School of Arts and Sciences, University of Pennsylvania, 1991), 9.
[19] Lavoie, *Interview*.

to the citizens… [HABS documentation] is the [only] public record to read the history and culture of many physically inaccessible sites." [20]

HABS publicizes heritage information through brochures, pamphlets, project reports, architectural catalogues, books, and illustrations in diversified scholarly publications. A very important tool in developing a consciousness of cultural heritage is the *Built in America* website of the Library of Congress.[21] Through this website, HABS, HAER, and HALS publicize historic structures with measured drawings, photography, and written histories. *Built in America* has become a leading avenue for distributing copyright free heritage information to the public, with an average of 40,000 visitors to the site per month.

Public accessibility culminated with the engagement of diverse groups of communities with the digital HABS collection. The materials are no longer the sole domain of architecture professionals and academics. For example, kindergarten through twelfth grade (K-12) educators and students are the fastest growing user group of the collection. According to Woodcock, the extraordinary number of hits on the HABS digital archive by the K-12 group in "an exciting result of the collection's investment in the Electronic Library at the Library of Congress and justifies the decision to invest in making the HABS collection a prime component as that effort proceeded."[22] Lavoie states that the inclusive context of the collection, from the architectural achievements to

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[20] Brinkman, *Interview*.
[21] Library of Congress, "Built in America, Historic American Buildings Survey/Historic American Engineering Record/Historic American Landscapes Survey, 1933-Present," http://memory.the Library of Congress.gov/ammem/collections/habs_haer/.
[22] Cited in Tanya Wattenburg Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study" (Texas A&M University, 2005), 170.

the broader historical patterns of everyday life, is the driving force that engages these different groups.[23] Komas anticipates that the broadening definition of cultural and historical significance will draw even more groups into the program and the collection.[24]

HABS drawings serve as the infrastructure for different types of scholarly work. They appear regularly in magazines and in scholarly journals, as well as in publications such as the Norton/Library of Congress Press Visual Sourcebooks in the Architecture, Design, and Engineering Series.[25] HABS regularly publishes catalogs of records of historic structures. To date, state catalogs have appeared for New Hampshire (1963), Massachusetts (1965), Wisconsin (1965), Michigan (1967), Utah (1969), Maine (1974), Texas (1974), and many others. Numerous individual HABS documentation projects have been published as volumes, books, and booklets. *Monument Avenue History and Architecture* is a compilation of the measured drawings, large-format photographs, and written histories of the buildings along Monument Avenue in Richmond, Virginia that was done in 1991.[26] Another valuable report, *Recording a Vanishing Legacy: The Historic American Buildings Survey in New Mexico 1933-Today*, maps the evolution of HABS documentation in New Mexico.[27] *Silent Witness: Quaker Meetinghouses in the Delaware Valley, 1695 to the Present* resulted from a multi-year HABS documentation

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[23] Lavoie, "The Role of HABS in the Field of Architectural Documentation," 19.

[24] Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study," 170.

[25] Lavoie, "The Role of HABS in the Field of Architectural Documentation," 19.

[26] Kathy Edwards et al., *Monument Avenue: History and Architecture* (Washington, DC: U.S. Dept. of the Interior, National Park Service, Cultural Resources, HABS/HAER, 1992).

[27] New Mexico Architectural Foundation, American Institute of Architects, and New Mexico Historic Preservation Division., *Recording a Vanishing Legacy: The Historic American Buildings Survey in New Mexico, 1933-Today* (Santa Fe, NM: Museum of New Mexico Press, 2001).

project to record the architecture of Quaker meetinghouses within the Delaware Valley and its environs.[28]

The third reason behind my decision to use HABS as a case study is my own interest in the program. I worked as a HAER international intern at the Digital Statue of Liberty Project in New York City during the summer of 2006. The internship contributed tremendously to my perception of heritage documentation, which culminated with my enrollment in the PhD program at Texas A&M University to pursue a deeper understanding regarding documentation and digital tools. Consequently, I wanted to conduct a systematical inquiry to define what makes the HABS culture of documentation so distinctive.

Significance of the Study

> As the cultural heritage is a unique expression of human achievement, and as this cultural heritage is continuously at risk, recording is one of the principal ways available to give meaning, understanding, definition, and recognition of the values of the cultural heritage…[29]

Heritage documentation is a discipline characterized by continued change. Technological shifts in heritage projects clearly demonstrate how quickly new methodologies have spread throughout the profession and how they have influenced the execution of documentation. In respect to the technological availabilities of the era, heritage professionals have been using diversified technological tools from pen, paper,

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[28] Philadephia Yearly Meeting and Survey Historic American Buildings, *Silent Witness: Quaker Meetinghouses in the Delaware Valley, 1695 to the Present. Historic American Buildings Survey Recording of Friends Meetinghouses within the Region of Philadelphia Yearly Meeting* (Philadelphia, PA: Philadelphia Yearly Meeting of the Religious Society of Friends, 2002).
[29] ICOMOS, "Principles for the Recording of Monuments, Groups of Buildings and Sites," http://www.international.icomos.org/recording.htm (accessed September, 22, 2011).

and tape measures, to non-destructive evaluation techniques. Recently, digital technologies have been utilized increasingly in historic preservation in an effort to improve the quality and quantity of the products. Digital technologies have given us a world in which graphic representations have reached unforeseen heights, virtual surrogates have become accessible in any digital domain, inaccessible surfaces have become viable for recording, and documentation of exceptionally massive structures has become feasible. Hence, the heritage documentation world is heading in the direction of digital representation because of the sheer amount of x, y, z Cartesian coordinates, RGB values, reflectivity, and intensity parameters.

Elizabeth Lee, Director of Projects and Development at Cyark, asserts that digital data has significant advantages in documentation. Once the heritage professional collects the digital field measurements, then the documenter can utilize the same data in diversified venues to create hard-line drawings, flythroughs, digital-elevation models, etc., which can all be organized in a geo-referenced database. Lee stated, "Archiving the heritage [with digital means] is the only way to record them before they are lost forever." [30] Through digital models, future generations can experience the historic setting virtually and learn about cultural heritage and history. However, while digital instruments provide us with a view not previously available and allow new features to be used, they also condition the possible ways to see things. According to HAER architect, Dana Lockett, fieldwork is critical in heritage documentation, but in some cases, digital

[30] Elizabeth Lee, (Director of Projects and Development at Cyark) in discussion with the author, June 6, 2011.

means is not enough to determine the characteristics of the structure.[31] The documenter has to "walk [through] and touch to know what is going on" in the historic structure. Only by examining the building will the documenter be able to know what to show in the drawings. This level of analytical thinking requires meticulous observation and intensive drawing effort. This perception not only records and represents a historic structure through an accurate two-dimensional drawing, but also understands why and how the cultural scene was shaped.

According to Schara, historic research brings an exceptional knowledge to the documentation work.[32] Working with a historian on a project helps the documenter to focus on what is unique to the historic asset. Along this same line, Lockett emphasizes the "educated touch" of HABS drawings. [33] In each drawing, the documenter takes all the historical elements, as well as the research behind the structure, adds interpretation, and combines these to make a final product. With this type of product, it is important to combine everything to get a more comprehensive set of final information.

According to Warden and Woodcock, the seamless movement from data gathering to production with no human intervention tends to diminish the depth of the documenter's involvement with the historic environment and the abstract architectural thinking skills required by traditional methods.[34] The digital tools appear to disengage the documenter from the historic fabric by virtue of their automated capabilities of

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[31] Dana Lockett, (HAER architect) in discussion with the author, August 17, 2010.
[32] Schara, *Interview*.
[33] Lockett, *Interview*.
[34] Warden and Woodcock, "Historic Documentation: A Model of Project Based Learning for Architectural Education," 113.

remote sensing, remote production, and redefinition of documentation.[35] Warden and Woodcock also stated that in heritage documentation projects, the use of digital tools has the pedagogical drawback of separating the collector from direct contact with the artifact being collected.

While documentation technologies constantly evolve and new tools are being developed, some principles remain constant. The profession still needs focused and systematic thinking for documenting historic resources in the digital era that do not losing sight of the important issues and many intangible dimensions of historic documentation. The significance of this study arises from the necessity of addressing the consequences of digital documentation tools in view of the human bond with cultural heritage. Only when we can identify the pros and cons of technological mediation in heritage documentation, can we then proceed to a successful integration of heritage documentation with digital methodologies.

In many ways, we need to revisit Charles Peterson's original ideas from his the ten-page proposal for HABS. Peterson addressed the need for documentation of American historic resources as a means of safeguarding these values to the future.[36] However, Peterson's memorandum revealed a founding philosophy that was much more ambitious than just emphasizing the cultural loss associated with building demolition. His original goals were to develop a systematic way of documenting America's architectural heritage, to help design professionals understand the need for a specialized

[35] Warden and Woodcock, 110.
[36] Charles E. Peterson, "The Historic American Buildings Survey Continued," *The Journal of the Society of Architectural Historians* 16, no. 3 (1957): 30.

knowledge and education in the treatment of architectural heritage, and to provide employment for unemployed architects during the Great Depression.[37] The current study contributes to the heritage documentation discipline by opening a new perspective based on the assessment of drawing, technology, and human engagement with historic environments. The study seeks an approach that resides in today's digital world without losing any of the qualities that the HABS experience has offered to generations of architects.[38]

Objectives of the Study

The general objective of this study is to discover a thorough comprehension of heritage documentation in relation to the act of drawing and technology. Three objectives are more specific. First, the study aims to define how technological mediation transforms the act of drawing. The second line of inquiry is concerned with how technologies alter a documenter's engagement with cultural heritage. The third objective regards the HABS entity in the future and is an inquiry into the intersection of a way of thinking about heritage documentation that combines the benefits of drawing with the use of analogue and digital technologies.

[37] Skarmeas, "From HABS to BIM: Personal Experiences, Thoughts and Reflections," 47.
[38] Ibid., 53.

Literature Review

Reflections on Drawing

Drawing is a vital human endeavor that is directly linked with practices of thinking and observation. To draw, one must look carefully and fully immerse oneself in the dimensions of one's world and must observe the physical elements individually as well as collectively. The person drawing needs to note and record the idiosyncrasies that distinguish each element from the next.

The history of drawing is as old as civilization itself. Humans have always attempted to infuse meaning into the objects they observe in nature and the things they construct. The prehistoric paintings in the caves of Lascaux in France and similar wall paintings chronicled a successful hunt, a story of heroism, or acted as an amulet. Throughout past centuries, architecture communicated through drawings inscribed on papyrus, silk, paper, wooden panels, stone, clay tablets, and many other materials. These drawings often embodied highly ritualized, prophetic, or cultural values and content.

Drawing is the primary vehicle used in the analysis of architecture. In architecture, analytical thinking is defined as acquiring knowledge and understanding of the possibilities and workings of a structure by examining examples. The use of analytical drawing in architecture for the acquisition of knowledge and understanding has a long and distinguished history. The careful measurement and analysis of the ancient Greek and Roman architecture helped develop Renaissance architecture. Palladio, Vignola, Scamozzi, Serlio and other thinkers not only brought attention to classical architecture through their meticulously measured and drawn analytical drawings, but also made a historical record of the surviving examples.[39]

In heritage documentation, analytical drawing has many merits. It constitutes a link between the hand, the eye, and the brain, supports the process of engaging with cultural heritage, provides a language of the basic elements of architectural design, and develops a way of viewing the world. First, through drawing, the documenter develops observation skills. Drawing demands careful scrutiny and a close regard for the parts as well as the whole. These observation skills are beneficial for the documenter to understand architectural sensibilities of the existing fabric, as well as develop design ideas. Second, the documenter is immersed in the historic environment and is able to develop an intimate knowledge of it. The documenter acquires knowledge of traces of the building campaigns and changes to the structure over time and develops an appreciation and passion for architectural heritage. Third, the documenter develops appreciation of the structure's design. Architects' intellectual resources of design come from their experience of the world and critical appreciation of the buildings they have documented, visited, or studied in published form. Fourth, drawing involves the relation of hand to eye, and ultimately, their relation to the brain. Drawing requires mediation in the setting with all three of these senses. The fifth merit is in some ways a summation of the prior four merits. Drawing requires time, attention, and a focused acknowledgement of particular places. That is why artists and architects keep sketchbooks with them.

[39] David G. Woodcock, "Discovery through Documentation: The Investigation of Historic and Cultural Resources," *APT Bulletin* (2006): 111.

Drawing within the confines of a sketchbook nudges them to take more care, to learn from the previous drawings, and to improve the next ones.[40]

In today's architectural culture, much of the act of drawing is digitally drafted. Through the digital translation of architectural worlds, architects translate their experiences into computer data, as well as their design ideas.

In heritage documentation, a number of digital recording technologies such as the three-dimensional laser scanner have drastically shaped the execution of drawing. The documenter collects field data in the digital format while producing a minimum number of actual drawings on site. In laser scanning documentation, the act of drawing is in the translation of the digital 3-D scanned data to 2-D heritage information. The user clips appropriate views from the three-dimensional scanned data and works from these. Researchers often use CADD to trace each element of the structure on the scans.

Due to the consistency and editable qualities of the digital data, heritage professionals increasingly prefer to communicate their projects with drafting software. For example, the extensive use of CADD in HABS projects illustrates the impact of digital means in the drawing component of documentation.

The use of CADD has given HABS a world in which graphic representations have reached unforeseen heights. For example, HABS teams were able to produce measured drawings of large-scale structures such as the Lincoln, Jefferson, and Washington memorials through CADD. However, a substantial learning curve was required to adapt traditional HABS methods to the CADD technology. The issue was

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[40] Marc Treib, "Drawing/Thinking:An Introduction," in *Drawing/Thinking: Confronting an Electronic Age*, ed. Marc Treib (London , New York: Routledge, 2008), x-xi.

complicated by the ease of drawing in CADD using orthogonal mode, which provided an incentive to use perfect right angles even though the historic structure was not rectilinear. However, it became apparent that the benefits of CADD were almost too numerous to mention. The utilization of CADD has become a mutual means of production and distribution of drawings. Some of these benefits include:

a) the ability to include all the requisite detail in a single drawing (instead of having to manually redraw items at larger scales),
b) the ability for multiple draftsman to work simultaneously on a single drawing,
c) the ease of copying replicated items,
d) the ability to plot drawings at any scale,
e) the combining of the drawing and inking processes, and
f) the ease of disseminating drawing files.[41]

By the 1990s, traditional hand drawing and hand inking was replaced by CADD. At present, all the in-house HABS projects are executed using CADD. [42]

The intensive use of digital media clearly indicates that heritage documentation is a discipline characterized by continued change. On the other hand, digital media directly alters the form of heritage information as well as how it is understood. The scanned data becomes an invisible environment in which the documenter’s engagement with cultural heritage has been transformed. The documenter does not rely on his own individual

[41] Lavoie and Schara, “Reinforcing Our Structure, Enhanced Standards, Methodologies, and Outreach,” 74.
[42] Ibid., 75.

empirical observations; instead, the documenter focuses on the digital environment to tell him about the historic structure. Furthermore, the production of digital drawings through CADD has also transformed the act of drawing. The delineator creates a drawing using particular conventions of CADD through copying, pasting, offsetting lines, and rectangles. In an effort to describe the future of HABS with technological methodologies, it is critical to determine the merits of drawing in heritage documentation, as well as the transformations that technologies bring to the act of drawing.

Philosophy of Technology

The heritage documentation field has grown in tandem with technological advancements. Today, we can do practically anything in recording and documenting the built environment. However, it seems that heritage professionals are mostly concerned with the products and processes made possible by technology: bigger, better, faster, cheaper, newer, more unique, more durable, more ingenious, more efficient, etc.[43]

Humans, generally speaking, conceive technology as a trademark of their century; they take technological improvements for granted in the course of their lives. In particular, modern technology may seem to be just a more efficient means of doing what humans have always done. In addition, technology is a major force shaping the world in which humans live, the way they experience their surroundings, and the society in which

[43] Robert Silman, "Is Preservation Technology Neutral?," *APT Bulletin* 38, no. 4 (2007): 3.

they live. Hence, technology confronts humanity with issues that go to the core of who they are and how they live.

In an effort to discover the way technological mediation alters humans' connection with cultural heritage, the discussions regarding the philosophy of technology constitute a critical infrastructure of this study. In this context, the discourses of Martin Heidegger (1889-1976), Don Ihde (1934-present), and Marshall McLuhan (1911-1980) bring a vital perspective to this dissertation.

Heidegger is one of the most influential philosophers of the 20th century and discussed technology as a mode of revealing. Accordingly, modern technologies reveal the forces in nature as a supply of energy that is extracted and stored on command; the earth is converted into a coal-mining district and soil is a mineral deposit.[44] As human beings enter the world in action and interact with the world, the world is revealed and ordered in a definite manner with technology. Heidegger stated that humans' contact with the world is technically mediated. What they experience is not the pure immediate interaction, but rather they experience what is lived at the limit of technology. In fact, in heritage documentation technological mediation is evident in examples such as the use of photographs in architectural photogrammetry.[45]

Architectural photogrammetry is a technique derived from aerial map making in which images from photographs are converted to accurate scale drawings. The process is especially well suited to recording large or complicated structures and offers the

[44] Martin Heidegger, *The Question Concerning Technology and Other Essays*, 1st Harper pbk. ed. (New York: Harper & Row, 1977), 14.
[45] I am going to discuss architectural photogrammetry extensively in Chapters III, IV, and VII.

possibility of making and storing large numbers of photogrammetric images, from which measured drawings could be made at any time. However, Perry E. Borchers said that this recording methodology is limited to what the cameras can see.[46] Only what appears in a photograph, and often what appears simultaneously in two stereo-pairs, can be measured and drawn. Accordingly, the level of details covered in photographs determines the accuracy and content of the drawings. In other words, what is captured in the photographs dominates how the documenter sees and knows the heritage asset.

According to Heidegger, technology is not neutral, and it is imbued with many values. Technology, by its sheer mastery of certain aspects of nature, has made unprecedented advances in humans' lives possible. Consequently, the very existence of recording technologies imparts a real value. For example, using architectural photogrammetry to record tall structures without the need of any scaffolding possesses a significant value, because it is now feasible to include buildings with difficult or dangerous access in documentation projects.

Heidegger emphasized that technology never ends.[47] In the technological age, everything shows up as needing to be reorganized in order to make it more efficient, flexible, and useful in an infinite variety of ways. As people become addicted to the technological instruments, they start to identify all the experience in terms of ease and flexibility. For example, when heritage professionals purchase a digital tool or device, the instrument immediately becomes outdated and a more efficient, more accurate, and

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[46] Perry E. Borchers, "The Measure of the Future and the Past," *Journal of the American Institute of Architects* 28(1957): 353.
[47] Heidegger, *The Question Concerning Technology and Other Essays*, 16.

faster one has already been released. Then the documentation team strives to experiment with the newer release.

Another key theorist on technology, Ihde stated that technology is ambivalent. Ambivalent technology is distinguished from neutrality by the role it attributes to social values in the use and the development of technical systems. Technological culture no longer appears to involve a way of reduction of the ways that the world is revealed to the humans. Technology does not only develop in the direction of one-dimensionality, calculability, and uniformity, but rather in the direction of plurality. According to Ihde, there are many possible forms of technological mediation that transform human's access to the world. On one hand technologies open new ways of access to the world; on the other hand they narrow this access. Ihde's understanding of technology is very important because he explains human experience with technology through embodiment and hermeneutic relations.[48] Non-neutrality is most evident in the former, where bodily perception is extended by the use of tools (through the effects of either amplification or reduction). Hermeneutic relations occur when the technology represents the quality or value of an object without a person perceiving that quality directly.

Traditionally, hermeneutics was understood as to involve the interpretation of texts. Ihde, however develops a more material conception of hermeneutics. According to Ihde, it is possible to interpret things rather than texts hermeneutically such as those by scientific instruments. In other words, scientific instruments constitute what scientists observe; these instruments interpret reality before humans can observe it.

[48] Don Ihde, *Technology and the Lifeworld: From Garden to Earth*, The Indiana Series in the Philosophy of Technology (Bloomington: Indiana University Press, 1990), 6-13.

In both embodiment and hermeneutic relations, there is an important mutual characteristic: technology mediates experience, and through this mediation, it alters the experience of phenomena.[49] For instance, when a surveyor examines the surface of a historic structure, he experiences the surface through the tip of his fingers. However, when he uses a pair of plastic gloves, the smoothness or roughness of the surface can only be felt through the gloves. Therefore, his experience of the surface changes with medium that is used.

According to Ihde, mediation amplifies certain characteristics of an object. Amplification reveals features that are only partly available, or perhaps not available to the naked eye.[50] For instance, one of the recent additions to the arsenal of documentation technologies, the three-dimensional laser scanner[51], can reveal structural deformations of an artifact. This device rapidly shoots multiple laser points across a surface, resulting in a three-dimensional "point-cloud." Using relatively sophisticated software, surfaces can then be mapped to the points, and subsequent "slices" taken to determine if the structure is warping out of its true geometrical shape, and to see if the building is plumb or leaning in any direction. In the 2002 documentation project for the Bodie Island Lighthouse in Rockville, Maryland, NPS used the scanned data to determine if the tower had deviated from the centerline. The team created section cuts through the point cloud of the structure at ten-foot intervals. The point-cloud showed that the tower had

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[49] Don Ihde, *Technics and Praxis*, Boston Studies in the Philosophy of Science (Dordrecht, Holland , Boston: D. Reidel Pub. Co., 1979), 8.
[50] Ibid., 21.
[51] I am going to discuss three-dimensional laser scanner extensively in Chapters III, IV, and VII.

maintained true circular shape throughout its rise and had not deviated from the centerline.[52]

However, as Ihde stated, mediation amplifies our experience with our surroundings; it also reduces other features of the object.[53] While the mediated environment of scanning amplifies structural information which is not obvious to the naked eye, this mediation also reduces the documenter's engagement with cultural heritage. The documenter can now record the entire site in a couple of days, compared to weeks of fieldwork with traditional methods. While the reduction of the fieldwork is favorable in projects that have time contingencies, the documenter does not get the same sense of the heritage environment that he can when immersed in the historic setting.

Regarding technological mediated experience with our world, McLuhan discussed that, in fact, 'The Medium is the Message.' McLuhan viewed media not only as tools to be used in different ways, but as part of the environment, often fading in the background yet influencing and shaping humans in highly significant ways. The various media directly alters how information is understood and how reality is perceived. The different form, arrangement, or ratio of each medium cultivates our senses in a distinct manner, which creates new forms of awareness. These perceptual transformations happen regardless of the content of the message.[54] 'The Medium is the Message' implies that, in order to understand the context of the message, people need to start exploring

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[52] Todd A. Croteau, "Documenting Bodie Island Lighthouse: Using Digital Technologies for Efficient and Accurate Measurements," http://www.hnsa.org/conf2004/papers/croteau.htm.
[53] Ihde, *Technics and Praxis*, 21.
[54] Susan B. Barnes, "The Global Village Versus Tribal Man: Tthe Paradox of the Medium and the Message," in *The Legacy of McLuhan*, ed. Lance Strate and Edward Wachtel (Creskill, NJ: Hampton Press, 2005), 285.

what the medium is and move it from the invisible background into the foreground. Only by developing an awareness of media, can humans then analyze the powers of perception and capacity for understanding and begin to realize the different messages, different worldviews, and different ways of life that each different medium provides.

By medium, McLuhan refers not only to the material, but also to the means, modes, and methods by which humans operate on the material world. For example, writing is not only a conduit of information and communication, but it also transforms the way people think and organize information.[55] All media are dynamic metaphors in their power to translate people's experiences into new forms. Even a single spoken word has the power to render people's experiences. With words, humans can translate our immediate experience to vocal symbols, so that the world can be evoked and retrieved at any moment.[56]

McLuhan started his research with communication media, but soon after stretched his doctrine to the concept of technology as a whole. He felt that all technologies are inherently media because they interface between humans and their environment. Further, as with any media, technologies also restructure patterns of social independence and every aspect of a person's life.[57] Given this, the message of any

[55] Denise Schmandt-Besserat, "The Interface between Writing and Art," in *The Legacy of McLuhan*, ed. Lance Strate and Edward Wachtel (Creskill, NJ: Hampton Press, 2005), 109.
[56] Marshall McLuhan, *Understanding Media: The Extensions of Man*, [1st ed. (New York,: McGraw-Hill, 1964), 64. Denise Schmandt-Besserat, "The Interface between Writing and Art," in *The Legacy of McLuhan*, ed. Lance Strate and Edward Wachtel (Creskill, NJ: Hampton Press, 2005), 109.
[56] Marshall McLuhan, *Understanding Media: The Extensions of Man*, [1st ed. (New York,: McGraw-Hill, 1964), 64.
[57] McLuhan, 23.

medium or technology is the scale, pace, or pattern that it introduces to human affairs.[58] For example, laser scanning has revolutionized heritage documentation work in many ways. First, with the utilization of a laser scanner, all types of surfaces from artifacts to single structures to historic landscapes can be measured, and an accurate base of information can be provided. Second, laser technologies have changed the pace of recording, allowing information to be recorded at a much faster pace. Scanning technologies have allowed great advances in obtaining measurements and producing highly accurate representations in real time. For a simple comparison, a two-person HABS field crew can barely capture 500 points per day surveying with a total station or other electronic distance-measurement equipment. However, when using the scanner, technicians can record up to one million data points in minutes.[59] A large building such as the St. Andrews Church in Bryan, Texas can be scanned in one to two days. Third, technologies have introduced new patterns to heritage recording. Now heritage professionals can experience increasing numbers of new recording situations using diverse humanistic and technical sciences.

According to McLuhan, the use of modern technologies has brought distinct characteristics to human lives. For instance, through technology people acquired the ability to carry out dangerous social operations with complete detachment and a posture of uninvolvement. Imagine what would happen if a surgeon had to be involved directly in an operation on himself.[60] In the case of heritage recording, the remote sensing tools

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[58] Ibid., 24.
[59] Elizabeth I. Louden and Karen Hughes, “Bridging the Gap: Using the 3-D Laser Scanning in Historic-Building Documentation,” *APT Bulletin* Vol. 36, No. 2-3 (2005): 38.
[60] McLuhan, *Understanding Media: The Extensions of Man*, 20.

allow documenter to examine various phenomena that are under hazardous circumstances with a physical detachment. In addition, imagine the hazardous field environment if a surveyor had to record a severely dilapidated historic structure with only the use of a tape measure and a plumb bob.

Worldwide platforms such as the International Council on Monuments and Sites (ICOMOS) promote the application of theory, methodology, and scientific techniques to the conservation of the architectural and archaeological heritage. Technical forums such as the Association for Preservation Technology (APT), the accompanying APT annual conference, and peer-reviewed journals such as the APT Bulletin provide technical knowledge and guidance for heritage professionals in the international arena. Furthermore, organizations such as National Center for Preservation Technology and Training (NCPTT), a research division of the National Park Service, provide applied research and professional training in the heritage field in the United States. NCPTT awards grants for research for the use of science and technology in the field of historic preservation. In addition, many scholarly works such as Al-Ratrout's[61] dissertation work of the feasibility of the optical Moiré interferometry technique in heritage recording and Burt's[62] analysis of digital photogrammetry for the measurement of historic adobe ruins have been devoted to the efficient integration of technological applications in heritage projects. However, discussing the technological meditated environment of heritage

[61] Samer Abdulmunim Al-Ratrout, "Feasibility Study of Using Optical Moiré Interferometry Technique for Fine-Grain Surface Relief in Heritage Recording." (College Station, Texas: Texas A&M University, 2005), http://handle.tamu.edu/1969.1/2520.
[62] Richard Andrew Burt, "An Investigation into the Factors Affecting the Accuracy of Close Range Digital Photogrammetry for the Measurement of Historic Adobe Wall Ruins" (Thesis (Ph D), Texas A&M University, 2000).

documentation has never been part of the discipline; hence, the need to conduct a philosophical inquiry of the documenter's stance in the heritage documentation projects in the current study.

HABS in the Literature

One of the milestones of the American historic preservation movement, HABS was born on a Sunday afternoon in November of 1933 when Charles Peterson, then a young employee of the National Park Service, wrote a ten-page proposal for the program.[63] According to Peterson, our architectural heritage of buildings from the previous four centuries was diminishing daily at an alarming rate. The ravages of fire and other natural elements, together with demolition and alterations caused by real estate 'improvements,' formed an inexorable tide of destruction destined to wipe out the great majority of the buildings dating from the beginning of the nation. Therefore, Peterson felt it was the responsibility of the American people to see that these antique buildings must somehow be recorded before they disappeared into unrecorded oblivion.

HABS is one of the most remarkable products of the Great Depression. Since its inception, the HABS program has survived and continued to grow -- unlike other federal assistance projects that disappeared as soon as federal funding ended. The survival of HABS is due partly to the thoughtful structure of the initial program via the 1934 agreement between NPS, AIA, and the Library of Congress. In addition, the success of the program represents the widely perceived need in the United States to identify and

[63] Peterson, "The Historic American Buildings Survey Continued," 30.

document the surviving architectural masterpieces of the past, particularly the ones that might be threatened with development or demolition.[64]

Over the course of the years, HABS utilized the records produced by thousands of architects and architecture students spanning every part of the country, from Alaska to Florida, and recorded every architectural example from early American buildings to the 20th century Modernism. While HABS has continued to fulfill the task of documenting American architectural heritage uninterrupted to the present day, HABS documentation has been fine-tuned to incorporate a logical sequence of tasks over time.

First, HABS has evolved into an education platform with "hands-on" field training for young architects and students in the field of historic preservation. Through HABS, students learn several skills, including how to perform archival research, to collect accurate measurements and create comprehensive field notes, to use different documentation methodologies, to prepare "as found" condition drawings in a wide range of media, to pencil on trace paper, to ink on Mylar and/or CADD, to assemble a comprehensive package that would be a complete documentation record of as-found condition of historic resources, and to work on a professional project team.

Second, HABS has been assigned additional federal responsibilities following the amendment of the National Historic Preservation Act and the Secretary's Standards in 1983.[65] For example, HABS collaborated with diversified organizations to bring life into dilapidated downtowns that were suffering from urban renewal and other threats. In

[64] James C. Massey, "The History of HABS Nationwide," in *Recording a Vanishing Legacy: The Historic American Buildings Survey in New Mexico, 1933-Today,* ed. Sally Hyer (Santa Fe, NM: Museum of New Mexico Press, 2001), 1.
[65] Kapsch, "HABS/HAER: A User's Guide," 23.

addition, HABS became the central figure in federal mitigation projects. If a federally funded project had to alter or demolish a historic site, the NHPA mandated that the property be documented according to the HABS standards.

Third, HABS has evolved into a recognized federal partner in the preservation practice. HABS collaboration with the private sector and non-governmental organizations such as the National Trust, the Preservation Alliance for Greater Philadelphia, Cyark, and the Culture Minister for the Scottish Government define the program as an overarching cultural heritage program in the field.

Fourth, HABS has become an important vehicle to publicize heritage information. Numerous literature studies have discussed the HABS documentation philosophy. For example, *Recording Historic Structures*, ed. J. A. Burns and the staff of HABS/HAER, has been referred to as "the bible, so to speak," for recording historic buildings in the United States, [66] and it is the principal handbook used by any heritage professional or student who prepares documentation for HABS, HAER, HALS, or other federal bodies. The study addressed how to develop formal documentation of built heritage by using histories, large-format photography, and measured drawings. The compilation defined the use of measured drawing as a means to document historic structures and elaborated on how to prepare these particular drawings. The study presented various documentation methodologies such as hand survey, large-format photography, photogrammetry, and three-dimensional laser scanning as means to collect field data. However, because the book was designed to elaborate on the execution of

[66] J. A. Burns, *Recording Historic Structures* (Wiley, 2004).

HABS documentation, the study did not cover the philosophical inquiry of the act of drawing in heritage documentation or the transformations that the technological mediation brings to the profession.

Recording a Vanishing Legacy, ed. S. Hyer, is a compilation of articles of HABS works in New Mexico from 1933 to the time it was published.[67] This study is significant not only because it described HABS documentation in New Mexico, but also because of the accompanying personal accounts of the project participants. The contrasting perspectives of HABS team members from 1934, the 1960s, the 1970s, and the 1980s revealed much about their efforts to record the adobe structures using the HABS documentation methodology. Thus, the memoirs of these team members are pivotal to the comparison of the documentation culture in different epochs.

Komas' dissertation, *Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study*, explored how individuals with different levels of involvement with the program conceptualize the development, operational context, and future direction of HABS.[68] Komas also concentrated on examining the role of technology in the process of HABS documentation and its influence on the end-products. The participants in the study portrayed technology as a beneficial tool to facilitate obtaining measurements and produce drawings. However, Komas noted that the rapid obsolescence of digital technologies, as well as the unsolved digital data archival issues of the Library of

[67] Sally Hyer, "HABS Recording in New Mexico," in *Recording a Vanishing Legacy: The Historic American Buildings Survey in New Mexico, 1933-Today*, ed. Sally Hyer (Santa Fe, NM: Museum of New Mexico Press, 2001).
[68] Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study."

Congress, limited the inclusion of HABS projects that have been prepared by digital means to the Library's HABS archive.

The studies noted above provide an invaluable insight to the HABS culture of documentation. Yet, they do not study the way that technological decisions could change the perception of cultural heritage. Even though the execution of HABS documentation is intertwined with the act of drawing and technological progress, the technological inquiry has not been much mapped in the HABS discourse. In order to define HABS in the future, the causes and effects of technology should be clearly defined, and the meaning of drawing should be described in this context. The current study bridges this gap by studying drawing as a way of connecting to cultural heritage and determining what we are gaining and missing with the technological mediation.

Methodology

In order to embrace the existing structure and processes within the documentation environment, a qualitative research method was used in this study. Qualitative research has significant characteristics: an emphasis on natural setting, a focus on interpretation and meaning, a focus on how the respondents make sense of their own circumstances, emergent rather than tightly prefigured, and the use of multiple interactive and humanistic tactics.[69]

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[69] Adapted from Catherine Marshall and Gretchen B. Rossman, *Designing Qualitative Research*, 4th ed. (Thousands Oaks, CA: Sage Publications, 2006), 3, and Linda N. Groat and David Wang, *Architectural Research Methods* (New York: J. Wiley, 2002), 176-77.

Using a case study is a recognized approach in qualitative research that allows the researcher to entail immersion in the setting, and provides in-depth and detailed examination of the phenomenon under study. In this context, due to the physical limitations of this study, studying the entire field of heritage documentation is an impossible task. However, framing the documentation discipline to a smaller study area -- such as the HABS culture of documentation -- explores all dynamics in the field, elicits sub-themes extensively, and clarifies the patterns.

The strength of the case study strategy lies in the utilization of multiple data gathering methods.[70] The current study utilizes a literature review, in-depth interviews, the researcher's observations, and an analysis of individual documentation projects that follow the HABS methodology as individual methods. The literature review builds the logical framework for research and locates this framework in a context of related studies. Stemming from this foundation, the research constructs a body of knowledge through contrasting perspectives from in-depth interviews, the researcher's observations from participating in cultural heritage projects, and a critical insight of case studies.

The use of multiple tactics has several advantages. It limits bias in the findings, improves trustworthiness of the study, and facilitates the transfer of the discoveries to similar documentation settings that deal with technology and drawing. When the data coming from all these different methods indicates a certain issue, for example the virtues

[70] Groat and Wang, *Architectural Research Methods*, 360-62.

of the act of drawing in engagement with cultural heritage, this improves the validity of the particular discussion within the context of the current study.[71]

An Overview of the Study

The ramifications of the inquiry of this study necessitate delving into broad theories, methodology, and applications, some of which come from outside the discipline of heritage documentation. In this context, Chapter II presents the qualitative research and locates the study within this context. The chapter maps the research question by explaining the case study strategy. Chapter III examines analog and digital technologies used in heritage documentation, as well as reflecting on the issues of archiving heritage information. The chapter delves into hand survey and recording, large-format photography, total station theodolite, global positioning systems, pictorial imagery, rectified photography, photogrammetry, laser scanning, computer-aided design and drafting, structured light scanning, databases and geographic information systems. Chapter IV provides the history of HABS. The historical origins of HABS are reviewed here, as well as the noteworthy development of the program from 1933 to the present date. In addition, the chapter discusses HABS documentation strategies in tandem with historic epochs. Chapter V presents a thorough analysis of drawing in architectural history and thought. This chapter examines the values and meanings embedded in the act of drawing as well as in the final product. Furthermore, this chapter locates the HABS drawings in this tradition. Chapter VI examines the philosophical discourse of

[71] Groat and Wang, 360-62.

technology through Heidegger’s discussion of revealing, Ihde’s doctrine of meditation, and McLuhan’s argument of medium. Chapter VII deals with the transformation of the documentation practice. The chapter utilizes a comparative study of hand recording and laser scanner surveying. In this chapter, documentation projects from the center for Heritage are used as case studies. Chapter VIII contains a review of drawing and technology, presents the future of HABS culture of documentation, provides recommendations to heritage professionals in regards of a successful documentation project, and probes possible future research areas.

CHAPTER II

METHODOLOGY

This study examines how digital documentation media transform the act of drawing and, hence, the architectural documenter's bond with cultural heritage. The study also examines the ways that the technologically mediated documentation environment both helps and hinders the act of drawing, and how it alters a documenter's understanding of cultural heritage. In particular, this study focuses on the HABS documentation philosophy, which still includes the use of "low- tech" pencil sketches on graph paper, along with the use of "high-tech" documentation technologies. This study discusses heritage professionals' impressions and feelings, as well as the strategies they use to document historic fabric, the significance of drawing within this context, and the use of technologies to acquire information about architectural heritage assets. It is not a historical study, nor does it attempt to reconstruct a chronological of events of HABS history. It is not an experimental study because it is not trying to prove or disapprove a pre-stated hypothesis of technology or drawing. Rather, it is a practical study seeking to provide a better understanding of the relationship between documentation, technology, drawing, and cultural heritage. The desired results are recommendations to HABS staff and other heritage professionals on how the documentation process can evolve in the future using digital mediation, yet retain the intangible values of drawing.

The constructivist paradigm constitutes the infrastructure for this study. The constructivist belief system supports a relativist ontological position: "realities exist in the form of multiple mental constructions, socially and experientially based, local and specific, dependent for their form and content on the persons who hold them."[72] In other words, the constructivist conceives the nature of reality as multiple realities where each person holds a different and equally valid view of a situation. Constructivism advocates an epistemological stance in which the relationship between the knower and known is subjectivist: "[the] inquirer and inquired into are fused into a single (monistic) entity. Findings are literally the creation of the process of interaction between the two."[73] The constructivist perceives that he and his respondents influence each other, and this intense interaction develops the findings of the study. Hence, the methodology of the constructivist belief system elicits and refines individual constructions and compares them dialectically with the aim of generating one of few constructions on which there is substantial consensus.[74]

In accordance with constructivism, this study employed a qualitative research strategy. Qualitative research is a "multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials."[75]

Qualitative research is a broad approach to the study of social phenomena that varies in methodologies. In his 2007 work, Creswell discussed narrative research,

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[72] Egon G. Guba, *The Paradigm Dialog* (Newbury Park, CA: Sage Publications, 1990), 27.
[73] Ibid., 27.
[74] Ibid., 27.
[75] Norman K. Denzin and Yvonna S. Lincoln, *Strategies of Qualitative Inquiry* (Thousand Oaks, CA: Sage Publications, 1998), 3.

phenomenology, grounded theory, ethnography, and case studies as major qualitative inquiry strategies.[76] During, Denzin, and Lincoln recognized case studies, ethnography, phenomenology, grounded theory, life history, historical methods, action research, and clinical research as qualitative research genres.[77] Even though qualitative methodologies exist in great variety, they merge in some considerations and procedures.[78] The complexities of social interactions in life and contrasting perspectives of individuals channel qualitative researchers into natural settings, rather than laboratories, and foster pragmatism in using multiple methods for exploring a topic. For qualitative study context matters, the internalized notions of norms, traditions, roles, meanings, and values are critical aspects of the setting. [79] Only by working in the natural environment of heritage documentation can this study discover how these complexities and multiple versions of reality of heritage documentation operate over time.

This study defines the natural setting of heritage documentation as the cultural, social, and physical environment in which the documenter spends time working on a project. Thus, the documentation environment has two parts: (a) the actual site where the documenter gathers data, (b) the office environment in which the documenter translates the field data into heritage information.

Lincoln and Guba defined emergent design as one of the major characteristics of qualitative research. The flexibility of emergent design allows the researcher to

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[76] John W. Creswell, *Qualitative Inquiry & Research Design: Choosing among Five Approaches*, 2nd ed. (Thousand Oaks: Sage Publications, 2007), 10.
[77] Norman K. Denzin and Yvonna S. Lincoln, *The Sage Handbook of Qualitative Research*, 3rd ed. (Thousand Oaks: Sage Publications, 2005), xii.
[78] Marshall and Rossman, *Designing Qualitative Research*, 2.
[79] Ibid., 53.

determine the "unfolding, cascading, rolling, and emerging" issues during the study rather than to construct it preordinately.[80] In qualitative research, what emerges between the researcher and the phenomenon being studied is largely unpredictable in advance. Therefore, the unfolding multiple realities determine the design, and process of data gathering emerges as the needs of new information are revealed.

As the current study commenced, the researcher determined that more interviewees would add a valuable set of additional data and additional projects would demonstrate diversified aspects of documentation. As far as the methodology for this study, emergent design became evident during the process of selecting interviewees (guided by emerging findings), the structure of the interview questions (open-ended), and the selection of documentation projects (guided by emerging findings).

One of the implications of qualitative inquiry is that the researcher serves as the primary data-gathering instrument. The researcher constitutes an intimate part of research:

> …because it would be virtually impossible to devise a priori a nonhuman instrument with sufficient adaptability to encompass and adjust to the variety of realities that will be encountered, because of the understanding that all instruments interact with respondents and objects but that only the human instrument is capable of grasping and evaluating the meaning of that differential interaction, because the intrusion of instruments intervenes in the mutual shaping of other elements and that shaping can be appreciated and evaluated only by a human, and because all instruments are value-based and interact with local values but only the human is in a position to identify and take into account (to some extent) those resulting biases. [81]

[80] Yvonna S. Lincoln and Egon G. Guba, *Naturalistic Inquiry* (Beverly Hills, CA: Sage Publications, 1985), 41.
[81] Ibid., 39-40.

One of the challenges in qualitative study is to limit bias in the interpretation of data. Certainly, my own personal role as an architect in Turkey and heritage professional condition the research questions and the stake in the emerging answers. Further, my personal interests in HABS documentation have influenced the research process. My personal interest in documentation can be considered both valuable and detrimental to the results. It is valuable because with my knowledge and practice in heritage documentation, I can interact better with the phenomena and emerging questions in the study. In addition, my personal connection with heritage professionals provided easy access to the participants, and reduced the amount of time spent on data collection. It is detrimental due to potential bias and reactivity to the emergent information. Therefore, to limit bias I used the case study method as a means to utilize multiple data gathering strategies in order to provide a trustworthy and rich research study.

According to Yin, “A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”[82] The case study methodology constitutes an essential form of qualitative study. Studies focusing on society and culture in a group, a program, or an organization typically espouse some form of case study as a strategy. In this context, using the HABS culture of documentation as a focus of inquiry allowed me to explore all dynamics in the HABS context, extensively elicits sub-themes, clarify all the patterns, and gave me information regarding relevant variables that had yet to be identified.

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[82] Robert K. Yin, *Case Study Research: Design and Methods*, 2nd ed., Applied Social Research Methods Series (Thousand Oaks: Sage Publications, 1994), 13.

> Case study research strategy has five major characteristics:
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> (a) a focus on either single or multiple cases, studied in their real life contexts, (b) the capacity to explain causal links, c) the importance of theory development in the research design phase, (d) a reliance on multiple sources of evidence, with data needing to converge in a triangulating fashion, and (e) the power to generalize to theory. [83]

Case studies use multiple data gathering methods. When the data comes from different sources, using multiple sources of evidence strengthens a case study.[84] During the research, when findings, interpretation, and conclusions are derived from different data sources, the case study will be less prone to errors. However, if the researcher utilizes only one data source, the findings will not be reliable because he the interview may be inaccurate interview or the documentation may be biased.

Triangulation constitutes a process whereby data is gathered through different questions, different sources, and different methods to bear on the same set of issues. A point in space is described by specifying the intersection of three vectors. The social sciences imported the triangulation concept for dealing with qualitative evidence. Hence, the most robust fact should be determined through at least three coinciding sources.[85] In qualitative studies, researchers use triangulation to address issues of research validity, credibility, objectivity, and conformability.[86] If all the data sources all point the same direction, then the researcher has triangulated the data successfully and he can be more

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[83] Groat and Wang, *Architectural Research Methods*, 346.
[84] Robert K. Yin, *Applications of Case Study Research*, 2nd ed., Applied Social Research Methods Series (Thousand Oaks: Sage Publications, 2003), 83.
[85] Ibid., 83.
[86] Groat and Wang, *Architectural Research Methods*, 361.

confident in the conclusions. However, as Marshall and Rossman discussed triangulation is not about getting the "truth" but rather about finding multiple perspectives.[87]

Triangulating multiple data gathering strategies strengthens the transferability of the findings to other projects in similar situations, with similar research questions or questions of practice. The study of the HABS documentation methods illuminates the larger dynamics of heritage documentation and technology, and triangulating multiple data sources facilitates transposing the findings of this study to any documentation project that utilizes technology and drawing.

Methods

The current study is structured around three lines of inquiry. The first concerns documentation as a means to connect with cultural heritage. The second line of questioning complements the first one through seeking means of drawing as a way to engage with the historic environment. The third inquiry seeks the effects of technological mediation on the documenter's bond with cultural heritage through the act of drawing. These lines of inquiry were undertaken together using the HABS culture of documentation as a case study strategy. The case study utilized multiple and complementary data gathering methods that included a literature review, analysis of individual documentation projects that follow the HABS methodology, participant observation, and in-depth interviews.

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[87] Marshall and Rossman, *Designing Qualitative Research*, 204.

The study pursued a process by which data gathering, transcription, organization, and analysis were combined together. One of the major challenges during a qualitative study is dealing with vast quantities of data.[88] In fact, many researchers spent years in the field coding vast amounts of unstructured data. In order to ease retrieval of data for analysis, in the beginning of this study I prepared a list of predetermined themes for data coding based on the literature review and my participant observations from heritage projects. The list consisted of general themes such as HABS, drawing, cultural heritage, preservation education, architectural education, recording technologies, documentation, photography, photogrammetry, laser scanning, large-format photography, the Library of Congress, etc.

Relying on these themes facilitated retrieval and analysis. However, in order to remain true to the flexible nature of qualitative research, I added and eliminated some themes as the research unfolded. I also started to work on individual chapters based on the literature review. Even though the findings from the in-depth interviews did not proceed in a linear fashion, I categorized them as general statements, followed by syntactical information fragments. I categorized these information fragments digitally via Microsoft Office Word, as well as using conventional index cards. After that, I analyzed and compared the information fragments before embedding the statements of the participants in the corresponding chapters. The process of combining description, analysis, and interpretation, and putting these into the early drafts of the chapters allowed me to determine any troublesome or incomplete data. Consequently, I focused

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[88] Groat and Wang, *Architectural Research Methods*, 199.

on additional literature review to fill the research gaps and added corresponding questions in the coming interviews. In the literature, Schatzman and Strauss referred to this interpretive/subjectivist approach as one in which the researcher is guided by initial concepts and then shifts or modifies data as he collects and examines data as analytic strategy.

> Probably the most fundamental operation in the analysis of qualitative data is that of discovering significant classes of things, persons and events and the properties that characterize them. In this process, which continues throughout the research, the analyst gradually comes to reveal his *is's* and *because's*: he names classes and links one with another, at first with "simple" statements (propositions) that express the linkages, and continues this process until his propositions fall into sets, in an ever-increasing density of linkages. [89]

Literature Review

The literature review was used to build the logical framework for this research study. It was the impetus for the initial findings, as well as guiding the infrastructure for emerging issues. It contributed to every aspect of the research process from identifying the research questions, to determining the protocol questions of the interviews, to the development of my own thinking. A brief review of the literature relevant to this study is presented in the following paragraphs. For this study, the literature review fell into four categories.

The first category concerned the understanding of drawing in architectural history and thought. The role of drawing has been discussed as a means of

[89] Leonard Schatzman and Anselm L. Strauss, *Field Research, Strategies for a Natural Sociology*, Prentice-Hall Methods of Social Science Series (Englewood Cliffs, N.J.,: Prentice-Hall, 1973), 108-10.

representation, communication, design, and analysis.[90] The act of drawing constitutes a direct link between thinking, observation, and learning.[91] Drawing is also embedded with cultural and social values.[92] Yet, the conceptualization of the act of drawing in heritage documentation has not raised much discussion.

The second line of inquiry focused on a technological discourse and the history of technology as well as its reflections on our lives.[93] Of particular concern are Heidegger's doctrine of technology as a mode of revealing[94], Ihde's discussion of technology as a mediated environment which alters our experience of phenomenon[95], and McLuhan's doctrine of 'Medium is the Message.[96] I chose these philosophers because their discourses on technological mediation display similarities to the current situation in the documentation practice.

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[90] Jukka Jokilehto, *A History of Architectural Conservation*, Butterworth-Heinemann Series in Conservation and Museology (Oxford, England , Boston: Butterworth-Heinemann, 1999), S. Ridgway, "The Representation of Construction," *Architectural Theory Review* 14, no. 3 (2009), John H. Stubbs, *Time Honored: A Global View of Architectural Conservation: Parameters, Theory, & Evolution of an Ethos*, ed. World Monuments Fund (New York N.Y.) (Hoboken, N.J.: John Wiley & Sons, 2009), S Unwin, "Analysing Architecture through Drawing," *Building Research & Information* 35, no. 1 (2007).
[91] Manuela Antoniu, "Drawing without Drawing," *Architectural Theory Review* 14, no. 3 (2009), A. Bordeleau, "Drawing in Time: Cockerell, Archaeologist and Architect," *Architectural Theory Review* 14, no. 3 (2009), Marc Treib, *Drawing/Thinking: Confronting an Electronic Age* (London , New York: Routledge, 2008).
[92] M. Frascari, "Lines as Architectural Thinking," *Architectural Theory Review* 14, no. 3 (2009), Robin Evans, *Translations from Drawing to Building and Other Essays*, AA Documents (London: Architectural Association, 1997), Lavoie, "The Role of HABS in the Field of Architectural Documentation."
[93] Andrew Feenberg, *Critical Theory of Technology* (New York: Oxford University Press, 1991), Eric Katz, Andrew Light, and William B. Thompson, *Controlling Technology: Contemporary Issues*, 2nd ed. (Amherst, NY: Prometheus Books, 2003), Donald A. MacKenzie and Judy Wajcman, *The Social Shaping of Technology: How the Refrigerator Got Its Hum* (Milton Keynes , Philadelphia: Open University Press, 1985), Don Ihde, *Philosophy of Technology: An Introduction*, 1st ed., Paragon Issues in Philosophy (New York: Paragon House, 1993).
[94] Heidegger, *The Question Concerning Technology and Other Essays*, Andrew Feenberg, *Questioning Technology* (London , New York: Routledge, 1999).
[95] Ihde, *Technics and Praxis*.
[96] McLuhan, *Understanding Media: The Extensions of Man*.

The third line of questioning consisted of readings on heritage documentation. Heritage documentation is acquiring knowledge about architectural structures or artifacts that exhibit cultural heritage. Documentation is not just about the physical understanding of the building, but attempts to capture the spirit of the artifact.[97] Within the discipline of documentation, the researcher found that the existing literature focuses on technologies. Technologies have been perceived as essential in enhancing the quality of the documentation process, as well as augmenting analysis and diagnosis of current conditions.[98] However, digital tools have also been criticized as reducing the documenter's engagement with the historic environment.[99]

The fourth category of literature review consisted of readings on HABS. An early foray into preservation planning at the national level, HABS tapped into a growing sense that modern American society required a large-scale preservation of the past.[100] When Peterson designed HABS, his conception was to develop an "architect's program."[101] However, since its inception the program has evolved into a documentation leader in a field intertwined with cultural, educational, and social values.[102] It was interesting to

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[97] Woodcock, "Discovery through Documentation: The Investigation of Historic and Cultural Resources," 43.

[98] RA Williamson and J Warren-Findley, "Technology Transfer, Historic Preservation, and Public Policy," *The Public Historian* 13, no. 3 (1991): 18, William J. Murtagh, *Keeping Time: The History and Theory of Preservation in America*, Rev. ed. (New York: John Wiley & Sons, 2006).

[99] Warden and Woodcock, "Historic Documentation: A Model of Project Based Learning for Architectural Education," 110.

[100] Lisa Pfueller, Davidson and Martin J. Perschler, "The Historic American Buildings Survey During the New Deal Era: Documenting 'a Complete Resume of the Builder's Art'," *CRM: The Journal of Heritage Stewardship* Vol. 1, No. 1, no. Fall (2003): 51.

[101] Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study," 117.

[102] E. B. Cliver et al., "HABS/HAER at the Millennium: Advancing Architectural and Engineering Documentation," *APT Bulletin* 3/4, no. Thirtieth-Anniversary Issue (1998), Charles E. Peterson, "The Historic American Buildings Survey, Its Beginnings," *Historic America, Buildings, Structures and Sites* 8(1983), Kapsch, "HABS/Haer: A User's Guide."

note that mapping the HABS culture of documentation as an inquiry of recognizing the issues of contemporary documentation practice did not get much attention in the literature.

Analysis of Documentation Projects

This research study used a different avenue of data gathering that involved examining actual HABS documentation projects. This allowed another type of data to be included in the study that went beyond the literature review and the reflective thoughts of the respondents. Only by analyzing a documentation project from the beginning to the end could I have a thorough idea of what HABS culture of documentation is. In regards to this, the difficulty lay in the geographical variation of the projects. Every summer, teams from the HABS Washington, DC office troop around the United States to record historic structures; then they return to the DC office to finish the drawings. In most cases, the production of the drawings cannot be completed during the summer period, so the projects are being passed to other delineators. Hence, it was impossible for me to pursue each project at the HABS office because the completion of a project might stretch into two years or more. In order to acquire a deeper understanding of HABS projects, I traveled to the HABS/HAER/HAEL office in Washington, DC where I experienced in-house documentation work, talked with project participants, and attended their project review meetings. I was given published materials with information about some of the past HABS projects, including (a) Recording in New Mexico,[103] (b) Fleeting Streets:

[103] Hyer, "HABS Recording in New Mexico."

The Plight and Promise of North Philadelphia,[104] (c) Silent Witness: Quaker Meetinghouses in the Delaware Valley 1695 to the Present,[105] and (d) American Place: The Historic American Buildings Survey at 75 Years.[106]

Many universities offer summer courses for students to document a historic structure in a twelve-week period. The Center for Heritage Conservation (CHC) at Texas A&M University provides a survey class where students go out in the field, record information about a historic structure, produce measured drawings, compile a historic report, and undertake large-format photography of the structure. At the end of the course, the student team submits the documentation products to the Library of Congress, where it becomes part of the HABS collection. The team also enters the Charles E. Peterson student drawing competition, and to date the CHC teams have been awarded several significant prizes.

Because I worked on the CHC projects, both in the field and in the office throughout the course of this study, I had the opportunity to observe the in-house projects that were prepared in accordance with the HABS documentation philosophy. These projects included the documentation project of St. Andrews Episcopal Church in Bryan, Texas, and the Sharrock-Niblo Farm in Dallas, Texas. Furthermore, I spoke with participants in several CHC projects undertaken before this study, including the Pueblitos of Dinetah project in Rio Arriba County, New Mexico (1999), the Harris

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104 Brian D. Joyner, “Fleeting Streets, the Plight and Promise of North Philadelphia,” *Common Ground, Preserving our Nation's Heritage* Fall(2003).

105 *Philadephia Yearly Meeting and Historic American Buildings, Silent Witness: Quaker Meetinghouses in the Delaware Valley, 1695 to the Present. Historic American Buildings Survey Recording of Friends Meetinghouses within the Region of Philadelphia Yearly Meeting.*

106 *Historic American Buildings Survey. et al., American Place: The Historic American Buildings Survey at Seventy-Five Years (Washington, DC: Historic American Buildings Survey, 2008).*

Martin House project in Anderson, Texas (1995), the Union Trading Company project in Fort Davis, Texas, (1996), the Seward Plantation project in Independence, Texas (1998), and the Fort Pulaski National Monument project in Savannah, Georgia (2000-2003).

Participant Observation

The third data gathering strategy, participant observation, complements the second method, analysis of documentation projects. My participant observation in this study came from three interrelated channels. First, as a heritage professional, the documentation projects that I worked on constitute tacit knowledge in this study. Through such cultural heritage projects as the documentation of WWII military fortress, Pointe du Hoc in Normandy, France (2008), and the documentation of the Mayan archaeological sites at Blue Creek in Belize (2009), I had the opportunity to experiment with diversified recording technologies. These technologies included the hand survey, a total station, a structured light scanner, and a three-dimensional laser scanner. My observations during these projects provided insight regarding the nature and direction of technologies in heritage documentation. Second, as a previous HAER intern at the Digital Statue of Liberty Project (2006), I had vivid memories and written journal notes regarding the HABS culture of documentation. Third, during the course of this study, I took field notes at the time of the interviews. These field notes were reviewed after each interview and annotated with my impressions and emerging thoughts.

In-depth Interviews

Interviewing is a widely used research strategy that captures the deep meaning of experience through the participants' own words, and allows unique perspectives through face-to-face interaction.[107] Interviewing constituted a significant part of this study because the documentation process cannot be understood unless the meaning that humans assign to heritage is understood. Heritage professionals' thoughts, feelings, beliefs, values, and assumptive worlds all assign different meanings to, and provide multiple versions of, reality. These in-depth interviews allowed me unparalleled access into the full, rich, and personal accounts of the interaction between heritage professionals and the act of documentation. I conducted 13 interviews between June 2010 and June 2011 with HABS professionals, private practitioners, academicians, and past HABS project participants.

Context of the Interviews

Interview settings. Qualitative inquiry takes place in a natural setting. In this study, there is no one natural setting. Documentation projects following HABS philosophy are located across the U.S. These projects have been undertaken partially in the field, in various offices, homes, or at universities. Given this and the cost of travel, the interview locations were mutually chosen by individual respondents and me, based on practicality and convenience.

[107] Marshall and Rossman, *Designing Qualitative Research*, 101-07.

I conducted interviews in person during six trips, as well as conducting four by phone.[108] The first two trips took place in summer 2010 in Austin, Texas. I interviewed S. Elizabeth Valenzuela on June 5, 2010, and Justin Edgington on July 10, 2010. In August of 2010, I flew to Washington DC to interview HABS, HAER, and HALS staff. I interviewed Catherine C. Lavoie, Chief of HABS, James Rosenthal, a HABS/HAER/HALS photographer, and Dana Lockett, a HAER architect, on August 17, 2010. I also interviewed Mark Schara, a HABS architect, on August 18, 2010. I conducted a phone interview with Taylor Browne, Senior Account Executive at Trimble Navigation on April 22s 2011. Based on Browne's suggestion, I undertook my fourth trip on May 2, 2011, to Houston to attend an offshore technology conference. There, I had interviews with Kevin Smith, an applications engineer at Trimble, as well as interviewing Browne. On May 7, 2011, I met with Eugene Cisek, professor at Tulane University in New Orleans, Louisiana. My sixth trip was on May 13, 2011, to interview Mark Cowan, a project reviewer for the Texas Historic Courthouse Preservation Program, Texas Historical Commission. I had additional phone interviews with Elizabeth Lee, Manager of Documentation Projects at Cyark on June 6, 2011, with Bob Brinkman, Coordinator of the Historical Markers Program, Texas Historical Commission on June 10, 2011, and with Christine Whitacre, Program Manager for the Heritage Partnerships Program of the National Park Serve on June 13, 2011.

[108] During the interviews, I asked all the respondents if I could announce their names in this study and embed direct quotations from their narratives. They all agreed their names to be released and asked for a copy of the submitted dissertation.

How Respondents Were Chosen. With the goal of discovering an understanding of the relationship between heritage documentation, technology, and drawing through an extensive analysis of HABS philosophy, it was crucial for this study to include as many viewpoints, experiences, and expectations as possible. Consequently, maximum variation sampling was undertaken for this study. The selection of the respondents was accomplished by the emergent design framework. In this case, that meant selecting respondents based on emerging criteria of relevance to the study. The evolving process of selection changes as the needs of data gathering change. In all interviews, the baseline criterion for respondents was their experience with the process of heritage documentation and the use of technologies. I also sought a range of perspectives of different types of experience: (Group 1) HABS/HAER/HALS staff, (Group 2) heritage professionals who have participated in HABS projects, (Group 3) private practitioners, and (Group 4) academicians who follow HABS philosophy in their coursework. In order to deepen the collection of data, my intention was to talk with as many people as possible until theoretical saturation was reached within the physical limitations of this study. The respondents were initially identified by my chair, dissertation committee, and other experienced and knowledgeable experts in the field. Furthermore, in the interviews, I asked each respondent about any prospective interviewees who might be critical for this study.

Background of the Respondents. The respondents ranged in age from 35 to 75. All had various bachelor degrees from different universities. Some held masters and PhD degrees as well. Group 1 had five respondents, Group 2 had two, Group 3 had five, and

Group 4 had one. Even though these groups were defined based on the individuals' connection to HABS and technologies, in some cases the respondents might have been considered across categories. For instance, although I counted Valenzuela in Group 3 with the private practitioners, she could also be considered for Group 2. Valenzuela worked on a HABS project when she was a university student. Hence, her interview includes anecdotes from her participation in HABS projects in college. However, due to Valenzuela's intensive work in historic preservation projects, I decided to categorize her as a practitioner. Schara also worked as a student intern for HABS for a couple of summers before he became an architect in the program. Consequently, his insights working as a HABS intern could also be considered in Group 2. However, due to Schara's significant experience in the program, I considered him in the HABS group.

Group 1: HABS/HAER/HALS Staff

Catherine C. Lavoie, architectural historian, Chief of HABS. Lavoie holds a master's degree in American Studies from the University of Maryland. She is a recognized expert on vernacular architecture and its documentation, and she has published articles and contributions in a variety of books and journals. She joined HABS in 1985 as a historian. Since then, she has worked on a variety of research and writing assignments, including military housing at Fort Riley in Kansas, Quaker meetinghouses, a plantation dwellings, and small farmsteads. She has been Acting Chief of the HABS program since December 2005.

Dana Lockett, HAER architect. Lockett holds a bachelor's degree in architecture from Texas Tech University. He started to work for HAER in 1991. He has specialized in documentation technologies such as CADD, photogrammetry, and laser scanning. He has worked on numerous documentation projects such as the Statue of Liberty in New York City, Death Valley Ranch in California, and the Illinois Waterway. In July 2011, he conducted a scanning campaign in Ghazni, Afghanistan, to document 12th century minarets. At present, he is the architectural project manager for heritage documentation programs at HABS, HAER, HALS, and CRGIS.

James Rosenthal, HABS photographer. Rosenthal has a degree in Historic Preservation from Goucher College. From 1999 to 2005, he worked as staff field photographer and supervisor of the archival laboratory and assistant at HABS. In 2005, Rosenthal assumed the position of lead staff photographer for HABS. He is responsible for managing, executing, and delegating all large format photographic field assignments and reviewing all incoming donated work so that it meets the Secretary of the Interiors standards for archival permanence. He has documented such monuments as the U.S. Capitol in Washington, DC, Ellis Island quarantine station in New York, and The White House in Washington, DC His work covers everything from the grand to the vernacular, and over his 12-year tenure with HABS, he has contributed over 10,000 images to the permanent collection of the prints and photographs division of the Library of Congress.

Mark Schara, AIA/HABS architect. Schara holds two master's degrees in Architectural History and Architecture from the University of Virginia, School of Architecture, as well as a bachelor's degree from the University of Michigan College of

Architecture and Urban Planning. Since 1991, he worked as a HABS architect. During this time, he has worked in diversified HABS projects such as the Jefferson-Lincoln, and Washington Memorials; Storer College; Harpers Ferry in Jefferson, West Virginia; Fort McDowell; Battery Drew; Angel Island State Park in Angel Island, Marin, California; and Murallas del Viejo San Juan, Baluarte de San Antonio, in San Juan, Puerto Rico.

Christine Whitacre, NPS architect. Whitacre holds a master's degree in History from the University of Colorado, and a bachelor's degree in English from the University of Illinois. She has been working as an NPS historian since 1989. She has worked on diversified projects such as the Minuteman Missile National Historic Site in South Dakota, documentation projects of Cold War sites throughout the U.S., and the special resource studies of the Sand Creek Massacre National Historic Site in Colorado. She is currently the Program Manager of the Heritage Partnerships Program, NPS Intermountain Region (IMR). The IMR Heritage Partnerships Program includes HABS/HAER/HALS and 3-D documentation, National Historic Landmarks, and the Preservation of Japanese American Confinement Sites Grant Program.

Group 2: Heritage Professionals Who Participated in HABS Projects

Mark Cowan, architect, Texas Historical Commission, Texas Historic Courthouse Preservation Program, Project Reviewer. Cowan has a master's degree in Architecture and a bachelor's degree in Environmental Design from the Texas A&M University, College of Architecture. He began working at the Texas Historical Commission in Austin, Texas in 1999 as a Project Reviewer. He has reviewed work related to federal and state-regulated preservation projects including grants, Section 106 reviews, and Federal Tax Credit Program projects. Since 2002, he has been working as a project reviewer with the Texas Historic Courthouse Preservation Program. His responsibilities include compiling historical research, reviewing construction documents, conducting onsite reviews of construction work, and leading the state grant program.

Bob Brinkman, architect, coordinator of the Historical Markers Program, Texas Historical Commission. Brinkman holds a master's in historic architecture from Texas A&M University, College of Architecture, and a bachelor's degree in cultural geography from the University of Texas at Austin. Brinkman joined the staff of the Texas Historical Commission in 2001, and is presently the coordinator of the Historical Markers program. He has been a member and officer of several heritage groups, including the Williamson County Historical Commission, Round Rock Historic Preservation Commission, and Texas Old Missions and Forts Restoration Association (TOMFRA). He compiled the recent Arcadia Publishing pictorial history of Round Rock. He researched and wrote 10 official Texas Historical Marker applications researched between 1998 and 2009, 70 National Register of Historic Places nominations between 2002 and 2007, and as well as more than 250 official Texas Historical Marker inscriptions written from 2003 to the present.

Group 3: Private Practitioners

Elizabeth Valenzuela, preservation architect, Valenzuela Preservation Studio. Valenzuela holds a master's degree in architecture from Texas Tech University.

While she was a student, she participated in two HABS field documentation projects for Big Bend National Park. During her final year in the graduate program, she compiled a history of the ranching industry and architectural styles of the Big Bend area. Valenzuela has practiced architecture in the Austin area since 1998. She has led architectural survey efforts, managed architectural conservation projects, and provided specialized knowledge for the treatment and evaluation of historic architectural resources. She has documented structures for architectural reconnaissance and intensive surveys, case alternative reports, preservation analysis reports, condition assessments, materials conservation projects, and various HABS/HAER Level I, II, and III reports.

Justin Edgington, architectural historian, project manager, HHM, Inc. Edgington holds a master's degree in History from the University of Illinois at Chicago and a bachelor's degree in History from Trinity University. He has worked as a historian on TxDOT Intensive-level surveys, Integrated Cultural Resources Management Plans, National Register of Historic Places nominations and eligibility assessments, Historic American Buildings Survey (HABS) documentation, Phase I and II archaeological reports, and Section 106 reviews in Texas and the Mid-Atlantic region. He has performed archival research at a variety of institutions and special collections in the United States, including national and regional branches of the National Archives, the Library of Congress, and the Washington Navy Yard. He has also performed several HABS-level large-format photography documentation projects.

Taylor Browne, Senior Account Executive, Process Power and Plant Division, Trimble Navigation. Browne holds a bachelor's degree in X from Colorado

University. He has been the account executive for the startup division of Process, Power, and Plant (PPP) division of Trimble for the southern U.S. and Gulf Coast region since 2009. He works with client engineering departments and regional leaders in diverse industries dealing with geo-spatial positioning. He has introduced 3-D laser scanning hardware and software to the construction, Petro-Chem, and Oil/Gas industries.

Kevin Smith, Applications Engineer III, Trimble Navigation. Smith has been a Microstation CADD Administrator and Applications Engineer III since 2003.

Elizabeth Lee, director of digital preservation work, Cyark. Lee has a degree in Anthropology from the University of California at Berkeley. She founded the UC Berkeley/Cyark Visualization Lab and served as instructor for the UC Berkeley/Cyark Internship Program. She has conducted digital documentation training workshops for the U.S. National Park Service, the Presidio Trust, U.S./ICOMOS, and the University of Notre Dame. Lee currently directs all aspects of digital preservation project work and development, as well as university outreach and education at Cyark. She is also responsible for strategic development for the Cyark 500, helping organize expeditions and workshops in both Mexico and Scotland.

Group 4: Academicians Who Follow HABS Philosophy in Their Coursework

Eugene D. Cizek, Ph.D., FAIA, professor at Tulane University. Professor Cizek holds a Ph.D. Environmental Social Psychology, from Tulane University (1978), a D.Sc. in City Building, Delft Institute of Technology (1967), a master’s degree in Urban Design from MIT (1966), a master’s in City Planning from MIT (1966), and a bachelor’s degree in architecture from Louisiana State University (1964). Cizek has been a Louisiana Licensed Architect since 1964 with certification in architecture and city planning in the United States and Holland since 1967. His private practice has focused on historic preservation, environmental conservation, growth management, urban design, environmental social psychology, community renewal, preservation planning, and guidelines for new construction and development in historic settings. He has been at Tulane since 2007, where he teaches building preservation studio, environmental conservation studio, heritage education, and works as a thesis director for MPS students, dissertation co-director, Ph.D. Program in Historic Preservation, and the summer in South America Program. He uses HABS documentation methodology as a teaching strategy in his classes. His students have submitted innumerous documentation projects to NPS.

Interview Procedure

I initially contacted all the respondents via a recruitment email.[109] The email also included either the abstract of the study or the proposal. Each interview was held at either respondent's place of work, house, or location of their choice, and lasted approximately an hour. I drove to Austin three times to meet different interviewees, and to Houston and New Orleans once. Hence, in order to limit the number of my visits Washington, DC and keep the travel costs feasible, I determined interview times with the NPS personnel months ahead. I spent three days in Washington, DC in August 2010 and

[109] Please see Appendix A

conducted all the correspondent interviews then. If a mutually convenient meeting place was not available, phone-interviews were conducted.

Nearly all correspondence with the interviewees was done via email. However, most of the respondents gave me their personal phone numbers so that I could make a phone call a day before the interview to confirm the arrangements. Prior to the interview, I asked the interviewees to sign the consent form.[110] I prepared the consent form in the format established by the Institutional Review Board for Human Subjects at Texas A&M University. I asked all respondents if I could audio-record the interviews.[111] All of them agreed to be recorded and signed their permission on the consent form. The interviews were recorded using a hand-held audio recorder and my hand-written notes. Following each interview, I transcribed the audio recordings and checked the transcription notes against my hand written comments. I took note of highlights from each interview and compared each interview with the other interviews.

At the outset of each interview, I gave an informational statement about the research topic to initiate the interview discussion. Interviews were both structured and open-ended in order to allow study of the tailored responses to specific questions as well as allow unexpected realizations to emerge in the course of the interview. I encouraged the interviewees to channel the conversation in directions that they felt were important. Questions regarding the nature of heritage documentation were always discussed first to establish some agreement. With this agreement in hand, questions regarding technology,

[110] Please see Appendix B.

[111] Marshall and Rossman state that recording data in a systematic matter facilitate analysis. Recording strategies should fit the natural setting and the participants' sensitivities Marshall and Rossman, *Designing Qualitative Research*, 152. Using a tape recorder eases the retrieval of data analysis, maintains minimum interference on the setting and participants' interaction.

drawing, and HABS were discussed. These questions acted as a guide to get conversations about various issues started. The open-ended nature allowed for deviations and outright abandonment of the protocol at any time. I determined the initial protocol questions based on the suggestions of my chair. Furthermore, I utilized Komas' dissertation study to prepare the question format. [112] Almost all the interviewees showed their interest in the final product and asked if I could send them a published version of this dissertation.

Protocol Questions

The following protocol questions were asked of each participant.

1. Why are you and how you are involved in heritage recording and documentation?

2. How do you define heritage recording and documentation?

3. How do you define HABS' in architectural documentation? How do you assess the organization's social understanding of preserving? How do you interpret the process between the documentation standards, and the products? Should HABS be different in the future?

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[112] Komas organized the protocol questions based on seven philosophical questions: "*How were documentation standards understood and applied, what were the relative values of the process and products of documentation, how were the objective and subjective natures of documentation process understood and applied, with changes in the operations of the program since its inception, had the mission changed, what role should technology play in the process of HABS documentation and how does it shape the products of the collection, much had been written about the chronological history of the program, could broader historical epochs be defined, if so what could understanding the epochs tell us about the program, what were the reasons for HABS drawings style changes over time?*" Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study," 1.

4. How do you interpret HABS in private practice? How extensively do you think, heritage professionals should follow HABS' standards in their projects?

5. What do you think of the HABS' overall mission in heritage recording and documentation?

6. How do you approach digital surveying tools in heritage recording and documentation? How do you use these tools in your projects?

7. How do you maintain any standards/ methodologies in your documentation projects? Do you follow them exactly or project based? How does the application of digital tools change these standards/methodologies? How do you use HABS standards in your projects?

8. How has your documentation approach change over time? If changed, what are the reasons of these changes?

9. How do you see the future of heritage recording and documentation? Considering the technological progress in heritage projects, how do you define the role of technology in the future?

10. Given that the Library of Congress standard for HABS drawings will be ink on Mylar for the near future, what kind of issues should the HABS guidelines include in terms of 3-D digital data?

11. How do you think HABS will form in the future?

12. Are there any other areas/topics that you think I should include in these discussions?

13. Is there anyone that you would recommend that I interview for this research?

14. Briefly explain your educational and professional background.

Content Analysis

In qualitative studies, one of the most difficult tasks is to make sense of the massive amount of interview data. In order to integrate the contrasting perspectives of the interviewees with the research, I studied the interview data through repeated processes of organization, examination, comparison, contrast, and categorization until themes began to emerge related to the questions posed to the participants. First, I transcribed the interviews using the audio copies. Then I broke down the transcription into respondent's statements and then syntactical fragments that hold meaning. I recorded these entries, both with a word processor and on index cards. I sorted and catalogued the index cards into patterns based on subjective judgment. My criterion was to cluster entries that hold similar meanings. Then I sorted the piles according to similar content. I continued the same process for each emerging pile. I ended up having seven major themes: (a) drawing, (b) technologies in the documentation field, (c) three dimensional laser scanners, (d) CADD, (e) engagement with the heritage environment, (f) HABS as a leader in the field, and (g) the Library of Congress and archiving digital data.[113] The major themes that resulted from the interview data are discussed in the following paragraphs.

Drawing. All respondents made statements about drawing and their reflections alluded to divergent meanings. Drawing was discussed as a "permanent record of the

[113] Please see Appendix C for all the sub-categories that emerged from the interviews.

historic structure,”[114] a vehicle “to learn through buildings,”[115] and an indicator of cultural values.[116] Two respondents defined two-dimensional drawing as the best way to communicate a building.[117] Some stressed the value of drawing as a design tool.[118] Several interviewees commented on the transition from two-dimensional representations into computerized three-dimensional ones. One respondent defined this change as “exciting” because anybody could then have access to the historical asset’s virtual surrogate.[119] Another respondent pointed out that every structure is unique, and that different projects require diverse drawings.[120] In cases such as an archaeological site or an industrial complex, it is especially difficult to show all the details in two-dimensional drawings. The three-dimensional drawings “really bring out the feeling.” [121] In the case of HABS drawings, one interviewee indicated that it is very important to prepare the drawings in the digital format so that public could easily view them from the Library of Congress website.[122]

Technologies in the Documentation Field. All interviewees talked about technology. The digital technologies were discussed as facilitators in fieldwork that made “gathering data easier and faster”[123] In this context, one respondent stated that

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[114] Lavoie, *Interview*.
[115] Ibid.
[116] Ibid.
[117] Justin Edgington (architectural historian at HHM Inc.) in discussion with the author, July 10, 2010., Lockett, *Interview*.
[118] Cizek, *Interview*, Lavoie, *Interview*.
[119] Lavoie, *Interview*.
[120] Schara, *Interview*.
[121] Lockett, *Interview*.
[122] Elizabeth Valenzuela (preservation architect at Valenzuela Preservation Studio) in discussion with the author, June 06, 2010.
[123] Lockett, *Interview*.

digital imagery expedites “distributing data, and making changes on images”[124] Given this, several respondents noted the challenges of heritage professionals to keep pace with the use of advanced technologies in the private sector.[125] Most of interviewees spoke of the high cost of the digital technologies. [126] One interviewee elaborated that private sector heritage professionals must focus on one or two tools and execute the same methodology repeatedly. However, professionals in the documentation field must be creative when using tools.[127] During these discussions, the respondents discussed HABS’ relationship with technologies from different perspectives. One respondent asserted, “HABS cannot come behind the current practices because people have to participate in the process, and the collection should continue growing” [128] Another respondent stated, “It is [HABS’] responsibility to show how technologies can be used to produce HABS drawings”[129]

Three-dimensional Laser Scanner. During the discussion of technologies in the documentation field, the three-dimensional laser scanner emerged as the dominant concern. The ability to obtain highly accurate 3-D data, and to collect data remotely particularly in unsafe environments, has consolidated the use of scanning technology in documentation.[130] Hence, most HABS/HAER/HALS staff advocated the use of laser

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[124] Cizek, *Interview*.
[125] Lockett, *Interview*, Schara, *Interview*, James Rosenthal, (HABS photographer) in discussion with the author, August 17, 2010.
[126] Rosenthal, *Interview*.
[127] Lockett, *Interview*.
[128] Lavoie, *Interview*.
[129] Schara, *Interview*.
[130] Kevin Smith, (applications engineer at Trimble) in discussion with the author, May 02, 2011., Lavoie, *Interview*.

scanners in large structures because it eliminates the use of ladders and scaffolding.[131] However, the HABS staff discussed that scanning is cumbersome for small vernacular houses, because scanning, stitching the scans, and producing the drawings take more time than hand measuring.[132] In these projects, they still undertake hand measuring for small details.[133]

CADD. One of the major themes in the interviews was the integration of CADD with heritage documentation. The respondents defined the use of CADD in two manners. First, the documenter prepares the field notes by hand-drawn sketches in the field, and then digitizes them in a document scanner to trace in CADD.[134] Second, the use of CADD involves the hand-drawn sketches drawn in the CADD environment from scratch or using commercial software to translate the digital collected data in CADD.[135] In terms of the HABS measured drawing, one respondent asserted, “We completely embrace CADD. Look at the CADD drawing set. There is so much you can do with CADD, especially capturing detail, and being able to replicate that in a different scale rather than redraw everything from a scratch…”[136] Another respondent stated that “[HABS’] ultimate focus is on the end-product [two-dimensional plan, section, and elevation]… How to get to [the end product] is up to [the documenter]. [Delineators] are still welcomed to do hand drawing. They do not have to use the CADD program.”[137] Several

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[131] Lavoie, *Interview*.
[132] Ibid, Schara, *Interview*.
[133] Lavoie, *Interview*, Lockett, *Interview*.
[134] Cizek, *Interview*.
[135] Ibid, Lockett, *Interview*, Schara, *Interview*, Smith, *Interview*.
[136] Schara, *Interview*.
[137] Ibid.

respondents compared the engagement with laser scanning to the adoption of CADD.[138] "When HABS made the [CADD] transition… it took too much time to put [team members] on the same page in the context of using CADD. And now you cannot even find a student who knows how to hand draw."[139]

Engagement in the Heritage Environment. Most of the respondents raised some important issues concerning the effects of digital means on a documenter's engagement with the heritage environment, One interviewee raised her concerns about digital media because "[she does] not want her students to switch the scanner on and get a cup of coffee... [she wants] them to go out in the field and experience the historic structure."[140] Brinkman stated that the documentation team constitutes the only tangible link between the cultural heritage and the inhabitants.[141] Furthermore, in sites that are not accessible, most of the respondents supported the role of virtual models of heritage environments for educational purposes. The stakeholders can access the heritage asset without even visiting the actual site.[142]

HABS as a Leader in the Field. All the respondents admitted that the digital revolution has brought new heights to heritage documentation such as the ability to record colossal surfaces. Given this, some of the interviewees concurred that in HABS should lead the transformations in the field. One private practitioner said, "Technology

[138] Ibid, Lavoie, *Interview*.
[139] Lavoie, *Interview*.
[140] Ibid.
[141] Brinkman, *Interview*.
[142] Lee, *Interview*, ibid, Christine Whitacre (NPS program manager) in discussion with the author, June 13, 2011., Lavoie, *Interview*.

is a big component of the future… HABS should be the leader of change."[143] Another respondent stressed the fact that in the U.S., "[HABS] established national standards and shaped the preservation movement," hence HABS should be "a technology leader in the future"[144] Many respondents felt HABS should produce guidelines and establish standards for digital media. "I want to see HABS as a leader in the field to write guidelines for digital photography."[145] HABS should guide the professionals in how to "integrate three-dimensional digital data into a documentation product."[146] One interviewee said the documentation field is sometimes "struggling to find new techniques or products, and how apply them to [documentation work]." In this context, it should be collaboration with private practice and other entities to set industry standards for digital media and "HABS should be a part of this collaboration."[147] Two respondents brought their insights from the oil industry by stating that the "application of the scanner brings a lot of advantages that apply across industries… Scanning makes a project more marketable, competitive, and feasible in the industry."[148] However, not all engineering firms prefer to use the scanner due to the lack of information available. There is a substantial need for guidelines and standards in the industry to streamline the scanning process and incorporate all businesses.[149]

[143] Valenzuela, *Interview*.
[144] Lavoie, *Interview*.
[145] Rosenthal, *Interview*.
[146] Valenzuela, *Interview*.
[147] Lockett, *Interview*.
[148] Taylor Browne (Senior account executive at Trimble Navigation) in discussion with the author, May 02, 2011.
[149] Ibid, Smith, *Interview*.

The Library of Congress and Archiving Digital Data. Most of the interviewees raised concerns about the issues of archiving digital data. One respondent simply stated, "Digital data is problematic… That is one of the reasons why HABS is hesitant to go digital with large format photograph."[150] The HABS photographer asserted, "At this time, [the] digital product cannot compete with the quality, resolution, and flavor of the film."[151] There are significant archival issues with the digital data. One respondent said, "[The] Library of Congress is not willing to accept digital files before some standards or protocol [are] developed."[152] One HABS professional stated, "HABS does not have any place to archive digital data other than keeping at the office."[153] One respondent from the private sector noted that in terms of preserving digital data, right now, all they could do is to maintain the data in different servers.[154] Another respondent asserted that he uses the ASCII format for archival purposes.[155] Yet, respondents displayed hope to make digital data viable in the future.

Duration of the Study

The duration of the study, from my acceptance in to the PhD program at Texas A&M University in August 2007, to the submission of this study to my committee members was approximately four years. I completed the preliminary examination in April 2010 and proposal defense in February 2011. I began writing the manuscript and

[150] Edgington, *Interview*.
[151] Rosenthal, *Interview*.
[152] Lavoie, *Interview*.
[153] Ibid.
[154] Browne, *Interview*.
[155] Lee, *Interview*.

conducting the interviews in May 2010. I am planning to graduate in December 2011.
During the study, I lived in College Station, Texas.

CHAPTER III

A REVIEW OF HERITAGE RECORDING AND DOCUMENTATION TECHNOLOGIES

This chapter provides an analysis of technologies employed in data recording, analysis, and management in heritage recording and documentation projects, as well as reflections of the archival issues of heritage information. Heritage recording is defined as the graphic or photographic capturing of information describing the physical configuration, and condition of a cultural asset at known points in time. In addition, documentation is about the already existing stock of information. Documentation activity is the systematic collection and archiving of records to be used for reference purposes.[156] Its purpose is to collect, organize, explain, and illustrate information that is relevant to our understanding of the past and present of the entity in question.[157]

Recording and documentation constitute a significant part of cultural heritage projects by constituting the basis for research and conservation planning. Heritage recording activities constantly retrieve new data from the artifact, broaden our perspective of history, and allow us to understand the past.[158] Any information that is not properly recorded and achieved is lost information.

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[156] Robin Letellier et al., *Recording, Documentation, and Information Management for the Conservation of Heritage Places: Guiding Principles* (Los Angeles: Getty Conservation Institute, 2007), xv.
[157] Serra Akboy, "*The Application of New Survey and Documentation Technologies for Cultural Heritage Sites: Case Study Analyses of the Digital Statue of Liberty, New York City and the Ottoman Fortress of Seddülbahir, Gallipoli Peninsula*" (Thesis (M.A.), Koç University, 2007), 1.
[158] Burns, *Recording Historic Structures*, 6.

The tools and technologies used for heritage recording are categorized in two groups, analog and digital surveying technologies. The oldest and the most basic of traditional recording techniques is the hand survey, accompanied by sketches, 35mm photography, and large-format photography. Digital recording is the activity of collecting and processing any format of digital data. Any device that gathers field data in the digital format is considered a digital recording tool. Any architectural drawing, graphic representation, photograph, photogrammetric output, that is stored and used in the computer is categorized as a digital record. Digital recording tools are clustered in two groups, vector records, and raster records. CADD measured drawing, CADD overlaying rectified photos; 3-D modeling, GPS, digital photogrammetry, total station, and 3-D laser scanning are examples of the vector (CADD) group. Digital photography, scanning of photographs, digital video, tablet PC, digital photo rectification, texture mapping of 3-D models, orthophotography, and satellite imagery exemplify the raster imaging records.[159]

Surveying Methodologies

Hand Survey and Recording

Hand surveys are just one of the common ways to obtain dimensions of a structure to produce measured drawings. Hand survey records are consciously measured and written down field notes, which constitute the primary source for a measured

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[159] Ross Dallas, "Tools Overview," in *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, ed. Rand Eppich and Amel Chabbi (Los Angeles: Getty Conservation Institute, 2007), 5-9.

drawing. Hand measuring requires basic tools such as graph paper, pen, clipboard, steel tape, folding carpenter's rule, plumb bob, or similar weight and string.[160] With these basic tools and knowledge of geometry, accurate dimensions of the structure can be acquired.

Hand survey methods necessitate direct access to the object, which can sometimes be difficult to achieve and expensive to facilitate when faced with recording high-level detailing of very large sites or tall structures.[161] It is difficult to maintain accuracy when measuring high or vertical elements from ladders or scaffolding. In large areas, hand survey methods can become too labor intensive. For example, Eppich explains that a small area such as a single bay of a typical church can be measured with good accuracy via hand survey.[162] If that accuracy is extended across the whole church, using the same methods of diagonal checks and triangulation, the survey most likely will drift out of accuracy.

The quality of the record typically relies on both the drawing standards and the documenter's drafting skills and ability to interpret detailing within a graphical form.

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[160] According to Historic American Buildings Survey Guide to Field Documentation, the surveying equipment for hand recording as HABS, "Historic American Buildings Survey Guide to Field Documentation," (Washington, DC2011), 3.:
Necessary Equipment:
Metal measuring tapes in 35' and 50' (or 100') lengths, ideally one tape for each team member (fiberglass and cloth tapes stretch over long distances and are therefore unreliable), 17" x 22" graph paper (bond), eight divisions per inch, non-reproducible grid, oversized clipboard, Pencils (HB or harder) and erasers, molding comb/profile gauge (fine-toothed), digital camera
Recommended Equipment:
Red pens with archival ink (for writing dimensions), large 30˚-60˚-90˚ drafting triangle, flashlight/headlamps, plumb bob, line level and string, ladders, directional compass

[161] Paul Bryan, "Metric Survey for Preservation Uses: Past, Present, and Future," *APT Bulletin* 4/4, no. Special Issue on Documentation (2010): 26.

[162] Rand Eppich and Amel Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples* (Los Angeles: Getty Conservation Institute, 2007), 5.

Today, the data collected from hand survey most likely will be transcribed directly to computer as a CADD file.

Hand survey remains vital in heritage documentation because it is a very rapid method requiring few tools and minimal training, and often provides sufficient information with which to carry out conservation activities.[163] Hand survey also helps documenters become intimately familiar with the artifact by allowing the discovery of subtle aspects. Acquiring direct measurement using conventional tapes and scale bars may seem simple, but a well-done hand survey, efficient and accurate, is a highly skilled work. When tackling any form of heritage recording project, the use of hand survey and drawing techniques improves the ability to observe and interact directly with the object, and these techniques retain significant advantages over many survey methods.[164]

Large Format Photography

Large format describes large photographic films, large cameras, view cameras and processes that use a film, generally 4 x 5 inches (10x13 cm) or larger. Most large format cameras are view cameras, with fronts and backs called "standards" that allow the photographer to better control the rendering of perspective and increase the apparent depth of field. Architectural and close-up photographers in particular benefit greatly from this ability. This type of camera allows the user to correct for distortions and to show a resource in its true perspective. Rosenthal explains that the virtue of large-format

[163] Ibid., 5.
[164] Bryan, "Metric Survey for Preservation Uses: Past, Present, and Future," 26.

photography lies in the ability to “correct the optical distortion at the time of the capture.” [165]

A number of actions need to be taken to use a typical large-format. For example, a dark space is required to load and unload the film, typically a changing bag or darkroom, although prepackaged film magazines and large format roll films have also been used in the past.

Total Station Theodolite (TST)

A theodolite measures vertical and horizontal angles. When angles and distances are known, basic trigonometry can be used to calculate positions or coordinates. The early theodolites were built in the 16th century to measure the azimuth. The device had a compass and a tripod. The process has been cumbersome because every reading has to be written down manually, then calculated in long hand and laboriously hand-drafted. Over the centuries, with continuing refinements, the instrument steadily evolved into the modern theodolite reflector-less total station instruments used by surveyors today. The first great improvement came with the electronic theodolite. Manual recording of horizontal and vertical angles was replaced with electronic reading and recording devices in which the measurements were automatically recorded and stored in digital form.[166]

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[165] Rosenthal, *Interview*.
[166] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 6.

Concurrent with the invention of the electronic theodolite, methods of electronic distance measurement (EDM) were also developed. In simple terms, an infrared wavelength is transmitted to a prism or target or to the object (prism-less), and the time it takes for the light to bounce back is measured (because the speed of light is known) and hence distance is calculated. The benefits of EDM are speed and reliability, and measurements can be made over longer distances.

By combining the electronic theodolite with EDM, the total station theodolite was developed. It has now become the central instrument of modern surveying. It is valuable in creating building floor plans and site surveys, though it still requires the use of a prism reflector or target and usually two operators.

The next development was the reflector-less EDM (REDM) total station theodolite, which does not a prism to return the EDM signal. This improvement has hugely enhanced the usefulness of the theodolite for elevation surveys because it can take distance measurements straight from a surface without a reflector and requires only one setup or operator. The integration of REDM distance measurement, initially implemented in the 1980s, is now a mainstream application. This instrument allows remote angle and distance observations to be made and three-dimensional coordinates generated within approximately 1/4inch (6mm) accuracy within a range 0.5 and 1000 ft. (0.15 and 300m).[167]

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[167] David Andrews et al., *Measured and Drawn: Techniques and Practice for the Metric Survey of Historic Buildings*, 2nd ed., ed. Jon Bedford and Heather Papworth (Swindon, UK: English Heritage, 2009), 23.

The surveyor benefits from the REDM total station theodolite because of its speed of targeting, access to remote targets, accuracy, economy, and simplicity of operation.[168] However, the operator must monitor the fieldwork carefully because the accuracy of the measurements is affected by several factors, including:

a) range - the return signal is diminished and the contact area of the measuring beam is increased with long-range observations,

b) obliqueness - ambiguity of the point increases with the obliqueness of the object, hence distances being wrongly recorded, and

c) reflectance - reflective quality and surface texture of the target will affect the accuracy of the observed measurements.[169]

REDM TST is a rapid and precise surveying tool. However, it requires the surveyor to select the data to be recorded in the field. The documenter makes observations from fixed instrument points or stations. Depending on the size and scale of the project, further TST stations may be set out as required or a traverse used to link sets observations together.[170] Generally, computed points are coded on a sketch diagram on site. However, the latest generation TSTs can automatically transfer the measurement points to CADD. The use of real time CADD capture is of great benefit for large-scale, close range work such as in heritage documentation. The surveyor can capture details using the TST to position points and lines in the CADD drawing, and can view the data

[168] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 6.
[169] David Andrews et al., *Measured and Drawn: Techniques and Practice for the Metric Survey of Historic Buildings*, 2nd ed., ed, by Jon Bedford and Heather Papworth (Swindon, UK: English Heritage, 2009), 23.
[170] Ibid., 21.

as it develops in the field. This way, the operator would avoid any potential data omissions and mistakes.[171] A reflector-less TST, in theory can be operated by one person because the system does not need placing a prism or other reflector at the target. Yet, in practice, two people are often required because the surfaces usually necessitate a mix of targeting methods to provide full coverage.[172]

Global Positioning Systems (GPS)

Since the 1960s, when the first navigation system was launched, GPS has had a profound impact on many human activities. The GPS method of locating positions on the earth's surface through radio signals emitted from orbiting satellites or ground-based transmitters has been applied in many fields. The ability to use signals from orbiting satellites to locate an object in three-dimensional space anywhere in the world to ± ¼ inch (6mm) accuracy has profound uses in the surveying field. In heritage documentation, GPS has been particularly valuable in land surveying projects such as archaeological sites and cultural landscapes. GPS is mostly used to geo-reference the heritage information to a known, national coordinate system.[173] In this context, identifying the data within a common coordinate allows the heritage professionals to analyze and compare heritage sites using geographical information systems (GIS).

GPS follows a traditional method of survey of trigonometry: if the lengths of the three sides of a triangle are known, the angles in between can be calculated. This means

[171] Andrews et al., 23.
[172] Ibid., 23.
[173] Bryan, "Metric Survey for Preservation Uses: Past, Present, and Future," 27.

that if two corners of the triangle are fixed or located, the position of the third can be calculated. Satellites provide the known points and intersections from at least three satellites.[174]

Documenter should consider four major issues when using GPS in the field: (a) a clear view of sky is required in order to receive satellite signals, (b) it has different orders of point precision when compared to positions computed with a TST, (c) collecting reliable data requires both survey skill and specialist training, and (d) survey grade GPS equipment is costly.[175]

Pictorial Imagery

Pictorial imagery constitutes the bulk of standard or ordinary photographs taken during documentation fieldwork. The documenter utilizes a wide range of cameras from everyday ones to professional models. Pictorial imagery comprises the primary form of documentation. However, in order to use these images for surveying, the documenter has to address several issues. For example, taking a photograph with a scale against the structure gauges some dimensions. Yet, the documenter has to interpret these images with caution, hence scaling on pictorial photograph is difficult to achieve.[176]

Video photography can also be considered as part of pictorial photography. A video records a great deal of information quickly. Capturing a video has added

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[174] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 7.
[175] David Andrews et al., *Measured and Drawn: Techniques and Practice for the Metric Survey of Historic Buildings*, 2nd ed., ed, by Jon Bedford and Heather Papworth (Swindon, UK: English Heritage, 2009), 10.
[176] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 7.

advantages to documentation including a building's features, its construction, use, and significance with audio commentary.[177]

Rectified Photography

Rectified photography is the process of photographing a façade by aligning the images to be as parallel as possible to the section of façade to be recorded.[178] By aligning the principal film or sensor planes of the camera with those of the architectural surface, the user can acquire a single image. With the inclusion of a suitable scale, the image becomes rectified, or true to scale in two dimensions. The rectified image consists of the use of a relational scale so that dimensions can be measured.[179] The resulting scaled print provides a reasonably true to scale image of the façade which can be immediately printed out.

Albeit the photography part of the process has always been straightforward, traditionally the printing and scaling is often cumbersome. With the advances in computers and digital images, the latter process has also become simpler. The photograph can now be captured obliquely to the surface and usually with a digital camera. In the computer, the photograph can be easily manipulated, a scale introduced, and tilts and distortion can be corrected.[180] Low-cost software packages such as Adobe Photoshop have facilitated the ease of rectification and the creation of digital montages. If the façade consists of small components such as bricks, earth construction, or rubble

[177] Eppich and Chabbi, 7.
[178] Ibid., 7.
[179] Bryan, "Metric Survey for Preservation Uses: Past, Present, and Future," 27.
[180] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 7.

walling, rectification is done using a variety of software and can be a useful, rapid, and inexpensive form of documentation. In this context, rectified photography is a great fit for flat building facades such as floor surfaces, ceilings, and painted surfaces. However, if high accuracy is required —for example, to assess structural conditions—rectified photography is not appropriate.[181]

Photogrammetry

Photogrammetry is the art and science of acquiring measurements from photographs. This method was first applied to building surveying as early as the 1870s. The modern use of photogrammetry for architectural survey dates from the late 1930s through the 1950s, and it has been used substantially since then.[182] Traditionally, a documenter had to use special equipment including a metric camera, where the geometric properties of the body/lens combination were determined through a process called calibration, and the photogrammetric plotter to generate useable output. However, with digital advancements, the documenter can now utilize any type of digital camera because software such as Photomodeler allows the user to execute camera calibration automatically, undertake orientation, viewing, and generation of a wide variety of outputs, including line drawings in CADD, contour plots, orthophotographs, digital surface models (DSM), and three-dimensional animations.[183]

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[181] Eppich and Chabbi, 7.
[182] Ibid., 8.
[183] Bryan, "Metric Survey for Preservation Uses: Past, Present, and Future," 28.

Stereo photographs are overlapping photographs of the same subject from slightly different positions. They reproduce the actual images captured by our eyes. For example, the left eye can only capture the image tilted to the left side, while the right eye can only see towards the right. The brain fuses these two images to form a 3-D image. The acquisition of stereophotographs is based on this principle.[184] In order to eliminate perspective problems of the image, the documenter captures two overlapping photographs, known also as stereo-pairs. The photographs should be taken as square-on to the object as possible, but if necessary, the camera can be tilted up to 30˚. The further the camera is from the façade, the greater the area covered. However, in order to maintain the highest accuracy, a sequence of stereo-pairs should be taken to cover one subject. Each stereo pair should overlap with its neighbors to guarantee complete coverage. Each photograph should ideally overlap the next one by 60%, with at least four control points in the overlap area.[185]

A standard photograph cannot be used for acquiring reliable measurements for two reasons. First, any photograph has an inherent perspective distortion. If the façade has any type of depth, or if the camera is tilted relative to the façade, there will be scale or displacement errors. Second, standard cameras can also display lens and film distortion. Traditionally, the documenter would use metric cameras designed for photogrammetry work. These cameras have little or no lens distortion. They encompass a small mechanism to ensure film flatness. They also have small reference points in the

[184] David Andrews et al., *Measured and Drawn: Techniques and Practice for the Metric Survey of Historic Buildings*, 2nd ed., ed, by Jon Bedford and Heather Papworth (Swindon, UK: English Heritage, 2009), 14.
[185] Ibid.

negative plane, known as fiducial marks, which appear in the image and allow the user to correct any film distortion that may occur. The user has to calibrate these metric cameras so that the focal length and any lens distortion are precisely known. As film-based photography is increasingly making way for digital imaging, so is photogrammetric photography. Digital cameras are now being extensively used for photogrammetric purposes. They obviously do not suffer from film distortion, and therefore do not need any fiducial marks. However, digital cameras still require calibration of the lens.[186] Yet, with photogrammetry software, the user can automatically calibrate the lens of a digital camera.

There are two types of photogrammetry, stereophotogrammetry, and orthophotography. Stereophotogrammetry involves taking stereo-pair photographs with calibrated cameras, then using the resulting images in a photogrammetric plotting device or computer to extract accurate measurements with which to produce drawings. This method is most appropriate in situations where a high level of detail or a great deal of irregularity requires to be recorded.[187] Orthophotography is a "true-to-scale process that combines the benefits of a photograph with its wealth of detailed information and the geometric measurement accuracy of a survey with instruments."[188] Orthophotography is an elaborate process that actually builds on using stereo-pairs of photographs. Very simply, a stereo-pair is captured and an entire series of corrections is made to the positions of identical points in the two photographic images. The result is a true-to-scale

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[186] Andrews et al., 14.
[187] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 8.
[188] Ibid., 8.

photographic image, or orthophotograph. With computerization, this process has become easier, faster, of better quality, and much less expensive. It is suitable for the representation of some types of features, such as drums or circular towers, and it is effective in representing irregular or complex facades.[189]

Compared to the quality and quantity of data provided, photogrammetry usually is a relatively inexpensive recording method. However, it requires a professional trained to use a digital camera and photogrammetry software. Photogrammetry is a great tool to capture architectural details of facades with high quality.[190]

Laser Scanning

A laser scanner is a device that mass-captures the three-dimensional data of a subject by use of rapid range measurement. The tool captures thousands of discrete points per second in near real time. The resultant three-dimensional mass is called a "point-cloud." Many industries utilize laser-scanning applications in a variety of ways. Management of oil drilling wells, mapping underground mining shafts, and determining the volumes of volcanic eruption masses are just a few examples of scanning uses.

The scanning applications have recently gained momentum in the heritage sector, guiding both documentation and conservation work. The heritage sector has a range of applications for which laser scanners are useful such as three-dimensional recording of surfaces not suited for photogrammetric coverage (sculptural details, vault webs, dome and pendentive soffits, profiles, etc.). According to Bryan, this trend in heritage

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[189] Eppich and Chabbi, 8.
[190] Ibid., 8.

applications is due to extensive marketing by manufacturers, along with contractors who have invested in these technologies.[191]

There are three major types of scanners: (a) optical triangulation, (b) light wave time-of-flight, and (c) laser phase comparison technology. Optical triangulation is used for smaller objects (statuary, detached masonry, small artifacts, etc.), which can be positioned closer to the device. In triangulation laser scanners, a light emitter and a receiver (such as a camera or a charge-coupled device) are separated by a known distance, and the angle of the reflected laser pulse is used to determine the distance. The scanner shines a laser onto the object, which is picked by the receiver. Hence, the laser emitter, the receiver, and the laser dot on the object form a triangle. With the distances between the corners of the triangle and the angle of the emitter and receiver known, the location of the laser dot on the surface of the object can be calculated by using the principles of triangulation. This method can achieve sub-millimeter accuracy and produces very dense point-clouds, with spacing (the distance between points) ranging between 0.1mm and 2mm.[192]

Time of flight laser scanners evolved directly from the total station theodolite and EDM. This type of scanner works by sending out thousands of pulses of laser per second at great speed. It then calculates the three-dimensional coordinates of points, thereby defining the surface. It is essentially carrying out a task very similar to that of a reflector-less total station theodolite, only automatically and at high speed. Horizontal

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[191] Bryan, “Metric Survey for Preservation Uses: Past, Present, and Future,” 28.
[192] David Andrews et al., *Measured and Drawn: Techniques and Practice for the Metric Survey of Historic Buildings*, 2nd ed., ed, by Jon Bedford and Heather Papworth (Swindon, UK: English Heritage, 2009), 18-19.

and vertical angles are measured, REDMs are made, and data are converted into coordinates.[193]

In phase-comparison laser scanners, the instrument emits light with a known frequency and phase and compares the emitted phases to the returned phases, thus the distance to the object can be determined.[194] The phase-comparison method calculates distance by sending a phased pulse of light and analyzing the variation of signals sent and received by the scanner.[195] This method can achieve accuracy of 3-6mm at about 100m.

Table 1 illustrates the various scanning applications in cultural heritage projects. Laser scans provide a unique way of recording surface details in three-dimensional. This technique, however, is unsuitable for surfaces where edge definition is important or if structures have reflective surfaces such as glass or metal. Vector products (i.e. drawings) are not easily extracted from laser scans. Furthermore, the laser scanner itself is very expensive. Due to the large amounts of data generated by the scanner, it is necessary to invest in computer hardware and software to deal with huge numbers of data sets.

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[193] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 6.
[194] Ibid., 6.
[195] David Andrews et al., *Measured and Drawn: Techniques and Practice for the Metric Survey of Historic Buildings*, 2nd ed., ed, by Jon Bedford and Heather Papworth (Swindon, UK: English Heritage, 2009), 19.

Table 1. Laser scanner applications in cultural heritage projects[196]

Scanning System		Use	Typical Accuracy/Operating Range
	rotation stage	scanning small objects (that can be removed from the site)	50microns/0.1m-1m
triangulation-based artifact scanners			
	arm mounted	scanning small objects and small surfaces (can be performed on site)	50microns/0.1m-1m
	mirror/prism	scanning small objects areas in situ	sub-mm/0.1m-25m
time of flight laser scanner		suitable for survey of building facades and interiors	3-6 mm at ranges up to 100m/2m-100m
phase comparison scanners		suitable for survey building facades and interiors	5mm at ranges up to 2m/2m -- 50m

Structured Light Scanning

A structured-light 3-D scanner is a device for measuring the three-dimensional shape of an object using projected light patterns and a camera system. While this method has been used in engineering and medicine, it has only been used in the heritage field in last seven years. Projecting a narrow band of light onto a three-dimensionally shaped surface produces a line of illumination that appears distorted from perspectives other than that of the projector, and can be used for an exact geometric reconstruction of the surface shape.

A faster and more versatile method is the projection of patterns consisting of many stripes at once, or of arbitrary fringes, because this allows the acquisition of a multitude of samples simultaneously. Seen from different viewpoints, the pattern

[196] Adapted from D. Barber, J. Mills, and E. Heritage, *3-D Laser Scanning for Heritage: Advice and Guidance to Users on Laser Scanning in Archaeology and Architecture* (English Heritage, 2007), 7.

appears geometrically distorted due to the surface shape of the object. Although many other variants of structured light projection are possible, patterns of parallel stripes are widely used. The displacement of the stripes allows an exact retrieval of the 3-D coordinates of any details on the object's surface. Two major methods of stripe pattern generation have been established, laser interference and projection.

The laser interference method works with two wide planar laser beam fronts. Their interference results in regular, equidistant line patterns. Different pattern sizes can be obtained by changing the angle between these beams. This method allows an exact and easy generation of very fine patterns with unlimited depth of field. Disadvantages are high cost of implementation, difficulties providing the ideal beam geometry, and typical laser effects like speckle noise and possibly self-interference with beam parts reflected from objects. Typically, there is no means of modulating individual stripes. The projection method uses non-coherent light, and works like a video projector. Patterns are generated by a display within the projector, typically an LCD (liquid crystal) or LCOS (liquid crystal on silicon) display. Principally, stripes generated by display projectors have small discontinuities due to the pixel boundaries in the displays. Sufficiently small boundaries, however, are practically negligible because they are evened out by the slightest defocus.

Portable coded light systems are usually composed of single or multiple cameras with a digital white light projector. The projector serves to project coded light patterns onto the object surface and the cameras serve to acquire the scene. In this way, the illuminated area is digitized in a single acquisition. The main advantage of these systems is the fast and precise acquisition of surfaces. [197] However, digitization of complex surfaces requires multiple acquisitions. This system works well with small surfaces, such as artifacts, sculpture, or excavation areas, but fails to record larger architectural structures.

Databases

A database is a collection of data, usually text, which is separated and systematically stored in tables with key identifiers. Records are often separated into sets, themes, and fields that allow for easy retrieval and "recombination," or queries of data.[198] Heritage professionals utilize databases at different scales and scopes. For instance, a database can be as simple as a few lines of data to keep track of the windows in a small historic building, or as complex as multiple tables for keeping an inventory of all the historic buildings in a region. Other types of data such as images, drawings, measurements, and videos are now stored in multimedia databases. A database can be useful in heritage projects, not only to keep track of surveys and drawings but also to inform the public or organize and plan a conservation project.[199]

Computer-Aided Design and Drafting (CADD)

Computer Aided Drafting describes the process of drafting with a computer. CADD is a database type. CADD software, or environments, provides the user with

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[197] N D'Apuzzo, "Overview of 3-D Surface Digitization Technologies in Europe" (2006), 3.
[198] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 8.
[199] Ibid., 8.

input-tools for the purpose of streamlining design processes, drafting, documentation, and manufacturing processes. CADD output is often in the form of electronic files for print or machining operations. Through CADD the documenter can display, edit, and present the survey data, as well as produce drawings and animations. CADD enables users to view drawings, zoom in and out, add and delete information, prepare specifications, print, and transmit information via the Internet. It is an immensely powerful tool now used in almost all aspects of documentation.[200]

Geographic Information Systems (GIS)

GIS is similar to CADD because it displays graphic information, but it is also similar to databases in that it contains tabular data.[201] Information about a subject can be classified in two ways: (a) the position or the spatial location (drawing) of a feature, and (b) the descriptive information (text or other form). If these two classes of information are brought together within a computer program, then a GIS has been created.

For example, when the documenter is working on a floor plan, for each room he creates an attribute table in the text format with information of size, function, and features. The floor plan drawing can then be combined with the text attributes in the GIS setting. With one click on the electronic drawing, the attributes can be displayed or the database searched, and the appropriate portion of the drawing displayed.[202] A floor plan of a historic building provides a simple example. For each room in the plan, a set of

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[200] Eppich and Chabbi, *Recording, Documentation and Information Management for the Conservation of Heritage Places: Illustrated Examples*, 8.
[201] Ibid., 8.
[202] Eppich and Chabbi, 8.

attributes such as dimensions can be ascribed. This is useful in managing data for complex or large sites with numerous features or elements; however, its usefulness is questionable for smaller sites or single structures.

Issues with Archiving Heritage Information

HABS measured drawings link the past to the future. Hence, the preservation of these records constitutes a key function. No matter which form is used for the record being made, it is fundamental to ensure that the data is preserved and made available for later use. However, the dilemma with technological progress is that it seems to come at the expense of preservation of information. For example, when wood pulp was introduced to paper production in the 19th century as a technological advance, nobody anticipated that this new technique would jeopardize the permanence of the documents. Until the middle of the 19th century, nearly all paper used for written or printed material was made from cotton or linen rags, and this type of paper could last for several hundreds of years without decomposing. When ordinary paper began to be made with wood pulp treated with acidic chemicals, the residual acid would slowly decompose the paper. After a period of only a few decades, books made with acid-based paper decomposed to the point that they crumbled into pieces and the problem persists. Libraries advise publishers to use acid-free paper, yet fewer than 20% of hardcover books are printed on acid-free paper.[203]

[203] I. H. Witten and David Bainbridge, *How to Build a Digital Library*, The Morgan Kaufmann Series in Multimedia Information and Systems (San Francisco, California: Morgan Kaufmann Publishers, 2003), 456.

Paper is only one issue facing preservation of heritage information. Other forms of media also jeopardize preservation of documents. For example, until 1951, the only type of film that was available contained nitrate. Nobody could foresee that nitrate caused the film to decay even in controlled environments. Sadly, around 21,000 feature films made in the U.S. before 1951 no longer exist.[204]

In the digital age, computers possess an unbelievably bad record in terms of the preservation of data. The U.S. government stated that by 1990, many important digital federal records, including the 1960 census, were about to be lost. The results were recorded on digital tapes that had become obsolete faster than expected.[205] Additional cases of possible loss include hundreds of tapes from the Department of Health and Human Services, from the National Commission on Marijuana and Drug Abuse, from the Public Land Law Review Commission, from the President's Commission on School Finance, from the National Commission on Consumer Finance, Combat Area Casualty files containing POW and MIA information from the Vietnam war, herbicide information needed to analyze the impact of Agent Orange, and many other files.[206]

Digital media are vulnerable to loss from two independent mechanisms: the physical media on which they are stored are subject to physical decay and obsolescence, and the proper interpretation of the documents themselves is inherently dependent on

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[204] Ibid., 456.
[205] United States. Congress. House. Committee on Government Operations., *Taking a Byte out of History: The Archival Preservation of Federal Computer Records: Twenty-Fifth Report*, House Report/101st Congress, 2-D Session (Washington: U.S. G.P.O., 1990), 3.
[206] United States, 16.

software.[207] Yet, as Kuny stated, “Let us be absolutely clear from the outset; no one understands how to archive digital documents.”[208] He believes that humans are living in the midst of a digital dark age because enormous amounts of digital information are already lost forever, information technologies become obsolete very rapidly, document and media formats continue to proliferate, and technology standards will not solve fundamental issues in the preservation of digital information.[209]

The preservation of digital data is paradoxical. The advantages of digital media over analog in fact cause the problems. “Ease of creation” creates information excess; it is not clear which one is the original or the copy. “Independence of media” means that it seems hardly worth keeping the physical artifact. “Constant improvement in hardware and software” promotes obsolescence. [210]

Until now, professionals have developed four important preservation strategies: (a) paper, (b) museums, (c) emulation, and (d) migration. However, none of these suffices for long-term preservation of digital data. The first two options define printing the document on paper and preserving that technology in museums. Emulation involves keeping the documents in exactly the same form as they are, copying the functionality of the original, keeping the original software as well as the hardware. For example, current incarnations of Microsoft Word can read most of the old Word documents. However, neither Microsoft nor Word may be around in the coming decades; therefore, the user

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[207] J. Rothenberg, *Avoiding Technological Quicksand: Finding a Viable Technical Foundation for Digital Preservation. A Report to the Council on Library and Information Resources* (Council on Library and Information Resources, 1755 Massachusetts Ave., NW, Washington, DC 20036 ($20). 1999), 7.
[208] T. Kuny, “The Digital Dark Ages? Challenges in the Preservation of Electronic Information,” *International Preservation News* (1998): 4.
[209] Ibid., 2-4.
[210] Witten and Bainbridge, *How to Build a Digital Library*, 459.

will have to emulate crucial parts of Word's functionality on then-current hardware to read and display old documents. To preserve the physical bit-stream, the user has to apply error detection to determine whether degradation is occurring, and to write codes to ensure that new generations are faithful copies of the original. However, emulation is problematic if the format is proprietary, as is Microsoft Word. One cannot write software without inside knowledge. Migration involves translating the document from the old format (or near-obsolete format) to one that is accepted by new software. Migration involves copying the physical bit-stream to new media as well as transcribing it to a new logical format. For example, one can go through the Microsoft files, open them into Word, and save them in the latest version of format. Even though this strategy seems very straightforward, the user may lose some features during the translation of data. In other words, the document is reconstituted.[211]

The general practice among heritage professionals is to migrate digital data to newer formats. However, migration requires continual operational expense, which includes personnel to update the documents constantly, technological infrastructure to maintain the upgrade, and every version of the software. In most cases, a cultural institution does not have the resources to undertake such a rigorous task. Considering the fact that there is no particular industry standard for migration and the future of digital mediums is unknown, "to keep the data alive" becomes problematic. [212]

The intense use of 3-D scanning data adds another layer to archival issues. The storage, manipulation, and circulation of so much laser point data -- gigabytes of spatial

[211] Witten and Bainbridge, 460-61.
[212] Lee, *Interview*.

and attribute data -- is a terrific challenge for computers, and in many cases the data have to be down-sampled to be viewed and processed by the computer. However, this contradicts the purpose of applying this high-resolution technology in the first place.[213]

The documenter can use different exchange formats in order to facilitate scanned data transfer between users. ASCII (American Standard Code for Information Interchange) is a simple text file that provides fields for x-y-z co-ordinates, intensity information, and possibly color (RGB) information. Users can transfer the scanned data between different software using the ASCII format. However, reading and interpreting ASCII elevation data can be very slow and the file size can be extremely large, even for small amounts of data. Furthermore, any raw data and information specific to the LIDAR data collection will be lost. In order to standardize the transfer of such information, and ensure that important information is not lost in transfer, it might be appropriate to consider a formal data exchange format such as LAS. LAS is overseen by the American Society for Photogrammetry and Remote Sensing (ASPRS) and intended to address all these issues. It is a public file format initially developed for the interchange of 3-D airborne laser scanned data between data users. However, this binary format can also be used to transfer ground based laser scanning data.

[213] SP McPherron, T Gernat, and JJ Hublin, "Structured Light Scanning for High-Resolution Documentation of in-Situ Archaeological Finds," *Journal of Archaeological Science* 36, no. 1 (2009).

The Library of Congress does not accept any medium or format that does not meet the 500-year durability standard. Consequently, the digital hardware and software do not meet these standards. The library stores the actual HABS drawings, large-format photographs, and historical reports accompanied with negatives on safety film. In addition, the Library digitizes these tangible records and then put them on the Built in America Website.

CHAPTER IV

A HISTORY OF HABS WITH AN ANALYSIS OF DOCUMENTATION APPROACHES

We are making architectural history faster than we are recording it. [214]

Charles Peterson

Introduction

The concern for endangered buildings that could not be preserved through other means culminated in the creation of HABS.[215] However, to date, the program has flourished with regard to the transformations in architectural, cultural, and educational settings.

The purpose of this chapter is to provide a review of HABS history of documentation. The chapter delves into the different epochs of the program, and the dynamics behind the evolution of its documentation approach. The chapter pursues a chronological order of 1930-1950, 1950-1980, and 1980-to the present. This classification aims to organize the account of HABS in accordance with the inception of

[214] Charles E. Peterson, *Interview* (Philadelphia, PA: conducted by Tanya Wattenburg Komas, 13 October 2000).
[215] Early instructions to district officers specified that "*absolute priority will be given to buildings…which have not been restored or remodeled and which are in imminent danger of destruction or material alteration*." Administrative records show frequent revisions of priority lists, often annotated to indicate the addition of a building because demolition was scheduled or removal because it was found to be restored or remodeled. Buildings considered "safe" because they were owned by historical societies or government agencies, such as Mount Vernon or the White House, were largely omitted from the program in favor of those with more precarious futures Davidson and Perschler, "The Historic American Buildings Survey During the New Deal Era: Documenting 'a Complete Resume of the Builder's Art'," 56..

the program, post-WWII, and the establishment of the Secretary of the Interior's Standards for Architectural and Engineering Documentation.

HABS Documentation from 1930-1950

The creation of HABS in the 1930s coalesced because of certain significant cultural settings of the era. The need to provide jobs to unemployed architects and drafters during the Great Depression culminated in the federal government establishing HABS. There were precedents for the use of unemployed architects to record historic buildings. In 1931, depression-era architects and draftsmen, under the purview of the Royal Institute of British Architects, were put to work making measured drawings of historic buildings in London. The Architects' Emergency Committee of New York City put unemployed architects and draftsmen to work making measured drawings and photographs of old buildings from Maine to Louisiana, and the Pittsburgh Chapter of the American Institute of Architects (AIA) organized a survey of the early architecture of Western Pennsylvania.[216] In Philadelphia, the AIA chapter periodically drew individual, historic buildings. A broader effort was initiated in 1930, when "The Old Philadelphia Survey" put 57 unemployed draftsmen to work preparing 407 measured drawings of structures in the Old City and along the banks of the Schuylkill River. Additionally, 125

[216] Wilton Claude Corkern, "Architects, Preservationists, and the New Deal: The Historic American Buildings Survey, 1933-1942/by Wilton Claude Corkern, Jr" (Ph D, George Washington University, 1984), 33.

photographs and a map were produced.[217] As Peterson wrote, “The dank winds of the Great Depression did blow some good.”[218]

Davidson and Perschler argued that the growing interest in American culture and expanding role of the federal government in such endeavors set the background for the formation of HABS.[219] The federal government’s move into historical documentation coincided with a new popular understanding of American culture. This view placed the patterns of everyday life on a par with rarified examples of fine art as important cultural products. During this period, cultural diffusion models shaped studies such as HABS, which focused on vernacular architecture studies based on geographic diversity. Other New Deal cultural initiatives, such as the Farm Security Administration aimed to collect documentary photographs and Works Progress Administration (WPA) guidebooks, sought to compile information on American life through different mediums. For all these programs, geographic diversity, or regionalism emerged as a key organizing principle for the study of American culture. Furthermore, the frequent use of regional building traditions and local materials in new federal government building construction at this time indicated a similar impulse to acknowledge the regional variety of the United States.[220]

Lavoie stated that the creation of HABS was part of a ground swell of interest in collecting and preserving information, artifacts, and buildings related to America’s early

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[217] Charles E. Peterson, “HABS -- in and out of Philadelphia,” in *Philadelphia Preserved: Catalog of the Historic American Buildings Survey*, ed. Historic American Buildings Survey. and Richard J. Webster (Philadelphia: Temple University Press, 1976), xxix.
[218] Ibid., xxviii.
[219] Davidson and Perschler, “The Historic American Buildings Survey During the New Deal Era: Documenting 'a Complete Resume of the Builder's Art',” 52.
[220] Ibid., 52.

history, which was recognized as the Colonial Revival movement.[221] Like HABS, the movement was motivated in part by the perceived need to mitigate the effects of rapidly vanishing historic resources upon America's history and culture. Organizations such as the Association for the Preservation of Virginia Antiquities, the Society for the Preservation of New England Antiquities, and Colonial Williamsburg presented models for the collection of historical artifacts and the interpretation of architectural heritage. Architects trained in the École des Beaux Arts prepared drawings of colonial-era buildings in folio volumes as a means of promoting and understanding historic architecture. While important, these activities occurred only on a limited, local, or regional basis. For the first time, the HABS surveys implemented a comprehensive examination of historic architecture on a national scale to uniform standards.

The rapid and uncontrolled destruction of the historic fabric during the turn of the century culminated with the inception of HABS. During the 1920s and 1930s, an expanding automobile culture, overcrowding in urban neighborhoods, and uncontrolled real estate development were rapidly destroying architectural resources. Edgington states that HABS was originally started as "a last defense to industrialism." As historic buildings were being demolished on behalf of modernism, the HABS staff was trying to record as much as they could for posterity.[222] Lavoie referred to the preservation movement of the 1930s as a "profound social responsibility." Even before the notion of

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[221] Lavoie, "Laying the Groundwork, Prologue to the Development of HABS," 1.
[222] Edgington, *Interview*.

heritage recording and documentation was extensively conceptualized, architects in the 1930s had concerns about the loss of the historic fabric. [223]

By documenting the physical remains of earlier eras, the intangible qualities of early American architecture might not be lost to the forces of progress. In most cases, preservation through documentation has provided the only tangible record of the fast disappearing past. For example, soon after the architectural study of the old riverfront area on the Levee St. Louis in 1936, the entire site was replaced by a city development.[224]

Peterson recommended that the program consider pre-1860 structures as representing “a complete resume of the builder’s art,” including “public buildings, churches, residences, bridges, forts, barns, mills, shops, rural outbuildings, and any other kind of structure of which there are good specimens extant.”[225] Hence, the collection includes not just high-style structures, but those that reflected average Americans. Peterson emphasized that buildings should be selected for HABS documentation based on academic interest, not on commercial interest in historic models for new buildings that had tended to drive previous studies of historic American architecture. Figure 1 illustrates the HABS drawing of a Greek revival house, the General Robert Lee Bullard House, built in Alabama, Texas, in 1850. The house was documented based on Peterson’s vision of documenting ‘a complete resume of the builder’s art.’ The drawing set was produced in 1934 right after HABS was established.

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[223] Lavoie, *Interview*.
[224] Peterson, “HABS -- in and out of Philadelphia,” xxxiii.
[225] Peterson, “The Historic American Buildings Survey Continued,” 30.

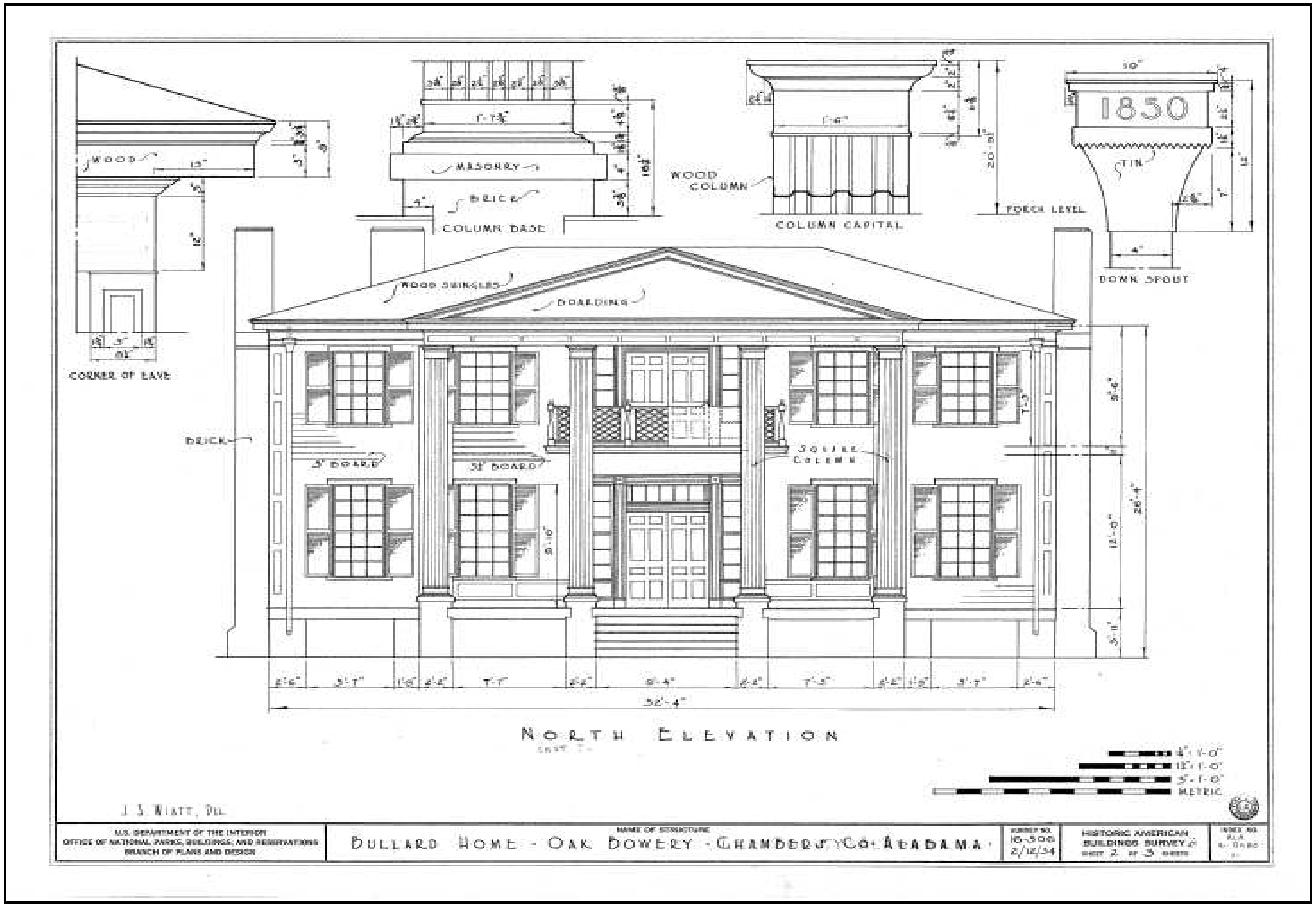

Fig. 1. A drawing showing the north elevation of the General Robert Lee Bullard House. (Copyright-free image acquired from the Built in America website of Library of Congress, September 1, 2011.)

During this time, HABS teams utilized recording strategies available during the era. In the HABS memorandum, Peterson stated that surveying equipment such as tracing paper, pencils, erasers, and molding combs would be furnished free to the drafters enrolled in the HABS projects. On the other hand, the enrolled men would be expected to provide their own drawing boards, T-squares, triangles, rules, scales, tapes, curves, and other materials which they could be reasonably expected to have already in their possession.[226] Victor Hornbein, a drafter in the New Mexico HABS project during 1934, recalled that the team was given a six-foot folding carpenter's rule, a field notebook, string, plumb, and a simple transit that could only turn horizontal angles.[227]

Peterson determined large-format photography would be the formal documentation tool in addition to measured drawings and written histories. In the memorandum, he wrote that each project should be supplemented with photographic work.[228] These photographs should be produced under a rigorous set of standards. They must be taken with a view camera; they must be black and white, between 4x5 and 8x10 inches in size, with 5x7 being the most accepted standard.

Another reason why Peterson added photographic work in the survey was to provide jobs for unemployed photographers. M. James Slack became the official photographer, but architects who were working on the projects also did photographic documentation. For instance, Frederick D. Nichols took photos of the structures in the northern counties of Santa Fe, Taos, Rio Arriba, San Miguel, and Colfax in the summers

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[226] Peterson, 31.
[227] Victor Hornbein, "The 1934 HABS Project," in *Recording a Vanishing Legacy: The Historic American Buildings Survey in New Mexico, 1933-Today*
ed. Sally Hyer (Santa Fe, NM: Museum of New Mexico Press, 2001), 25, 28.
[228] Peterson, "The Historic American Buildings Survey Continued," 31.

of 1936 and 1937. Another architect, John P. O'Neill, photographed Isleta and Laguna pueblos in 1937. A consulting architect with HABS, Delos H. photographed the Albuquerque area in 1940.[229]

The HABS surveys ended in 1941, as did all WPA funded programs, with America's entry to WWII. Although the program virtually ceased in less than eight years, the new HABS catalog included records of 6389 structures on 23,765 sheets of drawings and 25,357 photographs in the Library of Congress.[230] HABS remained active during the 1940s and 1950s through the work of the National Park Service's Branch of Design and Construction and its regional offices, and through donations of records by former district officers, other members of the AIA, and by universities and private institutions.

HABS Documentation from 1950-1980

In 1956, NPS launched a ten-year initiative, called "Mission 66," to rehabilitate national parks in time for 1966, the Park Service's 50th anniversary. Following WWII, the national parks were decrepit. Years of neglect, an upsurge in postwar visitation, and a shortage of funds had created overcrowded and deteriorating facilities. Hence, Mission 66 was concerned largely with issues like campground fees, visitors' accommodation, maintenance of the facilities, and construction of new structures. However, funds were also allocated for HABS to renew the active measuring program. With the mandate to

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[229] Hyer, "HABS Recording in New Mexico," 15.
[230] Charles E. Peterson, "Thirty Years of HABS," *Journal of the American Institute of Architects* 40(November 1963): 84.

reactivate HABS in the post-war years came an appropriation in 1958 for $116,000 of funding for the program.[231]

The goal of Mission 66 was to complete the recording of all historic American buildings in ten years. After years of drought, the HABS funds seemed an overwhelming embarrassment of riches. As Peterson recalled, "We had no staff to work with and we had to spend it by the end of the year and show that it had been spent well… We nearly drowned in it for a year."[232] With both money and mandate, HABS was thrust into a dizzying array of activities:

- buildings under the jurisdiction of the Park Service were to be recorded,
- projects unfinished from the 1930s were to be completed,
- new subjects were to be identified and acted upon,
- the Historic American Buildings Inventory (HABI) was to be carried out,
- the HABS catalog of 1941 was to be updated and reproduced (a catalog supplement was published in 1959) and
- new recording techniques were to be evaluated.

HABS was no longer constrained to recording park properties. For the first time since the Depression, HABS could mount recording projects of privately owned structures and carry documentation to remote locations. Teams moved to the middle Connecticut River Valley (1959), to the Maine coast (1960-1962), to Savannah, Georgia

[231] Vider, "The Historic American Buildings Survey in Philadelphia, 1950-1966: Shaping Postwar Preservation," 43.
[232] Interview with Charles Peterson in 20 February 1991 cited in Ibid.pp 44.

(1962), to St. Augustine, Florida (1960-61), to San Juan, Puerto Rico (1962), to Charleston, South Carolina (1963), and to Annapolis, Maryland (1964).

With the available funds from Mission 66, the post-reactivation years brought changes to the recording and documentation techniques used by HABS. The Cronaflex method as a drafting method, and architectural photogrammetry as a data gathering strategy, were both introduced to HABS during this time.

Since the program's inception, the survey had required the final record drawings to be made with permanent, waterproof ink. Ink, however, was a difficult medium to work with. In 1956, Chief Architect Dick Sutton stated:

> There is definite objection to the continued use of ink on the bond paper because of the difficulty in making corrections and the difficulty of tracing because of its opaque characteristic. The draftsmen today are not in the same class of competence as those who worked on the original projects and cannot be relied upon to produce such fine work.[233]

However, pencil was not considered as a permanent medium for archival purposes. Therefore, HABS began to use DuPont's "Cronaflex" method. A finished pencil drawing on HABS paper was photographed full size onto a photographic film to produce a master negative. The negative was then contact-printed in a vacuum frame onto a sensitized, polyester plastic sheet to make the master positive, which had the appearance of an ink drawing. The original pencil drawing, master negative, and master positive were all deposited in the Library of Congress as part of the HABS collection. Prints of HABS drawings obtained from the Library of Congress would be made from

[233] Memorandum, "Historic American Buildings Survey." Dick Sutton to Thomas C. Vint. 19 April 1956. "Advisory Board Correspondence. 1957-66." HABS Office Files. Washington. Cited in Ibid., 51.

this positive without the need for handling the original pencil drawing, which was kept for future photography. Some drafters preferred to use special pencils directly on plastic sheets.[234] The Cronaflex method was first used by HABS in 1959. By 1961, the Cronaflex method had become standard procedure, replacing the use of ink, but by the late 1960s, it had been replaced as standard procedure by ink-on-Mylar. Figure 2 depicts the final measured drawing produced by the Cronaflex method, which was produced in 1965. It was originally a pencil drawing printed on sensitized polyester Cronaflex sheet.

HABS' efforts to document historic structures as a permanent record for the future intensified following World War II. The 1960s witnessed massive destruction of historic assets as urban renewal swept away neighborhoods in the name of progress and economic growth. People and resources were reallocated to the suburbs. Even though regions identified with their historic downtown areas, in practice these became increasingly irrelevant except as a place for employment or destination for an occasional night out. In addition, highways cut across swaths of countryside, bypassing towns and communities. The construction of highways either demolished or geographically isolated many old neighborhoods. Architectural signs of progress, irreverent of the past and jarring in scale, replaced the buildings and symbols of past eras in broad, indiscriminate strokes. In this setting, HABS worked with numerous communities to record historic resources compromised by these changes.[235]

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[234] Harley J. McKee, *Recording Historic Buildings*, ed. Historic American Buildings Survey. (Washington: U.S. National Park Service, for sale by the Supt. of Docs., 1970), 48.

[235] Virginia B., Price and James A. Jacobs, "A Framework to Build Upon, HABS and the Impact of the National Historic Preservation Act of 1966," in *American Place: The Historic American Buildings Survey at Seventy-Five Years* (Washington, DC: Historic American Buildings Survey, 2008), 49.

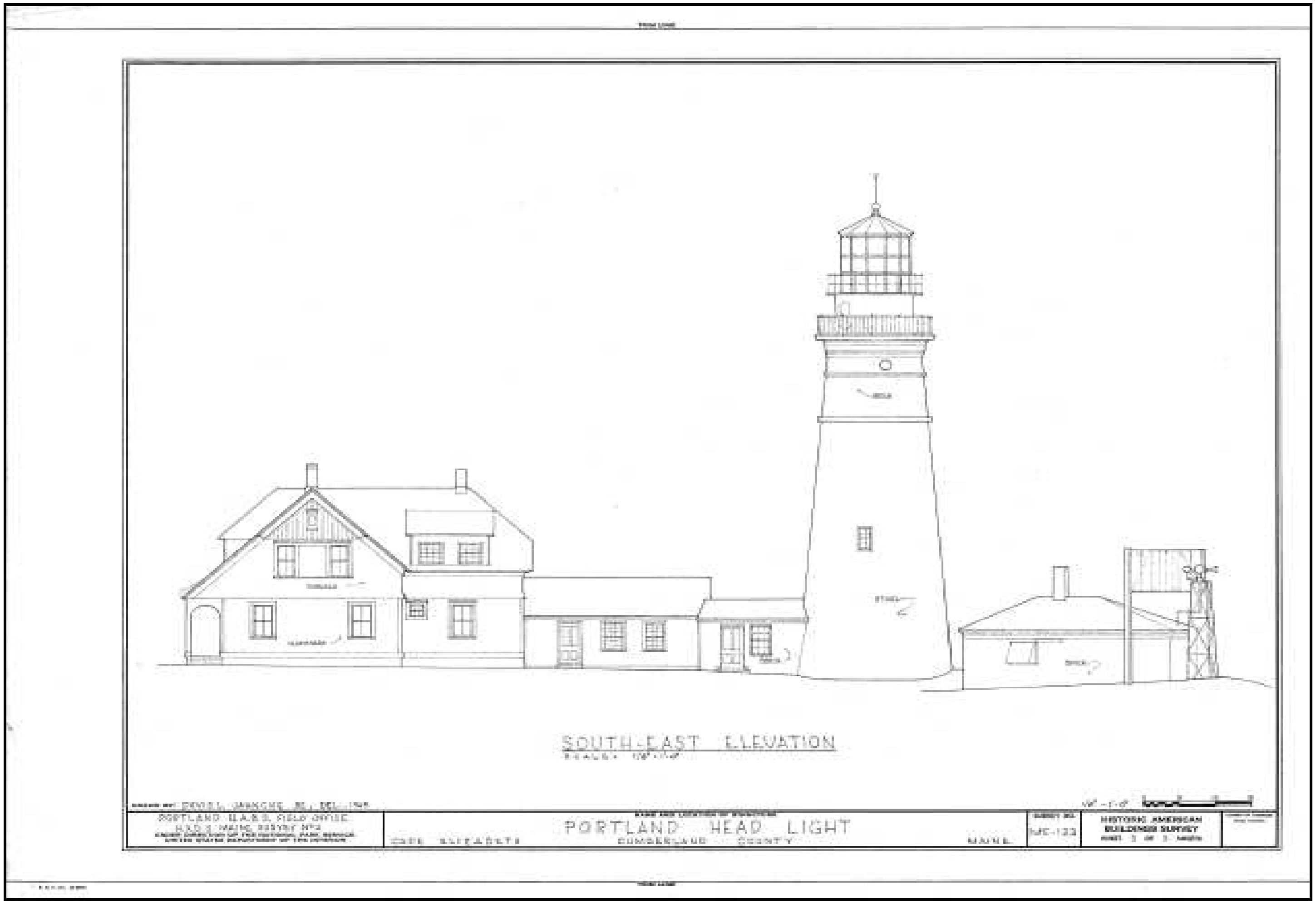

Fig. 2. A drawing showing the southeast elevation of the Portland Headlight, Cumberland County, Maine. The drawing was generated by the Cronaflex method. (Copyright-free image acquired from the Built in America website of Library of Congress in September 1, 2011.)

It was estimated that by 1966, 50% of the properties previously recorded by HABS had been lost.[236] During this time, HABS was called upon to record large groups of threatened historic buildings that were to be torn down for redevelopment or highway projects. One example was the HABS campaign to document the Sweet Auburn Historic District, once called the "richest Negro street in the world," which was compromised by a highway project.[237] The 1979 "Sweet Auburn" Project included both documentary recordings of historic structures and proposals for their rehabilitation. Figure 3 shows the HABS drawing of the district.

Another example of these last minute records are the early Bayou St. John houses in New Orleans and the McKim, Mead, and White's shingle-style W.G. Low Home, built in 1887 in Bristol. Figure 4 presents a large-format photograph of the exterior of the W.G. Low Home. Built with respect to Bristol's long tradition of using wood construction in its architecture, the William G. Low House is a key example of the shingle-style. The house was a massive low gable in overall form and was made of wood-frame and clad with shingles, materials that lent their name to the aesthetic. The building was demolished in 1962. Today, only a couple of photographs are left from the house. Even though preservation through documentation is not a substitute for a historic building continuing to serve a useful contemporary purpose as in these cases, it does provide a permanent record of the historic asset for the future.

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[236] James A. Jacobs, "Urban Renewal," in *American Place: The Historic American Buildings Survey at Seventy-Five Years* (Washington, DC: Historic American Buildings Survey, 2008), 54.
[237] Price and Jacobs, "A Framework to Build Upon, HABS and the Impact of the National Historic Preservation Act of 1966," 49.

Fig. 3. This drawing of the 1979 Sweet Auburn Project depicts the north side elevation of the street. (Copyright-free image acquired from the Built in America website of Library of Congress in September 1, 2011.)

Fig. 4. This is one of the few remaining photographs of the William G. Low House, which was demolished in 1962. (Copyright-free image acquired from the Built in America website of Library of Congress in September 1, 2011.)

Massey said that in most cases HABS teams continued to record threatened buildings, even as the bulldozers approached.[238] During these endeavors, HABS teams started to explore ways to produce last minute records of demolition threatened buildings in a rapid and efficient way. In the 1950s, HABS teams adopted architectural photogrammetry to document historic fabric. The process was especially well suited to recording large or complicated structures and offered the possibility of making and storing large numbers of photogrammetric images from which measured drawings could be made at any time.[239] Through photogrammetry, the stereo photographs of the building could be made quickly before it was demolished. The drawings could then be plotted from the photographs whenever needed, perhaps for years. Peterson refers to this characteristic of photogrammetry as "canning the structure with little more than camera work."[240]

The NPS, especially, took advantage of photogrammetry to record structures before their imminent demolition or collapse. In 1959, when the molded plaster ceiling in Congress Hall in Philadelphia was about to collapse before the restoration work, the NPS commissioned the School of Architecture at Ohio State University (OSU) to photogrammetric ally record and draw the endangered portions. In another project, OSU recorded the exterior of the Old Stock Exchange Building in Chicago with

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[238] James C. Massey, "Preservation through Documentation," *Historic Preservation* 18, no. July -- August (1996): 148.
[239] Perry E. Borchers, *Photogrammetric Recording of Cultural Resources*, ed. Archaeology United States Office of, Division Historic Preservation Technical Preservation Services, and United States. Office of Archeology and Historic Preservation. Technical Preservation Services Division., National Park Service Publication (Washington, DC: Technical Preservation Services Division, Office of Archeology and Historic Preservation, National Park Service For sale by the Supt. of Docs., U.S. G.P.O., 1977), 1-2.
[240] Charles E. Peterson, "Photogrammetry for HABS," *Journal of the Society of Architectural Historians* 16, no. 4 (1957): 29.

photogrammetry in 1963, and made two measured drawings accordingly. Years later, when the City of Chicago was commissioned to aid in storing and future reassembly of the great entrance archway of the Stock Exchange in 1971, one of the original glass-plate stereo pairs was reoriented and plotted at a larger scale to provide the corresponding drawing.[241]

Between 1957 and 1959, in order to experiment with photogrammetry for architectural documentation, NPS contracted for photogrammetric work with Ohio State University because Professor Perry E. Borchers was one of the foremost American experts in architectural photogrammetry. At the time, Peterson wrote that the purpose of the contract was to compare costs of work done by photogrammetry with conventional methods.[242] He anticipated that the smaller and simpler buildings could be done more cheaply with hand surveying. On the other hand, tall and elaborate structures requiring scaffolding would be probably documented more quickly and accurately by photogrammetry. In this context, the Plum Street Temple, a fancy Moorish-style building in Cincinnati, was chosen to be delineated with photogrammetry to test the feasibility of this method in architectural documentation.

After the Temple project, there was great excitement about photogrammetry at the HABS office. In 1958, HABS supervising architect Thomas C. Vint wrote to the Advisory Board, "If photogrammetry is as good as it looks to us now it may be well to reconsider our method of making our records."[243] Peterson supported the use of

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[241] Borchers, *Photogrammetric Recording of Cultural Resources*, 2.
[242] Peterson, "Photogrammetry for HABS," 29.
[243] Memorandum. "A Summary Statement of the Present Status of HABS and a few Suggested Questions for the Advisory Board to Consider." Thomas C. Vint to Advisory Board, 27 January 1958. "HABS

photogrammetry in architectural documentation, and wrote that the savings of time in fieldwork and the accuracy of the results were striking.[244] By using this method, tall buildings and structures with difficult or dangerous access could be recorded without the need of any scaffolding. Physical contact with unstable structures could be avoided. Furthermore, the recording of the intricate minarets of the Temple resulted in a spectacular drawing for HABS that would have been impossible using conventional methods.[245] Years later, in 1983, Peterson wrote, "HABS successfully pioneered historical photogrammetry in this century... I am proud of this project."[246]

Subsequent to WWII, another shift occurred in the infrastructure of HABS teams. When the postwar building boom was in progress, HABS could no longer rely on a pool of unemployed architects as it had throughout the 1930s. After WWII, all the employed architects and drafters went back to work. In order to maintain the workforce needed for the HABS projects, Peterson hit upon an idea, borrowed from the U.S. Army Corps of Engineers, of using undergraduate and professional students during their summer recess. The first students worked directly for Peterson in the summer of 1950 in Philadelphia, making measured drawings of buildings scheduled for restoration at Independence Park. In the coming summers, detailed measured drawings were made as properties were acquired for the park.

Advisory Board 1953-61." HABS Office Files, Washington. Cited in Vider, "The Historic American Buildings Survey in Philadelphia, 1950-1966: Shaping Postwar Preservation," 52.

[244] Charles E. Peterson, "Photogrammetry, the Magic Scaffold," *Journal of the Society of Architectural Historians* 17, no. 2 (1958): 27.

[245] Peterson, "HABS -- in and out of Philadelphia," xxxix.

[246] Peterson, "The Historic American Buildings Survey, Its Beginnings," 13-14.

In 1966, the enactment of the National Historic Preservation Act (NHPA) manifested a new era in federal historic preservation. HABS then became the precursor to a growing number of cultural resources partnership programs in the National Park Service. In addition to the public documentation of historic structures, HABS started to provide support to private agencies and to state and local governments undertaking historic preservation initiatives.[247] Another result of the NHPA legislation was the establishment of Historic American Buildings Survey (HAER). The increased professionalization and specialization of federal preservation programs with NHPA culminated in the need to expand the depth and breadth of architectural study and documentation.[248]

NPS initiated HAER in 1969 with a focus to compile a record of the design and operation of important engineering and industrial works throughout the country. The HAER documentation projects included bridges, dams, canals, power plants, factories, ships, and missile silos, among others. Even though HABS included industrial and engineering structures in the collection, the establishment of HAER was particularly intended to document America's industrial and engineering achievements.

During the 1970s, HABS teams explored aerial photogrammetry as a means to gather field data. Borchers stated that photogrammetry was an efficient system for recording structures that are architecturally ornate, complex, irregular, or in situations where it is difficult to recognize or establish a coordinate system for measurement on

[247] Price and Jacobs, "A Framework to Build Upon, HABS and the Impact of the National Historic Preservation Act of 1966," 47.
[248] Ibid.

site.[249] Hence, both terrestrial and aerial photogrammetry was used to record the Native American pueblos of the Southwest. These sites have an organic form with house clusters irregularly aligned, and with occasional sculptural masses of buttresses or collapsed structure. For instance, in 1970, HABS commissioned Ohio State University to record the pueblos of New Mexico and Arizona using aerial photogrammetry. A considerable change of architectural character was taking place because of new Indian housing sponsored by the U.S. Department of Housing and Urban Development then. Thus, HABS wanted to document these sites before any imminent change to the historic environment. However, acquiring permission from the Native American villages prolonged the periods necessary to complete documentation work and the tribes did not welcome documentation teams working in their villages. Accordingly, the aerial photogrammetric documentation of the villages were done by using a Zeiss AR 15/23 wide-angle aerial camera at heights of 1500 ft. (approximately 500m) above the ground. A sufficient number of manhole covers of the sewer systems were recognized for survey control and orientation of the optical models in the A7 Autograph machine. With the use of photography and survey controls, OSU produced drawings of the villages at scales as large as 1:240.[250] Figure 5 demonstrates the plan drawing of the Pueblo of Nambe, in Santa Fe, New Mexico undertaken by aerial photogrammetry in 1975. The site plan was produced by using glass photogrammetric plates. This project was coordinated with the New Mexico State Highway Department.

[249] Borchers, *Photogrammetric Recording of Cultural Resources*, 2.
[250] Borchers, "Photogrammetry of the Indian Pueblos of New Mexico and Arizona," 191.

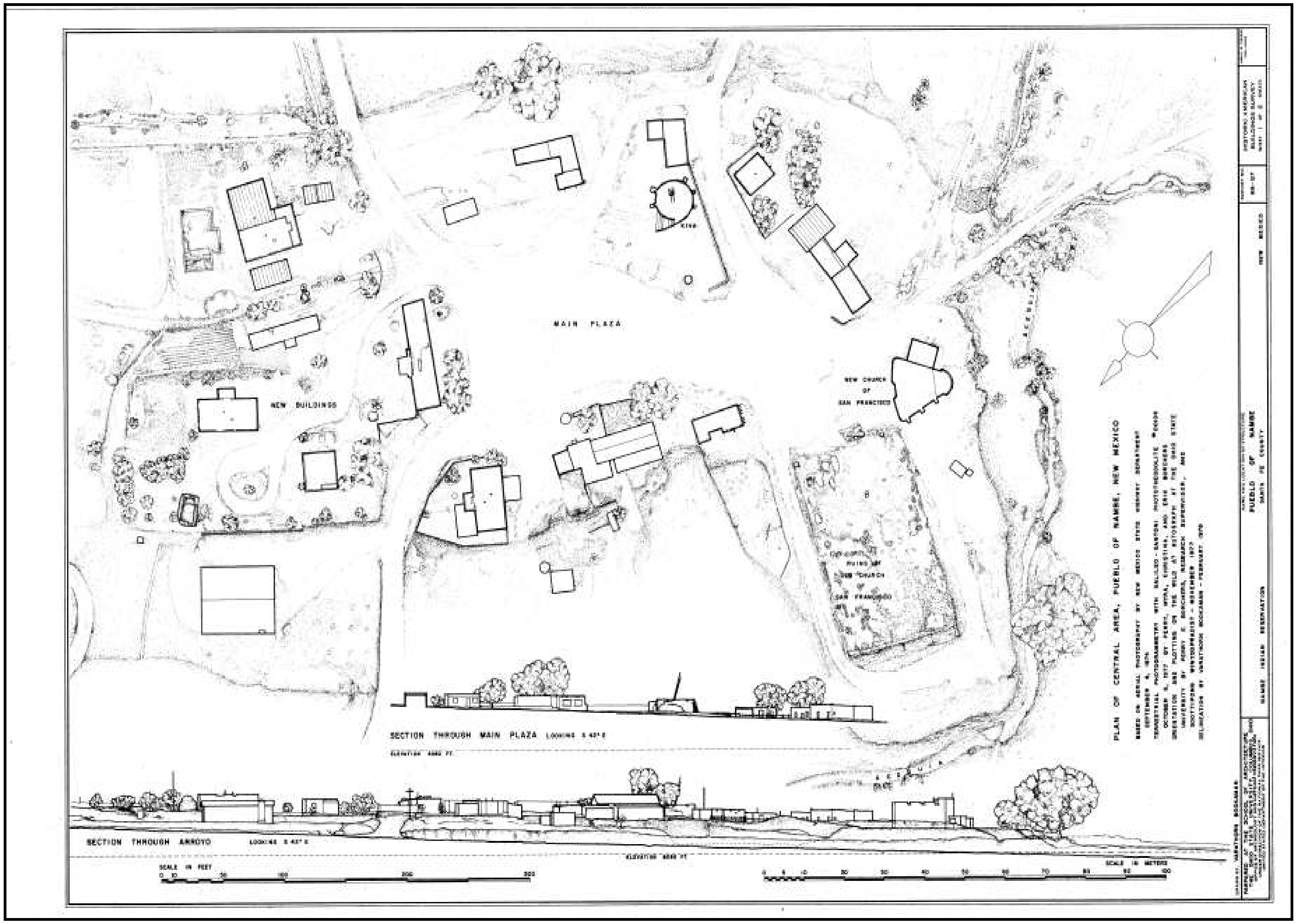

Fig. 5. The site plan for the Pueblo of Nambe was produced using glass photogrammetric plates. (Copyright-free image acquired from the Built in America website of Library of Congress in September 1, 2011.)

Despite the successes of photogrammetry, the technology had drawbacks and HABS never fully abandoned traditional, hand measuring techniques. One drawback was that photogrammetric equipment was prohibitively expensive for the Park Service to purchase. Hence, the process remained limited to contracts for especially tall or complicated buildings, and in a few limited instances, for stereo-pairs that would be stored for the future.[251] At the time, Borchers stated there was a large initial investment in equipment; stereo cameras and photo-theodolites could exceed $2,000 and $4,000 and first plotting machines could cost as much as $63,000.[252] Another drawback could that occur would be when a single stereo-pair failed to capture the complete façade, additional stereo-pairs were required. Each additional stereo-pair multiplied the time needed in the field to take photographs and establish survey control. In addition, the character of the buildings, the architectural elements of special interest, the conditions of the site, and the requirements for accuracy varied greatly from site to site. Cramped conditions on the site or projected elements covering a portion of the structure could require other means of recording such as hand measuring. Therefore, floor plans, sections, and other drawings still had to be produced by hand techniques.

Borchers believed that architectural students derived a special benefit from hand measurement because this method allows them to have contact with the realities of architecture, which may otherwise elude them during much of their professional career.[253] Furthermore, there are similar benefits for the architect who learns to plot and

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[251] Vider, “The Historic American Buildings Survey in Philadelphia, 1950-1966: Shaping Postwar Preservation,” 53.
[252] Borchers, “The Measure of the Future and the Past,” 353.
[253] Borchers, “Photogrammetry of the Indian Pueblos of New Mexico and Arizona,” 189.

draw a building using the A7 Autograph machine. This is a geometrical experience of the building, which cannot be otherwise matched because the coordinate system of the instrument reveals qualities in the optical model that are often not apparent even to a person in physical contact with the structure.[254] In this context, a photogrammetrist should have some appreciation of the virtues of hand measurement of buildings because hand-measurement and architectural photogrammetry should be complementary in architectural documentation.[255]

HABS Documentation from 1980 to the Present

In September of 1983, the publication of the Secretary of the Interior's Standards for Architectural and Engineering Documentation established HABS/HAER methods as the benchmark for recording by government agencies.[256] The Secretary's Standards were first published in the Federal Register to provide guidance for mitigation documentation in accordance with NHPA of 1966. The Standards outlined the development of documentation for endangered sites and structures. NPS would coordinate most of the mitigation projects, and State Historic Preservation Offices (SHPOs) would give advice for the projects. During this era, HABS worked with a number of SHPOs to record a selection of historic sites that best represented the state's own architectural heritage. In addition, HABS was commissioned to provide documentation in support of significant government sponsored initiatives such as the creation of National Historic Areas like the

[254] Borchers, 190.
[255] Borchers, *Photogrammetric Recording of Cultural Resources*, 3.
[256] Lavoie and Schara, "Reinforcing Our Structure, Enhanced Standards, Methodologies, and Outreach," 65.

Southwestern Pennsylvania Industrial Heritage Area (1988), and the Cane River Heritage Area (1994). The 1983 guidelines were updated in 2003 to add E-size drawings (34” X 44”) and large-format color transparencies, to drop Level IV documentation, and to incorporate the Historic American Landscapes Survey (HALS) program. These four standards have remained unchanged.[257]

The establishment of HALS in 2000 demonstrates the need to encompass new scholarship on the built environment in order to record America’s historic landscapes. The historic landscapes range from designed to vernacular, rural to urban, and agricultural to industrial spaces. Vegetable patches, estate gardens, cemeteries, farms, quarries, nuclear test sites, suburbs, and abandoned settlements can all be categorized as historic landscapes.

The Charles E. Peterson prize is an important student initiative created in 1982. The prize is cosponsored by the Athenaeum of Philadelphia and the American Institute of Architects. The award was created with the intent to increase awareness, knowledge, and appreciation of historic buildings among university students while adding to the permanent HABS collection at the Library of Congress. To 2008, more than 2000 students from 68 colleges and universities have participated and completed more than 500 entries and almost 5000 measured drawings. The students come from different backgrounds such as architecture, architectural history, historic preservation, and American studies. The projects vary in scope ranging from the famous Pavilion I - X at the University of Virginia to St. Andrews Episcopal Church in Bryan, Texas.

[257] Burns, “Overview,” 6.

The significance of the HABS program resides in the scope of the collection and its public accessibility.[258] Shortly after HABS was established in 1934, arrangements were made for the resulting documentation to be housed at the Library of Congress.[259] As was intended, the HABS collection represents a complete resume of the builder's art, ranging from the smallest utilitarian structures to the largest and most monumental, and the Library has been an important channel for publicizing heritage information. Today, along with HAER and HALS, the HABS materials are available to the public copyright-free and online through the Prints and Photographs Division of Library of Congress. Thanks to the Built in America website of the Library of Congress, the HABS collection of drawings, photography, and written histories has become a leading venue for distributing heritage information to the public.

In February 1997, the Library of Congress opened a "Preview" page for the HABS/HAER collections, featuring photographs and drawings of fifteen sites. The full catalog of the HABS/HAER collections was made available online to the public in early 1998, and included drawings, large-format photographs, and written histories. Additional digital images are added monthly.[260] HABS is now one of the most widely used of the Library's collections and is among the largest collections of architectural documentation in the world.[261]

[258] Lavoie, "Laying the Groundwork, Prologue to the Development of HABS," 1.
[259] The cooperation between the National Park Service, the AIA, and the Library was formalized with a tripartite agreement announced in April 1934 Davidson and Perschler, "The Historic American Buildings Survey During the New Deal Era: Documenting 'a Complete Resume of the Builder's Art'," 53..
[260] Cliver et al., "HABS/HAER at the Millennium: Advancing Architectural and Engineering Documentation," 35.
[261] Lavoie, "Laying the Groundwork, Prologue to the Development of HABS," 1.

During the 1980s, without a doubt one of the most substantial transformations occurred at the production end, where traditional hand drawing and hand inking has been replaced by CADD. Although a handful of earlier field projects involved the tentative and partial use of CADD, the first in-house projects to produce a complete set of drawings in CADD were documented the Washington, Lincoln, and Jefferson memorials, which began in 1991.

There are several important issues regarding the adoption of CADD. First, the large size of the Washington, Lincoln, and Jefferson memorials dictated that the drawings would eventually be plotted on E-size sheets (34 inches X 44 inches). However, this type of sheet is difficult to work with using traditional hand drafting. Second, the project sponsors' need for digital data to be used in facilities management and restoration projects was a significant driving force.[262] Instead of the cumbersome sheets of drawings, the contractors could easily distribute digital drawings of the projects. Drawings in digital format could be updated easily as changes were made to the buildings. In addition, they could easily be linked to databases for maintenance and facility management purposes. The fact that data can be sent digitally to the Library of Congress as an addendum to the hard copy permanent records means that HABS projects can now be made available on-line almost immediately upon transmittal.

Nevertheless, the adaptation of traditional HABS measuring methods to CADD requirements of CADD meant a period of trial and error. For the most part, simple hand measuring was used to obtain dimensional information on the buildings. This process

[262] Lavoie and Schara, "Reinforcing Our Structure, Enhanced Standards, Methodologies, and Outreach," 75.

was abetted by an extensive system of scaffolding erected at each site. However, because drawing in CADD involves essentially drawing at full scale, the measuring methodology had to be particularly accurate and precise. The remarkable precision of the CADD software, up to 1/64 of an inch, was well beyond the drafter's ability to achieve via hand measuring. Instead, the HABS teams decided to measure to the nearest eighth of an inch, which was the smallest division on some of the tapes. Metal tapes were used exclusively because of the tendency of cloth (fiberglass) tapes to stretch when pulled over long distances.[263]

During this era, HABS teams also utilized digital photogrammetry. Architectural photogrammetry traditionally involved the use of fragile glass plate negatives and a large, specialized machine (a stereo plotter, i.e. an Autograph A7) in order to produce a drawing. The entire process was cumbersome and tedious. The advent of new photogrammetric cameras and corresponding software (which resolved issues of scale and perspective distortion) has facilitated and simplified the process, which can now take place on a computer. The entire process has become digital via software such as PhotoCAD [264], in which multiple digital images (either original digital photographs or scanned printed photographs) can be manipulated on the computer screen, as opposed to being traced manually on a digitizing table.[265] HABS has found this digital-rectified photogrammetry useful in a number of situations, perhaps most notably when the four sides of the Washington Monument were photographed from the U.S. Park Police

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[263] Schara, "Recording Monuments," 227.
[264] The photogrammetric software used was PhotoCAD, which was selected primarily because it was relatively inexpensive and works as an add-on inside AutoCAD, Ibid., 227.
[265] Ibid., 231-33.

helicopter in order to determine the precise locations of the exterior stone joints for the structure's elevations.[266]

As with any technology, digital photogrammetry has both advantages and disadvantages. Although useful for vertical surfaces (elevations and sometimes sections) and relatively close-up, straight-on details, it is not useful for plans, which typically still need to be hand-measured.[267] During the photogrammetric fieldwork, photos need to be taken at some distance from the surface. The documenter can move the camera around the structure to get the vertical coverage. However, in order to capture the plan, the documenter has to place the camera a couple of meters above the floor. In practice, this setting is unrealistic regarding the physical attributes of an enclosed room space. Furthermore, features need to be visible in order to be photographed. Thus, buildings encumbered with foliage or with features too high up for good photographic resolution are not good candidates for photogrammetry.[268] For example, while documenting the Lincoln and the Jefferson Memorials, the documenters encountered logistical problems. Much of the ornamentation was too high up to be photographed from the ground. Scaffolding towers were erected to provide the HABS team and the restoration architects with access to most surfaces of the building for hand measuring. However, these towers were too close to the building for photography. This situation was resolved by mounting the photogrammetric camera on an 11-foot boom and then swinging it out into space for proper positioning. A 15-foot shutter release cable was used to take the pictures. The

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[266] Lavoie and Schara, "Reinforcing Our Structure, Enhanced Standards, Methodologies, and Outreach," 78.
[267] Schara, "Recording Monuments," 227.
[268] Ibid., 229.

attic frieze, entablature cornice, and entablature frieze at the Lincoln Memorial were all photographed using this method as the towers moved systemically around the building.[269]

Pictorial imagery through inexpensive digital cameras has proven to be a boon for HABS field teams. Traditionally, teams used 35mm photography in order to capture images in the field for reference purposes back in the office. This process invariably involved issues of logistics and expense, not to mention the inevitable time lag required for development and printing of the photos. Digital photography has made these issues moot. In addition, clear, straight-on photos of relatively small and flat details can easily be brought directly into CADD, scaled, and then traced -- a timely and effective way to capture field data. Digital photography has not replaced large-format, black and white for formal documentation due to the need for the permanence and archival stability provided by the original negative; however, it has facilitated capturing field information photographically.[270]

The most recent major addition to the HABS arsenal of digital field devices is the three-dimensional laser scanner. The NPS began to explore the feasibility of the laser in pilot projects such as the Statue of Liberty in New York City (2001) and the Bodie Island Lighthouse in North Carolina (2002). In 2001, NPS contracted with Texas Tech University's College of Architecture to demonstrate the feasibility of using a laser scanner to provide documentation of the skin of the Statue in order to monitor the patina

[269] Ibid., 229.
[270] Lavoie and Schara, "Reinforcing Our Structure, Enhanced Standards, Methodologies, and Outreach," 78-79.

and thus to supply a plan for facility management of the Statue. The scaled drawings would be used to monitor and preserve the statue, and will eventually become a part of a GIS project that will enhance maintenance and management of the landmark structure.[271] The team submitted a preliminary drawing of the horizontal sections of the statue, a grid of 4” x 4” squares with an elevation on the left that showed where the section cuts were, and as a visual reference the elevation data of the pedestal (in registered point cloud) to NPS.[272] The second phase of project, which was documenting all of Liberty Island and producing detailed drawings of the Statue, began in 2006.

In the documentation project of the Bodie Island Lighthouse, the team’s goal was to explore the feasibility of scanned data for critical structural assessment. The NPS commissioned a surveying firm based in Rockville, Maryland, to undertake the laser scanning of the Lighthouse with a Cyrax brand laser scanner. They had two project goals. First, they wanted to obtain field measurements while avoiding any need for elaborate scaffolding, cranes, or climbing gear. Second, they wanted to create section cuts through the point cloud of the tower at 10-foot intervals to determine if the tower was warping out of its true circular shape and to see if the tower was plumb or leaning in any direction.[273] The point-cloud showed that the tower maintained a true circular shape throughout its rise and did not deviate from the centerline. However, this type of time-of-flight scanner gives erroneous results due to the refraction of the laser beam through

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[271] Akboy, “*The Application of New Survey and Documentation Technologies for Cultural Heritage Sites: Case Study Analyses of the Digital Statue of Liberty, New York City and the Ottoman Fortress of Seddülbahir, Gallipoli Peninsula*,” 104.
[272] Akboy, 110.
[273] Croteau, “Documenting Bodie Island Lighthouse: Using Digital Technologies for Efficient and Accurate Measurements.”

glass. Therefore, the NPS contracted another surveying firm from Baltimore, Maryland, in order to obtain glass prisms for the Fresnel lens of the Lighthouse. This time, another type of scanner, the Farro Arm, was used to record x,y,z coordinate information from the glass surface. Both sets of scanned data were used as a template for the rehabilitation and restoration projects of the lighthouse. These experiments with scanning technology culminated in the NPS purchasing a LEICA Scan Station 2 a couple of years ago. Now, HABS, HAER, and HALS can undertake in-house scanning campaigns.

Conclusion

HABS was formed in order to create a public archive of America's architectural heritage, using measured drawings, historical reports, and large-format photographs. As the program unfolded, the impetus of its agenda was a result of several movements.

The notion of preservation through documentation became a critical aspect of the HABS program as the forces of urban renewal and highway construction wrought havoc on the historic landscape throughout the 1950s and early 1960s. "What we can't protect in physical being, we can protect in spirit. The Historic American Buildings Survey shows us how we can catch the historic places for the files before the bulldozer comes," stated John A. Carver Jr., Assistant Secretary of the Department of the Interior in 1963.[274] The implementation of Mission 66, between its inception in 1956 and its official termination in conjunction with the NPS' 50th anniversary, played a substantial role in

[274] John A. Carver Jr., "An Inexact Business," *Journal of the American Institute of Architects* (1963): 33.

shaping HABS. With Mission 66 funding, HABS had the resources to experiment with recording methodologies such as architectural photogrammetry.

In the following years, the HABS field measuring methodology evolved by incorporating new recording and documentation technologies. Most HABS projects still involve both the use of penciled field note sketches on graph paper and the use of standard measuring tapes. However, a number of new technologies such as CADD, digital photogrammetry, pictorial imagery, and three-dimensional laser scanning have enhanced the ability of HABS teams to capture information and data while on site, especially where issues of size, height, access, time, and complexity of detail are significant factors.

CHAPTER V

DRAWING AS A MEDIUM OF ARCHITECTURAL UNDERSTANDING AND ITS ROLE IN HABS CULTURE OF DOCUMENTATION

God created paper for drawing architecture. [275]

Alvar Aalto

Introduction

Drawing has a past as long as human history and remains a primary means to record, document, and analyze our world. The act of drawing continues to be a significant vessel of creative development, exploration, and achievement. In architecture, drawing constitutes a fundamental medium to communicate and distinguish ideas. Design drawings transform intangible thoughts into existence while measured drawings are a fundamental means to investigate the built fabric.

The purpose of this chapter is two-fold: to investigate the role of drawing in architectural cultural, and to assess HABS within this context. Drawing has always been integral to architectural thought and history as a means of representation, communication, design, and analysis. The chapter starts with a review of the development of drawing in architectural culture. Following this perspective, the chapter continues with the assessment of drawing as a means of analytical thinking. Hence, these discussions constitute the infrastructure needed to locate the notion of drawing in

[275] Alvar Aalto, *Sketches*, ed. Göran Schildt (Cambridge, Mass.: MIT Press, 1978), 104.

heritage recording and documentation, and to discuss HABS within this context. This chapter is significant because a better understanding of the relationship between drawing and the HABS culture of documentation provides the dynamics in order to anticipate the future role of the program in the heritage field.

The Development of Architectural Drawing

Drawing is a human endeavor. Humans are the only beings to draw in a meaningful way who are also born with the urge to express their feelings. Any scribble with a pen or paper conveys an intense communication with the world; these drawings portray a great effort to depict the humans' impression of the world. Drawing alters the world.

A mark on a surface immediately energizes its neutrality; this graphic imposition transforms the actual flatness of the surface into the virtual space, and translates the material reality to the fiction of the imagination.[276] Throughout human history, rendered images and symbols have demonstrated humans' urge to express their thoughts. Even before history was recorded with written materials, drawing was used to fulfill humans' compulsion to represent the world surrounding them. The rendered images and symbols on the walls of Paleolithic caves show the level of engagement and connection of humans' with material life as well as with their beliefs.[277]

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[276] David Rosand, *Drawing Acts: Studies in Graphic Expression and Representation* (Cambridge, UK , New York: Cambridge University Press, 2002), 1.
[277] Melanie Holcomb and Lisa Bessette, *Pen and Parchment: Drawing in the Middle Ages* (New York New Haven: Metropolitan Museum of Art ,
Yale University Press, 2009), 3.

Drawing is a basic form of visual expression and an invention of a specific time and place. Merriam-Webster defines drawing as "the art or technique of representing an object or outlining a figure, plan, or sketch by means of lines."[278] With this in mind, architectural drawings are any "drawings of architecture or drawings for architectural projects, whether the project was executed or not. Drawing may also refer to any image in a two-dimensional medium that serves this same purpose, including prints and computer images."[279]

The origin of architectural drawings emerged in the ancient world. The most common mediating artifact between idea and building was drawing. In addition to custom and traditional construction techniques, ancient builders also made drawings to guide construction. Ancient drawings were inscribed directly onto the surfaces of buildings. For instance, the Greek temple of Apollo at Didyma in Turkey still has the construction outlines of columns, columns bases, lintels, and traces of the inclined walls that were depicted directly on the stone surfaces. One can still observe the millimeter accurate tracings of the structural elements on these walls because the construction of the temple was not completed.[280]

Similar drawing methodologies were also maintained in late medieval and Renaissance architectural practice. In medieval architectural practice, most of the drawings were embedded in the construction process; full-sized details were drawn onto

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[278] Merriam-Webster Inc., *Webster's Ninth New Collegiate Dictionary* (Springfield, Mass., U.S.A.: Merriam-Webster, 1991), 381-82.
[279] Art & Architecture Thesaurus, "Architectural Drawing," http://www.getty.edu/vow/AATFullDisplay?find=drawing&logic=AND&note=&english=N&prev_page=1&subjectid=300034787.
[280] Ridgway, "The Representation of Construction," 269-70.

the plaster on the floor or carved into the stone surfaces in the secondary parts of the building.[281] The complicated geometries of medieval religious buildings also encouraged the development of sophisticated construction techniques such as the accurate cutting of three-dimensional pieces of stone blocks. The ability to predict the exact shape of stone pieces before lifting and installing them necessitated a template drawing on each surface of the stone and transferring this geometrical diagram to the uncut stone blocks.[282] These template drawings symbolized God's creation. Each engraved stone was considered sacred and a part of God's house on earth.[283] The making of these construction-embedded drawings represented highly ritualized, prophetic, and cultural values. In other words, the drawings were rarely conceived of as the result of personal will, as is the case today, but were believed to be divinely inspired.

In the Renaissance, architectural thinking coalesced with pure mathematical understanding. Architectural drawing became an instrument to depict three-dimensional objects accurately in two-dimensions and included plans, sections, and elevation drawings. This projection system was designed to show the maximum amount of information with the minimum means (a plan, elevation, and section) drawn on paper. This way of representation was first used at the Academia di Santa Lucca in Rome during the Renaissance and was mastered by such artists as Raphael. The depiction of the building through a plan, elevation, and section compelled young students to

[281] Marco Frascari, "A Reflection on Paper and Its Virtues," in *From Models to Drawings: Imagination and Representation in Architecture* ed. Marco Frascari, Jonathan Hale, and Bradley Starkey (London , New York: Routledge, 2007), 25.
[282] Further, the medieval architects could not envisage the whole building in the drawings because the notion of scale was unknown Alberto Pérez Gómez and Louise Pelletier, *Architectural Representation and the Perspective Hinge* (Cambridge, Mass.: MIT Press, 1997), 7-8.
[283] Ridgway, "The Representation of Construction," 272.

condense both their unruly thoughts and the essential abstraction elements in the drawing.[284]

With the introduction of Euclidean geometry in the 18th century, architectural representation was further reduced to the realm of algebraic analysis.[285] Drawing became a precise mathematical description of reality.[286] When the École Polytechnique was established in 1795 in France, the conception of the school was to establish radically reformed technical education for architects and engineers. Therefore, the school focused on descriptive geometry that described the physical description of objects in space with a set of coordinates in line with x,y,z axes. The dose of algebraic analysis in architectural education was increased considerably. Architects and engineers came to be educated in order to make production more efficient. In the 18th century, the popularization and implementation of scientific methods and descriptive geometry were considered integral to advancements in technology.

The 19th century witnessed the development of another strategy in architectural thinking that is still prevalent in architecture today. The French architect, Jean Nicolas

[284] Treib, *Drawing/Thinking: Confronting an Electronic Age*, 31.
[285] Around 300 BC, Euclid wrote *The Elements*, a major treatise on the geometry of the time, and what would be considered 'geometry' for many years after. In his book, Euclid states five postulates of geometry which he uses as the foundation for all his proofs. It is from these postulates we get the term *Euclidean geometry*, for in these Euclid strove to define what constitutes 'flat-surface' geometry. These postulates are:
1. [It is possible] to draw a straight line from any point to any other.
2. [It is possible] to produce a finite straight line continuously in a straight line.
3. [It is possible] to describe a circle with any centre and distance [radius].
4. That all right angles are equal to each other.
5. That, if a straight line falling on two straight lines makes the interior angles on the same side less than two right angles, the two lines, if produced indefinitely, meet on that side on which the angles are less than the two right angles Daniel Marshall and Paul Scott, "A Brief History of Non-Euclidean Geometry," *Australian Mathematics Teacher* 60, no. 3 (2004): 1.
[286] Alberto Pérez Gómez, *Architecture and the Crisis of Modern Science* (Cambridge, Mass.: MIT Press, 1983), 279.

Louis Durand (1760-1834), pushed the boundaries of the reductionist approach to architectural discourse by introducing the representation of a building with a descriptive set of projections in different scales. In contemporary practice, architects still use this geometrized set of projections of a building to represent real space. Durand's design method "rejected both personal expression and the appeal to any transcendent authorities such as nature, divine proportions, ideal prototypes, or absolute standards of beauty to which virtually all previous architecture in the western tradition referred."[287] This design method reduced architectural production to the selection and combination of building forms and elements.

Since the mid-1900s, architectural thought has been preoccupied with the elimination of the irrational and the personal in favor of a universally applicable system of principles and rules based on absolute certainties. This is why the introduction of computers to architectural practice in the 20th century was viewed with such favor; the computational operations performed on precisely selected and organized data were perfectly suited to a reductionist understanding of architectural production. According to Bruegmann, "architects had been preparing themselves to welcome such a tool for two centuries. The exactitude of computers in relation to the processing of information, which is ultimately broken down into digital units, would finally eliminate all imprecise or subjective factors."[288]

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[287] Ridgway, "The Representation of Construction," 274-75.
[288] Robert Bruegmann, "The Pencil and Electronic Sketchboard: Architectural Representation and the Computer," in *Architecture and Its Image: Four Centuries of Architectural Representation: Works from the Collection of the Canadian Centre for Architecture*, ed. Eve Blau, Edward Kaufman, and Robin Evans (Montreal
Cambridge, Mass.: Centre Canadien d'Architecture/Canadian Centre for Architecture ,

Vesely argued that the production of architecture is currently dominated by scientific and technological thinking, which is concerned primarily with the instrumental, reductionist, and mathematical representation of reality.[289] He wrote that both technology and modern science are motivated by the same interest, the will to dominate reality and thus control power. Ridgway said buildings resulting from contemporary architectural drawings struggle to embody any meaningful symbolic qualities other than those thought to be associated with production itself.[290] Architects have been locked into a system of commoditization that demands increasingly efficient production of buildings. As architects have moved deep into the instrumental realm of production, architecture has been confronted with the possibility of design based on no more than an understanding of form, formal purpose, material, and technique. The simplicity and intrinsic poverty of architectural design are complemented by an unprecedented complexity of personal intentions and formalizations.

Drawing as a Means of Analytical Thinking

In architectural literature, drawing was discussed in four distinct ways: as a medium for representation, for communication, for design, and for analysis. Drawing is first a medium of representation. The resultant artifact, be it design or any working drawing, exhibits knowledge and understanding, and disseminates information to others. The world of architecture is a world of representations. Architects do not only build

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Distributed by the MIT Press, 1989), 141.

[289] Dalibor Vesely, *Architecture in the Age of Divided Representation: The Question of Creativity in the Shadow of Production* (Cambridge, Mass. , London: MIT Press, 2004), 241-42.

[290] Ridgway, “The Representation of Construction,” 275.

buildings, but they represent them, mainly through drawings, models, words, and numbers. Intentionally and otherwise, drawings represent many things. Drawings are the result of both productive and symbolic representations. Drawings are made according to the prevailing conventions of production while also seeking to satisfy the human need to embody symbolic meaning.[291]

Architects create drawings to communicate ideas, i.e. to present project information to the client, to exchange ideas with peers, and to show the builders what to do. These drawings constitute the documents by which the design is realized and executed. The indispensability of drawing as a communication tool for both clients and builders only hints at the difficulty that might be encountered if drawings were not used. Evans stated that drawing is necessary "for architecture, even in the solitude of pretended autonomy, [because] there is one unfailing communicant, and that is the drawing."[292]

Drawing comprises a fundamental part for the intellectual process called design.[293] Architects think through their observations of the world; they test ideas on paper and they innovate. They externalize design ideas and test them against project requirements and their own design aspirations. The image tells more than was projected into it, and new or unrecognized relationships or ideas emerge that stimulate further creativity.

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[291] Ridgway, 268.
[292] Evans, *Translations from Drawing to Building and Other Essays*, 155.
[293] Brian Edwards, *Understanding Architecture through Drawing*, 1st ed. (New York: E & FN Spon, 1994), 1.

Piano interpreted the process of design as a game, and drawing as a fundamental component of interactive play: "designing and making is like having a quiet sort of game, and that game is played through drawing."[294] Drawing engages the mind of the designer in two invaluable ways. First, drawing-as-seeing enables the designers to document or capture aspects of places as they educate their eyes through a deeper perception of their surroundings. The study of existing architectural examples helps cultivate an understanding for design and enables architects to explore significant aspects of architecture such as form, construction, and material. The second way drawing engages the designer's mind is through visual thinking. Drawing-as-thinking is an interactive process that materializes what is inside a designer's mind. As the designer works with symbolic surrogates, these rendered thoughts become displayed architectural ideas. The inquirer discovers new ideas through configurations, images, ideograms, metaphors, and representations. Whether it is ink marks on paper or pixels on a screen, drawing transforms intangible thoughts into tangible existence.[295]

The process of producing analytical drawings is where knowledge and understanding of architecture comes together. Piano stated that the gist of analytical drawing is not to borrow references for use in design, but to understand the connotations. For example, if the architect is working on a design scheme, then scrutinizing the streetscape provides real references for the architect's thinking. If there is a small piazza for 32 meters square, and it is a functioning piazza at the scale of the design scheme,

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[294] Renzo Piano, cited in Edward Robbins, *Why Architects Draw* (Cambridge, Mass.: MIT Press, 1994), 127.
[295] Vincent Brian Canizaro, "Drawing Place: An Inquiry into the Relationship between Architectural Design Media and the Conceptualization of Place" (Dissertation, Texas A&M University, 2000), 3.

then the architect can abstract down the scale and size of the piazza to the project. Even if it is a piazza from the fifteenth century, it is still a good reference.[296]

Ching made a remark similar to Piano, but added that studying architecture is not just gathering real references, but is also acquiring a new language. [297] As when learning a language, one must know and understand the alphabet before words can be formed, recognize the grammar and syntax before sentences can be made, and know the rules of composition before an essay can be written. For student architects in particular, it is useful to recognize the basic elements of architectural form and space, to understand how they can be manipulated in the development of a design concept, and to realize their visual implication in the implementation of a design solution.

Producing analytical drawings of existing architecture has a unique place in architectural history and thought. For example, the architectural writers of the Renaissance all referred to lessons to be learned from the study of existing ancient structures. One of the most influential Renaissance architects, Leon Battista Alberti (1404-72), wrote that those responsible for continuing a building should examine it thoroughly and understand it well in order to "adhere to the original Design of the Inventor," and not spoil the work that had been well begun.[298] He advised that architects should carefully survey historic buildings, prepare measured drawings, examine their proportions, and build models for further study.

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[296] Robbins, *Why Architects Draw*, 130.
[297] Frank Ching, *Architecture, Form, Space & Order* (New York: Van Nostrand Reinhold, 1979), 11.
[298] Jokilehto, *A History of Architectural Conservation*, 26-27.

Leonardo de Vinci was one of the central figures of the Italian Renaissance. Leonardo related buildings to human beings in terms of their structural integrity and proportions. In his view, the health of men depended on the harmony of all elements, and disease resulted from discord. Various sketches and manuscripts show Leonardo's structural thinking and the way he constantly compared human beings to architecture.[299] Analytical drawing was essential for Leonardo in order to acquire the power of architecture. He advised his students on how to represent the appearance of buildings in their drawings rather than on how to design them. His purpose in doing analytical drawings was not to produce drawings as artifacts but to acquire knowledge and understanding that could be used in the translation of the appearance of humans in the composition of pictures. "Through drawing, Leonardo acquired the 'language' (anatomy) of human form and posture. Having learned it, he could then 'speak' it in his paintings."[300]

Some four centuries later, French architect and historian Eugène Emmanuel Viollet-le-Duc (1814-1879) studied architectural documentation as a formal step in restoration. He wrote that before any repair work begins, it is necessary to ascertain the exact age and character of each part of the building and to compile all this documentation in a report.[301] This official report should include written notes, as well as drawings and illustrations of the historic asset. Thus, when the architect starts the restoration work, he should have exact knowledge of the building and shape his work

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[299] Jokilehto, 28.
[300] Unwin, "Analysing Architecture through Drawing," 105.
[301] Eugene-Emmanuel Viollet-le-Duc, "Restoration," in *Historical and Philosophical Issues in the Conservation of Cultural Heritage*, ed. Nicholas Stanley-Price, Mansfield Kirby Talley, and Alessandra Melucco Vaccaro, *Readings in Conservation* (Los Angeles: Getty Conservation Institute, 1996), 314.

according to this documentation information. Consequently, Viollet-le-Duc and his followers produced meticulously accurate and detailed documentation of historic structures prior to any restoration work.[302] They documented characteristics of style, details of the buildings, and methods of construction.

Architect Le Corbusier (1887-1965) pursued the quest of analytical drawing during his grand tour of the Mediterranean. He took sketchbooks and he drew the buildings he encountered. Even though he is usually associated with stark modernist design, Le Corbusier celebrated the geometries of historic buildings in his sketchbook.[303] He also wanted to access the underlying 'anatomy' of the buildings. He examined design possibilities and the workings of architecture. For Le Corbusier, sketching was a personal way of gradually understanding more and more about what he could do with architecture.[304]

Though they were centuries apart, Leonardo de Vinci, Viollet-le-Duc, and Le Corbusier used the same medium, analytical drawing, to understand the underlying anatomy of buildings. They exhaustively recorded their surroundings while developing a wide range of ideas and sharpening their critical ability.

Understanding the use of analytical thinking as an educational tool culminated in 1648 with the systemization of the École des Beaux-Arts, the French National School for the Arts. This institution was the premier vessel for the continuation of the practices and

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[302] Alessandra Melucco Vaccaro, "Restoration and Anti-Restoration," in *Historical and Philosophical Issues in the Conservation of Cultural Heritage*, ed. Nicholas Stanley-Price, Mansfield Kirby Talley, and Alessandra Melucco Vaccaro, *Readings in Conservation* (Los Angeles: Getty Conservation Institute, 1996), 308.
[303] Warden and Woodcock, "Historic Documentation: A Model of Project Based Learning for Architectural Education," 111.
[304] Unwin, "Analysing Architecture through Drawing," 105.

ideals that started during the Renaissance. The school codified the architect as an artist, gentleman, and humanist scholar. The architect was compelled to read the treatises of Vitruvius and other Renaissance scholars and to follow the methodologies and mediation they advocated.[305] Hence, the students at École des Beaux-Arts measured and drew classical precedents in order to examine form, proportion, and building techniques used in old buildings. Measured drawings became the formalized deliverable of the education system that utilized recording and documentation as a means of understanding architectural precedents, learning construction details, and improving one's individual skill in the art of drawing.[306]

In the architectural culture, the ability to produce measured drawings is seen as personal improvement and as a badge of professional distinction since the Renaissance. Until the late 19th century, a professional would not be recognized as a good architect unless he completed the grand tour in Europe and Asia, and brought home measured drawings of ancient structures. Even into the late 19th century, architects were primarily clerks who learned their skills by being clerks to established architects. A prospective architect would be apprenticed to an architect at the age of 15, He would be taught how to design, to draw plans, sections, and elevations, be instructed in hydraulics and perspective, improve his French, and then finally would go abroad. During his grand tour, he would measure, draw, and study classical monuments. He would observe every piece of the composition, and translate these observations as drawings. When the student

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[305] Canizaro, "Drawing Place: An Inquiry into the Relationship between Architectural Design Media and the Conceptualization of Place," 82.
[306] Warden and Woodcock, "Historic Documentation: A Model of Project Based Learning for Architectural Education," 111.

returned home, he would be ready to become a good architect.[307] Graduating from the École des Beaux-Arts came to be a badge of professional distinction. It solidified the graduate's position in architectural practice and facilitated further opportunities as a young architect.

Lavoie stated that HABS techniques of using measured drawings as a learning tool is a continuation of the École Beaux-Arts tradition.[308] The École-Beaux-Arts has long influenced training in the United States. Until the 1930s, architectural history had not yet been established as a separate discipline from that of architecture, and thus many in the profession were considered architect-historians.[309] From the formation of the first American architectural program at the Massachusetts Institute of Technology (MIT) in 1865, and throughout the 1930s, students were encouraged to study historical precedents in order to understand various styles and their potential for use in modern designs.[310] Participation in the HABS program and learning to produce measured drawings has also been valued as a professional distinction in the historic preservation field. As Komas stated, "being a HABS intern significantly aids in graduate school acceptance, [and] serves as essential background for being hired as an entry-level architectural intern in professional practice and being given great responsibility almost immediately."[311] Furthermore, as a HAER intern during 2006, I have to admit that knowing my drawings

[307] A. Sharr, "Drawing in Good Faith," *Architectural Theory Review* 14, no. 3 (2009): 308.
[308] Lavoie, *Interview*.
[309] Catherine C. Lavoie, "Architectural Plans and Visions: The Early HABS Program and Its Documentation of Vernacular Architecture," *Perspectives in Vernacular Architecture* 13, no. 2 (2006): 15.
[310] Lavoie, "Laying the Groundwork, Prologue to the Development of HABS," 3.
[311] Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study," 10.

will be a part of the Library of Congress collection and shared with the public adds another layer of pride to my HABS experience.

The HABS Drawing Style over Time

1930-1950

During the 1930s, documenters were trained in architectural ateliers and university programs in the U.S. and abroad that followed the Beaux-Arts tradition. The Beaux-Arts drawing style emphasized excellence in drafting and producing drawings detailed enough to allow reconstruction. Drawing sheets contained plans, elevations, sections, and details in addition to copious details, notes, and excessive dimensions that filled much of the paper. According to Komas, early architects intended to use the drawings later in their professional work and, therefore, recorded what they thought was important.[312] Hornbein recalled that during the documentation project in New Mexico in 1934, the HABS team would include restoration drawings in the documentation set if necessary.[313] [314]

In the Beaux-Arts drawing tradition, the architect's drawing style should be as distinctive as his handwriting. The drawings would be delineated freehand and adorned with hand lettering. For example, the measured drawings of the 1934 New Mexico

[312] Komas, 140.
[313] Hornbein, "The 1934 HABS Project," 31.
[314] For example, when he was working on the documentation project of El Santuario del Señor Esquípula in Chimayó, the team realized that a choir loft was once existed in the structure, and the pitched roof had most probably been added at a later time. In order to understand the architectural phases of the church, the team consulted various information sources such as the local community and further written sources. One of the photographs in the articles revealed that when the building was erected around early 1920s, it did not have a pitched roof, but a parapet. Consequently, the crew members explored the attic space and found the original parapet. They measured the parapet, prepared the restoration drawing and added in the set to be used in a future historic preservation project. Ibid., 31.

project revealed the unique drawing skills of the drafters through their compositions of lines of different weights, use of stippled shading and decorative borders, as well as their descriptive notes with ornamental lettering.

Figure 6 depicts a detail drawing of one of the churches from the New Mexico project. The structure dates back to the 17th century, and the drawing was made in 1934. In this project, the crewmembers also produced six watercolor studies of *retablos* in churches at Laguna and Acoma, Talpa, Ranchos de Taos, and Chimayó, which are rare examples of the use of color in a HABS survey project. Leicester B. Holland, AIA, chairman of the Advisory Committee of HABS, spoke of New Mexico's drawings with the great pride and stated that they were among the very finest that had been produced in the U.S.[315]

Komas stated that the early architects did not deliberately fashion the appearance of their drawings to make them aesthetically appealing.[316] They did not intend to produce "beautiful works of art that were approachable, elegant, spectacular, wonderful, and beautifully composed." The architects were just following the style that was prevalent in the profession at the time.

[315] Hyer, "HABS Recording in New Mexico," 12.
[316] Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study," 141.

Fig. 6. This watercolor study of the San Esteban del Rey Mission is one of the rare examples of the use color in HABS measured drawings. (Copyright-free image acquired from the Built in America website of Library of Congress in September 1, 2011.)

Architectural graphic books of the period also reveal the prevalent drawing style in the architect's work. One example of this type of book is the *White Pine Series*, a set of copiously illustrated and annotated architectural monographs on early American wooden buildings ed. Russell Fenimore Whitehead and published bimonthly by Weyerhauser Mills of Minnesota from in 1914 to 1940. Another example is William Rotch Ware's multivolume work, *The Georgian Period*, a collection of photographs, measured drawings, and historical essays appearing in the American Architect and Building News prior to 1899. Both of these works reflect the Beaux-Arts drawing style of the period. These volumes were also significant guidelines that established industry standards for architectural documentation, incorporating three disciplines -- architecture, photography, and history -- in the recording process.[317]

Peterson's vision of the ideal drawing set for a building with many details and descriptions can be attributed to the HABS drawings of the 1930s as well. During an interview conducted by Komas, Peterson commented:

> "Usually they drew what was there. Occasionally if they got a lot of information on some building and they drew an extra sheet showing something that is missing or something, an old photograph they had. Actually, in an old building ideally you do this, you see the building and you decide it is in poor condition, you make a drawing the way it is and then the architect makes a drawing about the way he thinks it was because they are going to restore it. And then they go ahead and restore it, they discover all kinds of things they couldn't of known before they tore the building up and then they finally make one more drawing showing the way it was after it was restored. Now that is four sets of drawings... [318]

[317] Davidson and Perschler, "The Historic American Buildings Survey During the New Deal Era: Documenting 'a Complete Resume of the Builder's Art'," 58.
[318] Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study," 142.

1950-1980

For the hundreds of students who participated in summer survey teams during the 1950s and early 1960s, the HABS experience and training proved to be a seminal introduction to historic architecture, to recording and documentation techniques, and to the evolving philosophies and attitudes of historic preservation.[319] At the time, the National Park Service's summer program team in Philadelphia was the only American training ground in restoration architecture. The drafting room at Colonial Williamsburg was the first school of architectural restoration until James Marston Fitch began teaching the graduate course in the preservation of historic architecture at Columbia University in 1964.

The students of the 1950s and early 1960s who participated in the HABS summer teams came from American architectural schools that were heavily into modernism. The emphasis was on new design. The issues of restoration, architectural conservation, and related subjects were not considered in the curriculum.[320] As late as 1968, the National Trust for Historic Preservation reported, “architecture school curricula for the most part evidenced little interest in the grammar of historic styles and in draftsmanship.”[321] Thus, it was through HABS that a generation of young professionals gained their first exposure to historic American architecture with hands-on experience augmented by occasional lectures and training sessions.

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[319] Vider, “The Historic American Buildings Survey in Philadelphia, 1950-1966: Shaping Postwar Preservation,” 5.
[320] Ibid., 30.
[321] Elizabeth D. Mulloy, David E. Finley, and National Trust for Historic Preservation in the United States., *The History of the National Trust for Historic Preservation, 1963-1973* (Washington: Preservation Press, 1976), 174.

The architectural historian James F. O'Gorman trained as an architect and participated in several HABS summer projects, including the recording of the Andrew Johnson House in Greeneville, Tennessee in 1956. He recalled:

> I was educated in the fifties and we had little history... I can remember trying to draw some moldings in the house in Greeneville and not understanding what the hell I was doing and Charlie [Peterson] coming down and showing me what to do, showing me what a molding looked like under all that paint and what I was supposed to be looking for. I had five years of architecture education and I didn’t know what I was doing, what constituted a molding, what are the various profiles that go into a molding and that kind of thing. It was a revelation that there was a whole, vast area of architecture that I had missed... I was certainly aware that I was getting a part of my education that I hadn't gotten before. [322]

Ernest Allen Connally, a professor of architecture at the University of Illinois and a frequent summer HABS team supervisor, wrote:

> From the beginnings, one of the chief aims of the summer program has been to give our students -- our architects of the future-the opportunity to participate directly in the conservation of our architectural legacy, thereby cultivating and perpetuating an informed concern for one of our most significant cultural sources. This is a responsibility of the architectural profession at large. Even so, we still require within the profession a small corps of highly trained specialists to work in the field of preservation and restoration, and one of the collateral results of the summer program has been the decision of a number of able young men to make careers in this vital work. [323]

Connally saw the work as useful for all architects, even if they intended to pursue careers in modern design:

> By taking a building that's already an architectural creation and examining it and making drawings of it, which is just the reverse of the usual architectural process of conceiving of a building and making drawings of it and then seeing it built... You understand why things are the way they are, how buildings are put together,

[322] Interview with James F. O'Gorman in 12 March 1991, cited in Vider, “The Historic American Buildings Survey in Philadelphia, 1950-1966: Shaping Postwar Preservation,” 33.

[323] Ernest Allen Connally, “Preserving the American Tradition: The National Park Service Program for Students,” *AIA Journal* 35(1961): 57.

> the way space is formed, and the relationship of drawings to the fully realized piece of architecture which is the building itself. [324]

The summer teams also served as a de-facto recruitment mechanism for the Park Service by allowing Peterson to observe participants for a three-month period. Some of the most promising students were later recruited for full-time jobs in historic preservation. These students included James Massey, who later served as chief of HABS, and Russell V. Keune, who worked as a restoration architect at a number of national parks and as a staff architect for HABS in the mid-1960s and, much later, was a key figure in the establishment of the National Register of Historic Places. Others included Lee H. Nelson, who worked as a restoration architect at Independence for many years, and William J. Murtagh, who worked at Independence and served, much later, as the first Keeper of the National Register.[325]

The use of students did lead led to some inconsistencies in the quality of the drawings. Some students took readily to the intricacies of measuring historic structures, with their often irregular and eccentric spaces and details. Some were fine draftsmen. Others were less able and their work had to be checked carefully. A lack of understanding often led to inaccurate measurements, recalled Penelope Hartshorne Batchelor, who joined the Independence group as a staff architect in 1955. She said, “They didn't understand how buildings were knit together. They didn't understand shapes

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[324] Interview with Ernest Allen Connally 12 February 1991, cited in Vider, “The Historic American Buildings Survey in Philadelphia, 1950-1966: Shaping Postwar Preservation,” 32.
[325] Interview with Charles E. Peterson in 18 April 1991, cited in Ibid., 29.

of moldings. They would let thicknesses of paint interfere with their understanding of what a molding really was."[326]

The modernist approach to architectural education abandoned the traditional Beaux-Arts emphasis on drawings. Rejecting the elaborate presentation drawings demanded by the Beaux-Arts approach, modern architects developed a simplified, often simply linear, graphic style. While announcing the 1958 summer season, Peterson wrote, "The work is supervised by men who are both able to instruct in the professional draftsmanship not taught in the schools and who can explain design and construction of the past."[327] Accordingly, the HABS summer program emphasized draftsmanship and lettering. Frequent lettering exercises were conducted for the students and guest lecturers gave talks to the students. However, most of the training benefits ultimately came from the hands-on experience of crawling around historic buildings with tape measure in hand. "Making measured drawings of a building is the most educational thing for an architect," said Peterson.[328]

After WWII, according to Komas two factors determined the change in drawing style from the Beaux-Arts to the modern drawing style.[329] First, with the introduction of student teams, there was the problem that students could not draw with the skill demonstrated by earlier architects. Drawing styles became susceptible to drawing trends present in schools at the time. For instance, with the switch to Leroy lettering (lettering

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[326] Vider, 33.
[327] Charles E. Peterson, "Architectural Student Summer Program, 1958," *Journal of the Society of Architectural Historians* 16, no. 4 (1957): 29.
[328] Interview with Charles E. Peterson in 20 February 1991, cited in Vider, "The Historic American Buildings Survey in Philadelphia, 1950-1966: Shaping Postwar Preservation." pp32.
[329] Komas, "Historic Building Documentation in the United States, 1933-2000: The Historic American Buildings Survey, a Case Study," 144.

by machine), schools stopped teaching hand lettering and the drawings lost a certain character.[330] Second, the modern architectural movement was growing at the time and influencing students in the schools around the country. The idea of “less is more” leaked into the HABS drawings, and there were single view drawings standing alone in the center of clean, white sheets, essentially devoid of the clutter of notes, dimensions, and details. Although the common feeling was that the drawings were accurate, the lack of information on the sheets made them not as useful for understanding the buildings as the earlier drawings had done.[331]

On the other hand, the modern drawings, also referred as salon drawings, were regarded as very useful for illustrations in publications. The Beaux-Arts style drawings had excessive notes and dimensions, which did not have the same level of illustrative usefulness as those of the modern period. However, Peterson was not quite so dismissive about the change in the drawing styles. He felt “there has always been a demand for public use” of HABS drawings in books.[332] The modern drawing style was a substantial change from the earlier Beaux-Arts epoch in which there seemed to be no self-conscious aesthetics designed for a purpose outside of the historic architecture record. The drawings of the modern epoch took on a completely new meaning; the drawings themselves became “artifactual.”[333]

The establishment of HAER also had an impact on HABS drawing styles. The early HAER drawings continued the HABS tradition of portraying architectural design

[330] Komas, 17.
[331] Ibid., 145.
[332] Ibid., 145.
[333] Ibid., 146.

and construction details, but HAER documentation eventually gave way to a stronger focus on industrial processes. This approach culminated in a drawing approach rife with three dimensional perspective drawings that portrayed industrial processes.

1980 to the Present

The drawing style from the 1980s demonstrates a more comprehensive approach to drawings that is based on blending previous styles, addressing new concerns, and taking advantage of technological advances.[334] Unlike the previous HABS drawings that corresponded to prevalent drawings styles such as Beaux-Arts and the modern approach, drawings since the 1980s do not appear to be based on a particular stylistic movement in the profession at large or in the schools. However, the integration of technologies such as CADD in the end-product phase has become an important factor.

Komas defined the drawing epoch that began in the 1980s as a mixed drawing style. The drawings are still regarded as important illustrative resources for publications and even desirable as framed pieces of art.[335] In addition, there is also a more directed architectural intent that calls for reintroducing the details and notes found in the 1930s and 1940s.

Komas describes the mixed drawing style in relation to the impact of the chiefs of the HABS program. For example, when Popplier retired in 1980 and Kenneth Anderson became the chief of HABS, he implemented a different drawing style than Popplier. Anderson was a fully trained architect and focused almost exclusively on

[334] Komas, 147.
[335] Ibid., 148.

drawings. Anderson also saw the value of technology and began to introduce it into the process. The HABS office concentrated some of their funds and energy on developing a CADD lab and purchased a $50,000 camera for photogrammetry. Paul Dolinsky, a landscape architect, became chief of HABS three years later in 1988. With Dolinsky, there was a move toward more interpretative aspects of documentation. Dolinsky's goal was to combine the positions of the past chiefs by continuing Popplier's research tradition and Anderson's use of CADD, but to go back to the ideals espoused by Peterson. The legacy that Dolinsky worked toward included a focus on letting "the building speak to us rather than us putting our demands on it. [He advocated] a cultural rather than a proscribed architectural approach. Let the building tell you more."[336]

HABS Drawing as a Compound of Analytical Thinking

In heritage documentation, the conceptualization of analytical drawing is based on the production of measured drawings. Burns defined measured drawings as line drawings that portray a three-dimensional structure or site in two dimensions.[337] Measured drawings resemble the as-built architectural drawings in context as the latter are modified construction drawings that are produced immediately after construction. However, measured drawings are generally made years after a structure was built.

Analytical drawings are made for learning. Measured drawings are snapshots in time that record details of the built fabric at the time of documentation. They convey conditions of the building, as well as additions, alterations, and deletions made to the

[336] Komas, 149.
[337] Burns, "Measured Drawings," 88.

original structure. Whitacre asserts that the HABS drawing methodology aims to get a better understanding of the historic structure. Therefore, at the beginning of a documentation project, the HABS team researches all the available information and existing drawings regarding the cultural resource. Based on this research, they decided "how many drawings [were] needed, what types of drawings will be [used], what the drawing will show, which research question will be answered in that architectural prescription." [338]

The power of the HABS building documentation exists how the drawings define people, traditions, and even entire histories. The Built in America website of The Library of Congress has helped the HABS collection of drawings, photography, and written histories become a leading avenue for dissemination of heritage information and reaching out to diverse communities. Anybody who is interested in the drawings can access the collection via the website and use the copyright-free documents. To facilitate this ease of access, the drawings must be readable and understandable to anybody who wants to use and interpret the records.

McKee stated that the widespread use of HABS drawings by different stakeholders constitutes the aim of the program.[339] However, the needs of the varied interested parties such as historians, authors, architects, educators, etc. do differ. For this reason, it is necessary for HABS to reconcile or balance its divergent views, and to make drawings as intelligible as possible even to persons without a technical background. The

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[338] Whitacre, *Interview*.
[339] Harley J. McKee, *Manual of the Historic American Buildings Survey: Pt. Ix, Measured Drawings* (Washington, DC: Eastern Office, Division of Design & Construction, National Parks Service, 1961), 5.

selection of what to include in the drawings involves a forecast of what will be of greatest interest to the most people. Hence, complete floor plans and sections, copiously dimensioned and annotated, would appeal most to architects and preservation professionals. On the other hand, historians, educators, and other parties would prefer elevations with more pictorial emphasis and simple, two-dimensional plans suitable for illustrating lectures and books. According to McKee, the decision of what to include and emphasize in the measured drawing is related to the importance of the structure, the reason why documentation is maintained, and the type of the survey being carried out.

Edgington stated that the collection is a great resource to anybody who is just interested in history, building, a region, or architecture. However, he also said that there are issues of readability of the two-dimensional drawings for the layperson. Edgington suggests that when a layperson is interested in the HABS documentation, there could be an issue of people looking at the drawings and not knowing how to interpret the material. In this case, he suggests that photographs and written histories would be easier to understand. However, this does not mean that drawings are not significant to the documentation. In fact, "drawings are the most important thing because they are the building."[340]

Architects are trained to create and to appreciate depicting the space with two-dimensional drawings as a type of analogy. For example, a room plan is an analogical representation of the real space, where the representation of the window in the plan does not resemble the real one, but gives us an idea of its size, proportion, and the layout in

[340] Edgington, *Interview*.

the room. In this sense, a section of the room does not exist physically, but the architects are educated to develop sections to convey information regarding the height of the room and the vertical relationships between the features of the space. Although this logical picture of space with two-dimensional floor plans, sections, and elevations is understandable for the architects, this deductive way of representation may be incomprehensible for a person who lacks formal architectural training.

Schara pointed out that HABS has to provide a product that people who are not experts on technologies can use and interpret.[341] He argued that a layperson can read two-dimensional drawings, but probably cannot manipulate three-dimensional products. Christine Whitacre, program manager at NPS, defined the virtue of a two-dimensional architectural drawing as demonstrating the significance of the historic structure.[342] The documenter embeds the architectural, historical, and cultural values in the drawing, and maintains the drawing accordingly. Therefore, the viewer of the drawings reads the values with respect to the documenter's approach.

Whitacre advocated that representation of the structure through three-dimensional digital models is vital in an exhibition setting in order to illustrate the overall look of the asset. In most cases, the viewer can experience the historic setting without even visiting the actual site. Yet, the viewer can be challenged by trying to isolate the inherent values in the model and examine them thoroughly. There is always a need for two-dimensional drawing. In this context, Lee stated that in order to engage

[341] Schara, *Interview*.
[342] Whitacre, *Interview*.

different stakeholders in cultural heritage, the utilization of virtual environments is a necessity. According to Lee,

> Expecting the public to be able to view the robust 3-D dataset is not realistic. But creating […] tools [Google Earth, JAVA Web Start Launcher, LEICA TruView & Cyclone Publisher, etc.] is being helpful in terms of being able to show the 3-D data and creating the [heritage] environment. [343]

Each historic structure is unique. Therefore, each project requires different drawings. As Schara stated, HABS has to do certain kinds of interpretive drawings.[344] For example, in documentation projects such as the Statue of Liberty in New York City, it is very difficult to present the undulated skin of the building in two-dimensional drawings. Capturing the essence of a historic ship requires an interpretive approach to demonstrate the irregular surfaces of the structure.

Lockett said there is no "one single word flow" in a documentation project.[345] The documenter has to investigate the best ways to represent particular aspects of the building. Maybe it is a section, a three-dimensional asymmetric perspective, or a section perspective, or maybe the project has to include them all to reveal the heritage information. Furthermore, Lockett stated that "not everything is static [of cultural heritage], but it is dynamic as well" [346] In some cases, the documenter has to demonstrate a particular movement or the way a certain part of machinery or part moves. In HABS/HAER/HALS documentation, these kinds of movement have been traditionally displayed through the use of arrows or exhibiting stages of the process.

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[343] Lee, *Interview*.
[344] Schara, *Interview*.
[345] Lockett, *Interview*.
[346] Ibid.

Lockett stated that 3-D models are vital to display the dynamic processes of cultural heritage.

The possibility of using HABS architectural drawings takes on a heightened importance when a building is to be restored or reconstructed.[347] This was the case when the venerable [St. Michael's] Russian Orthodox Cathedral in Sitka, Alaska, burned to the ground. After the incident, it was decided to use HABS measured drawings to guide the reconstruction of the structure.

Heritage practitioners and other interested parties depend on the HABS drawings' quality and accuracy for preservation projects. Valenzuela stated that, as a preservation architect, any time she starts a project, she browses the online HABS collection.[348] In some cases, she uses the HABS drawings as base information due to their high accuracy and advances her project accordingly. Edgington, an architectural historian, utilizes the collection not only to retrieve accurate drawings of a building, but also to grasp an understanding of similar buildings.[349] Therefore, Schara stated, HABS must maintain the drawing quality that heritage professionals have come to depend.[350]

Lavoie mentioned that she frequently comes across remarks from the private sector praising the quality of the HABS drawings.[351] However, she said that engaging the private profession more in the HABS documentation process is a problem. Practitioners perceive undertaking the drawings according to the HABS standards as another layer to the project budget. One major criticism of the HABS drawings from the

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[347] Massey, "Preservation through Documentation," 150.
[348] Valenzuela, *Interview*.
[349] Edgington, *Interview*.
[350] Schara, *Interview*.
[351] Lavoie, *Interview*.

private sector is that “HABS allocates more time to make the drawings pretty rather than useful.” Lavoie said HABS needs to find a balance between the practitioners’ perception of “don’t change the HABS drawing standards, they are wonderful” while they are not allocating time to produce HABS drawings.[352]

In an effort to encourage practitioners’ contributions to the collection, based on the recommendation of the AIA-HABS Coordinating Committee, HABS does not require heritage professionals to produce an entire set of drawings. Instead of the complete 24 sheets of drawings, interested parties can donate only three sheets that communicate the significance of the heritage asset.[353] Another outgrowth of discussions held with the AIA-HABS Coordinating Committee in order to encourage participation among architectural professionals, is that HABS, together with HAER and HALS, established the Leicester B. Holland Prize in 2010. The Holland prize is also supported by the Paul Rudolph Trust, Architectural Record, the AIA, and the Library of Congress. The award will be given to the best single sheet of measured drawing that captures the significance of the site.

Cultural and Social Values Embedded in HABS Drawing

Humans’ thoughts, values, and experiences are cultural products, as well as the things that they build. In other words, cultural values are embedded within the structures that they create. Understanding architectural sensibilities, as well as recognizing the concepts, relations, and values that have governed its creation should be integral to

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[352] Lavoie, *Interview*.
[353] Ibid.

heritage documentation. Therefore, a sensitive drawing communicates the structure's architectural character as well as its cultural importance. For instance, an architectural plan demonstrates the nature of the human relationships. The plans for Palazzo Antonini, Udine, Italy designed by Andrea Palladio in 1556 reveal a villa with a set of interconnected chambers with multiplying doors.[354] The rooms have more than one door, sometimes as many as four. The 16th century villa was an open plan to household members who were obliged to pass through a matrix of connecting rooms where day-to-day life was carried out. Because of the multiple doors, it was normal to witness both private and business life in the house. Evans said the 16th-century villa depicted a fondness for company, proximity, and social relationships through the format of the architectural plans.[355] In contrast, the plans of a residential architecture from the early 20th century demonstrate the desire for individual privacy provided via a limited number of doors. For instance, the HABS measured drawings (Figure 7) of the Walter Dodge House, built in 1916 in Los Angeles, illustrate that movement of people from room to room remain divergent.

[354] Regarding the great variety and number of doors in Roman buildings, Alberti wrote that "It is also convenient to place the doors in such as Manner that they may lead to as many Parts of the edifice as possible." L.B. Alberti, The Ten Books of Architecture, translated by Leoni, ed. Rykwert (London, 1955), book I, chapter xii. Cited in Evans, *Translations from Drawing to Building and Other Essays*. Pp.63.
[355] Ibid., 69.

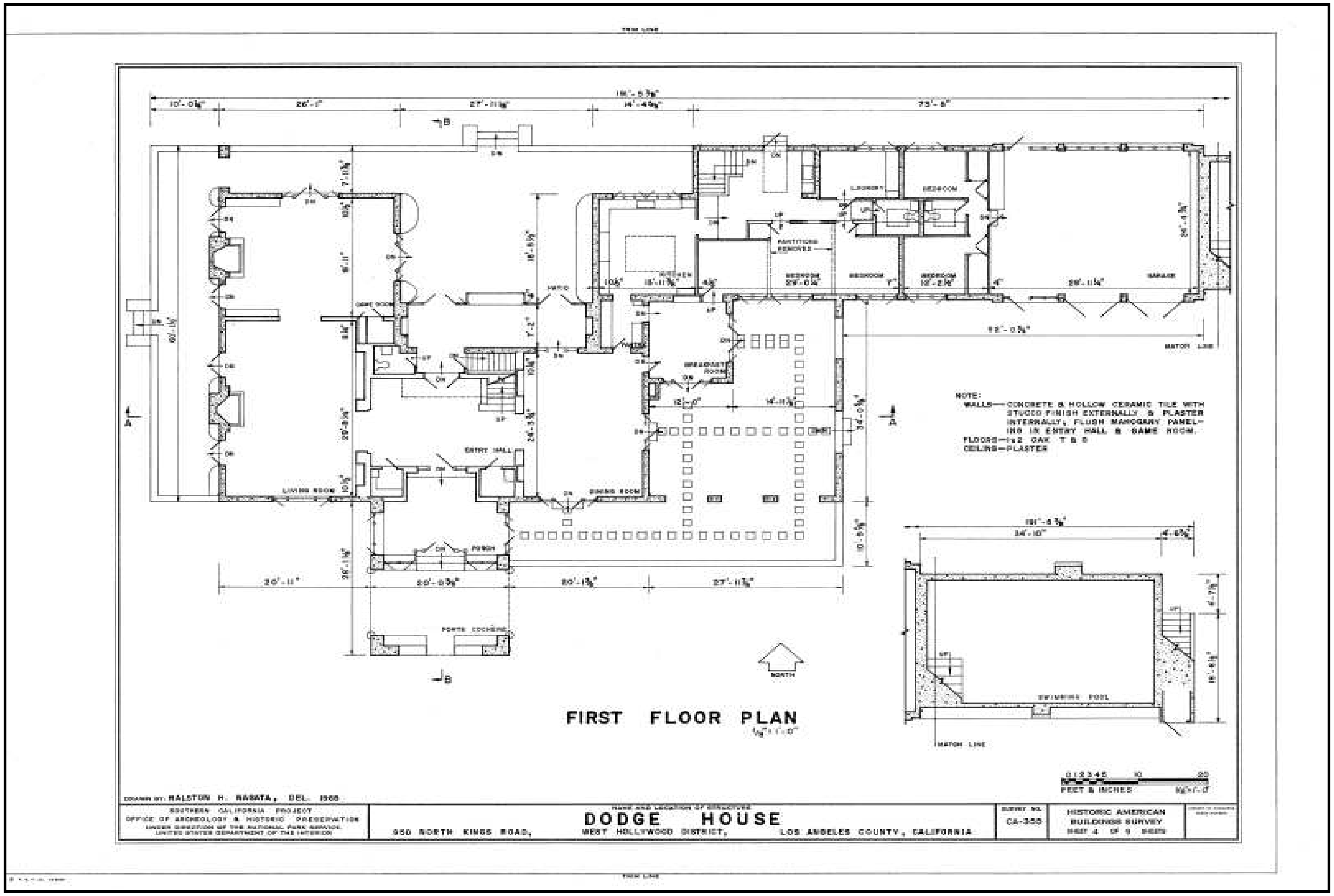

Fig. 7. The Walter Dodge House is a typical example of modern architecture from the early 20th century that celebrates the individual life style of the time. (Copyright-free image acquired from the Built in America website of Library of Congress in September 1, 2011.)

In this type of modern house, the circulation space is unified and distinct. Rooms do not interconnect unless they are used collectively by the household, i.e. living, dining, and kitchen spaces. Otherwise, the paths do not cross. The journey between bed and bath is in particular isolated from other routes. Often, these rooms are located on the second floor and do not have more than one entry door. The characteristics of the architectural plans mimic the social format of the 20th century and the way people occupy space. Unlike the social milieu of the 16th century where gregariousness was the norm, during the 20th century, individualism is celebrated and privacy is habitual. The split between architecture to look through, and architecture to hide in, is evident in the drawings of architecture.

Measured drawings, such as the HABS drawings of Quaker meetinghouses in Philadelphia, can also communicate the manner in which buildings were created, used, and evolved within the historical context. Measured drawings reveal how buildings were shaped to satisfy social and cultural practices, ranging from rudimentary single meeting places for worship to the more complex ones consisting of numerous spaces.[356]

Early Quaker settlers in America adhered to an architectural pattern imported from England. However, as meeting practices evolved, the colonial Quakers eventually deviated from English meeting practices as well as building design. For example, the Germantown Meetinghouse built in 1867-1869 by the Quaker master builder Hibberd Yarnall and designed by Quaker architect Addison Hutton demonstrate a significant shift in architectural layout. Instead of a partition in the center of the room to accommodate

[356] Lavoie, "The Role of HABS in the Field of Architectural Documentation," 20.

separate men's and women's business/meeting areas, the Germantown plan combines a main meeting room for worship and women's business with a rear Committee Room for the men's business meeting. The meetinghouse continued to evolve through later additions to the structure such as the dining room and kitchen in 1902 and offices in the 1960s. In addition to being a place of worship, the meetinghouse has evolved into a multi-purpose hall accommodating contemporaneous events such as "Tea Meetings," educational classes, and other cultural activities.[357] Figure 8 illustrates the section of the Germantown meetinghouse delineated during the HABS documentation project in the Delaware Valley in 1999. Construction of the Merion meetinghouse was started around 1695 and was completed by 1715. Thus, it is the oldest Quaker meetinghouse in the valley. Its near cruciform plan is unprecedented in a Quaker meetinghouse. Many resist the idea that the emigrant Quakers adopted a plan closely resembling one used by the Anglican Church after they rejected all that such a structure represented. However, its non-typical configuration may actually reflect a lack of prescribed standards indicative of meetinghouses erected by the earliest Quaker settlers.

[357] Philadephia Yearly Meeting and Historic American Buildings, *Silent Witness: Quaker Meetinghouses in the Delaware Valley, 1695 to the Present. Historic American Buildings Survey Recording of Friends Meetinghouses within the Region of Philadelphia Yearly Meeting*, 42-43.

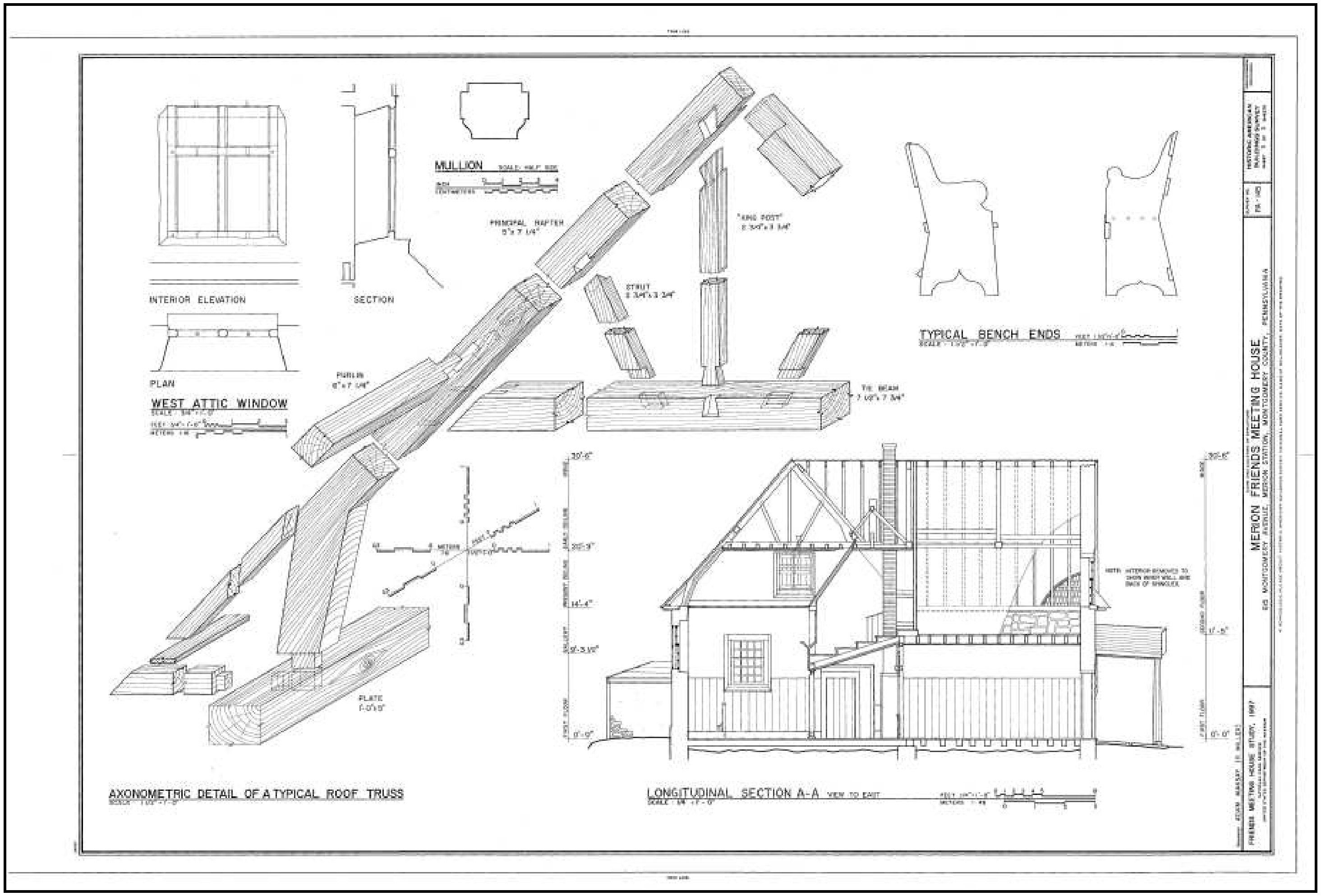

Fig. 8. This section drawing is of the Merion Quaker meetinghouse in the Delaware Valley. (Copyright-free image acquired from the Built in America website of Library of Congress in September 1, 2011.)

Heidegger's conception of "building" versus "dwelling" constitutes another perspective of the values embedded in a measured drawing. Heidegger challenged the professional appropriation of sites that people use every day by comparing the etymologies of these two words.[358] He suggested that legislative and professional structures served to distance the rites and routines of daily subsistence from the locations where they take place.[359] In other words, the meaning of building and dwelling had become distanced from each other, even though, etymologically they share the same original root, Bauen.[360] Today dams, bridges, hangars, stadiums, hospitals, schools are all considered to be buildings, but not associated as a dwelling place. Individuals inhabit these places, yet they do not dwell in them. The meaning of dwelling is associated with taking shelter in a building. In the modern world, residential buildings do provide shelter. The modern dwelling is not constructed based on the individual's habits or way of life, but assembled through as a series of construction conventions, safety, and health and accessibility regulations. Heidegger does not suggest that individuals should abandon modern heating, sanitation, light, power, and communication systems to construct single room huts in the wild. However, he did state that, "…dwelling is not experienced as man's being; dwelling is never thought of as the basic character of a human being."[361] Given this, the way that HABS measured drawings reveal cultural and social patterns becomes the means of re-uniting people with the "lost" meanings and values of building and dwelling.

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[358] Martin Heidegger, *Poetry, Language, Thought*, 1st Harper Colophon ed., His Works (New York: Harper & Row, 1975), 145-61.
[359] Sharr, "Drawing in Good Faith," 314.
[360] Heidegger, *Poetry, Language, Thought*, 148.
[361] Ibid., 148.

Engagement with Cultural Heritage through HABS Drawing

The direct connection with a heritage asset constitutes the axiom of HABS culture of documentation. HABS accentuates the act of drawing as a mediating conversation between the artifact, documenter, and the public who value the cultural asset. The rigor of the HABS culture ensures that the future will continue an essential, inspirational dialogue with posterity. Although HABS was not initiated as a program actively engaged in saving buildings, HABS has actually assisted in saving buildings by generating public interest. In many occasions, HABS efforts of preservation through documentation have initiated an awareness that could be translated into advocacy for endangered property. Massey wrote that the federal recognition of a historic building by HABS recording has sometimes culminated in attempts to keep the building away from its wreckers.[362] The recording of threatened buildings, such as New York's Metropolitan Opera House and the 18th-century Leiper House near Philadelphia, called attention to their historic importance and architectural merit and aided the preservationists who were trying to save them.

As in the case of the documentation project in North Philadelphia, the HABS team documented the historic fabric while bringing attention to the need for preserving the buildings. Today, North Philadelphia is a surviving catalogue of 19th century architecture.[363] However, the area suffered from the destructive forces of urban renewal in the 1960s when many of the historic structures were torn down. Most of the buildings

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[362] Massey, “Preservation through Documentation,” 148.
[363] Philadelphia flourished as a huge industrial city after the Civil War. Between 1875 and 1900, North Philadelphia became a huge construction site with a surging populace and industrialization. The city became a leader in pharmaceuticals, textiles, shipbuilding, glass and more. Joyner, “Fleeting Streets, the Plight and Promise of North Philadelphia,” 47.

that were spared then are now abandoned. Dilapidated buildings sit next to vacant lots. Hence, the area needs civic and economic bolstering. In order to raise awareness of the area's industrial past and legacy, HABS collaborated with nongovernmental organizations such as the Foundation for Architecture (now defunct) and the Advocate Community Development Corporation. The Foundation for Architecture paired with HABS to produce a promotional brochure to be used in architectural tours of North Philadelphia (Going Uptown: The Extraordinary Architecture of North Philadelphia). Furthermore, the Advocate Community Development Corporation developed the exhibit 'Acres of Diamonds: The Architectural Treasures of North Philadelphia' based on HABS documentation. The exhibit traveled to numerous venues between 2003 and 2005, including the University of Pennsylvania in Harrisburg, Pennsylvania, the Community College of Philadelphia, and Philadelphia's Temple University. After these efforts, the local chapter of the American Institute of Architects gave three blocks in North Philadelphia its Landmark Building Award. All parties agree that higher visibility will benefit the community and encourage home buying and rehabilitation. Due to limited resources, the city could not conduct surveys to designate buildings or districts to the National Register of Historic Places, which are measures that could help to provide protection and open doors to potential funding. Now, the HABS documentation can be used to acquire Federal tax credit for rehabilitating National Register properties and homeowners who restore their historic houses.[364]

[364] Joyner, 51-52.

HABS documentation methodology requires intensive, hands-on work and analysis that culminates in the production drawings.[365] Cowan asserted that in order to understand a historic structure, a documenter has to recognize all the epochs that the building has witnessed, and this level of intense engagement can only be achieved through the act of drawing.[366] He remembered that in the 1995 documentation project of the Harris-Martin House located in Anderson in Grimes County, Texas, the documentation team found 19th century wallpaper. However, in order to figure out the wallpaper design, the team had to undertake some "detective work." They took photographs of remains of the historic wallpaper, printed them on different scales, traced little bits from the original design, overlaid the traces with other photographs, and were then able to reconstruct the entire pattern. Cowan stated that the process of drawing the reconstruction of the wallpaper provided him with "a lot of time to think about the design, aesthetics, and aspirations of the folks who lived there." He describes the Harris-Martin House as an unusual type of structure in a modest town. Yet, the craftsmanship of the wallpaper indicated that the owners were "frontier of the community with all the aspiration of high style."

Drawing forces the documenter to realize details. Therefore, the skill of being able to portray architectural description constitutes vital for preservationists. Cizek informed us that the act of drawing is integral to the historic preservation program at Tulane University, New Orleans.[367] Even though the students come from different

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[365] Lavoie, "The Role of HABS in the Field of Architectural Documentation," 20.
[366] Cowan, *Interview*.
[367] Cizek, *Interview*.

educational backgrounds such as architecture, urban planning, history, law, and science, they all take basic drafting classes and then produce measured drawings of artifacts. As a part of their documentation projects, they draw a variety of tombs in accordance with HABS documentation methodology. The students go to the field, in this case the cemetery, make field drawings, scan those drawings back in the lab and then trace the scans using CADD, In Design, or Sketch-up. On the drawings, the students show nuances of decay, biological growth, or settlement problems while using HABS terminology. In some cases, if the student does not have a background in drawing, the drawing may not be up to HABS standards. However, Cizek asserted that all the preservation students should have a certain level of HABS drawing experience.[368]

The Future of HABS Drawing in the Digital Age

HABS prepares project deliverables to meet the archival standards of the Library of Congress. Only materials that meet the 500-year permanency standard of the Library can be submitted. The hardware and software necessary to recognize digital files have a limited lifespan that makes them unacceptable for use in the Library. Consequently, only measured drawings that are ink on translucent material, accompanied with negatives on safety film, can be submitted to the Library. However, the consensus among the interviewees indicates a future for HABS loaded with two-dimensional drawings with the addition of three-dimensional digital data to the documentation set. Rosenthal suggested that, when the digital data becomes viable for archival purposes, "[The

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[368] Cizek, *Interview*.

Library of Congress and HABS] will be able to see merit in switching to a digital capture format."[369]

Lockett calls two-dimensional measured drawing is a great way to show "what a building is, structure is, site is,"[370] He asserts that this type of drawing will not be abandoned, and always be a major part of documentation. On the other hand, he anticipates a future with more three-dimensional digital representations.

Lee conceives the three-dimensional data as a present addition to the HABS set; however, she emphasizes the necessity to carry digital data as the major source and says, "There should be more thought around how [heritage professionals] can better leverage new technology for still getting to the level of detail and completeness of HABS set of drawings."[371] She asserts that people live in the technological age surrounded with divergent digital media. In most cases, "3-D construction software" has already leaked into many architectural offices. NPS is already taking advantage of scanning technologies for data capture. The digital media offer other products in addition to the data required to produce two-dimensional drawings. The same digital data can be used for making two-dimensional drawings, further products for education, heritage tourism, etc.

During these discussions, Whitacre compared traditional two-dimensional drawing with the current use of film-photography.[372] The advent of digital cameras has created a new cultural structure, in which film applications have been dramatically

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[369] Rosenthal, *Interview*.
[370] Lockett, *Interview*.
[371] Whitacre, *Interview*, Lee, *Interview*.
[372] Whitacre, *Interview*.

reduced. Digital photographs have become the means by which the cultural capital is spread, and to communicate and disseminate information about the artifact's details, form, fabric, shape, aesthetics, and history. However, there are professionals who still prefer film for image quality, resolution, and exposure features. Whitacre anticipates that segments of professionals who see the value in two-dimensional drawing are still going to follow that tradition. However, the use of new technologies will drastically expand heritage documentation.

Lee approaches the analogy of drawing and photography from a different perspective. [373] Even though technologies are constantly developing and changing, the name of the equipment persists. For example, since the invention of photography in the early 19th century, we still refer to the industrial product as a "photograph." However, photography technology has totally changed. We no longer use Louis Daguerre's[374] camera box with sliding plates, which captured the image on one of the plates. The latest digital cameras come with a GPS, compass, barometer, and altimeter; some even have the capability to take 3-D photos. The captured image is a digital file ready to be stored, printed, and manipulated. For the same reason, the physical appearance of a drawing may change in the future due to new developments in 3-D digital representations, but it will still be called a "drawing." Another option might be a new title for 3-D data while the 2-D drawing might stay as it is.

[373] Lee, *Interview*.
[374] Peter Walsch, "Rise and Fall of the Post-Photographic Museum," in *Theorizing Digital Cultural Heritage: A Critical Discourse*, ed. Fiona, Kenderdine Cameron, Sarah (Cambridge, MA, USA: MIT Press, 2007), 20.

Several respondents described digital data as the advantage needed to connect new generations to cultural heritage. For example, Whitacre said that the current generation of architectural students is more comfortable working with digital data. [375] This situation has a two-fold effect in the heritage field. First, in order to keep the next generation of architecture students interested in historic preservation, the discipline has to embrace a certain level of digital media. Second, the students' intense relationship with digital means will be a powerful force in the shift to 3-D representation in heritage documentation.

Along this same line, Lee asserts that preservation of cultural heritage depends on engaging the next generation of stakeholders.[376] She defines drawing as a substantial part of documentation; however, she feels that the characteristics of digital 3-D (it can be touched, looked at, viewed from all angles, exist in real time, etc.) are more appealing to the young generation. Hence, Lee says, "In order to generate interest of an exciting next generation, [professionals] are responsible to carry [heritage] sites to them [with visual models]." [377]

At present, one of the challenges with 3-D data is the transition process to 2-D drawings, which is expensive and time-consuming. The current concern regarding 3-D lies in "the temptation of storing the digital data as it is and not producing a drawing/"[378] However, it is hoped that the recent development of new software will make it less

[375] Whitacre, *Interview*.
[376] Lee, *Interview*.
[377] Ibid.
[378] Whitacre, *Interview*.

difficult to convert digital data into drawings.[379] For example, with the latest version of Autodesk software, the delineator can manipulate the scanned data without the need of interphase software. This makes the drafting process from 3-D scanned data to 2-D drawing much easier.[380]

Conclusion

Drawing has a long and distinguished history in architectural thought. Some famous examples are the Renaissance architects who analyzed and assimilated the world of landscapes around them through drawing. In the architectural culture, the process of producing analytical drawing has been valued as an education tool as well as a means to engage with the historic environment. The architects' intimate access to the artifacts of their surroundings enables them to develop a consciousness for cultural heritage and cultivate an appreciation for the compositional sensibilities of the architectural precedents. Frascari summarized the role of drawing in architectural culture as:

> Architectural lines are material, spatial, cultural, and temporal occurrences of refined multi-sensorial and emotional understandings of architecture. Architectural lines create a graphesis, a course of actions based on factures by which architects actualize future and past architecture into representations.[381]

HABS pursues the line of thinking of Frascari and other educators who describe drawing as a unique way of representation, communication, design, and analysis. Since the inception of the program, the drafted lines have become a permanent record of many

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[379] Whitacre, *Interview*.
[380] Schara, *Interview*, Lockett, *Interview*.
[381] Frascari, "Lines as Architectural Thinking," 200.

heritage assets, communicated cultural values, promoted awareness for historic preservation, introduced student architects to the relationship between material, form and function, embodied details for future design projects, constituted the infrastructure to scholarly work, and used for the conservation of historic fabric.

The HABS drawing style has changed over time due to the prevailing architectural thinking and available technologies of the era. For example, the Beaux-Arts drawing style was replaced by Modernist drawing conventions after WWII. Similarly, the introduction of new documentation and recording technologies (i.e., architectural photogrammetry in the 1950s, CADD in the 1980s, and laser scanners in the 1990s) have culminated in transformations of drawing techniques as well as the appearance of the drawings.

HABS stems from the idea of creating a permanent record of cultural heritage for posterity. Therefore, following the Tripartite Agreement between the NPS, AIA, and the Library of Congress in 1934, the Library of Congress houses all HABS/HAER/HALS documentation and shares the heritage information with interested parties. With the launch of online The Library of Congress catalog in the late 1990s, the audience for HABS documentation is rapidly increasing. The Built in America website has facilitated both intellectual and physical access to the cultural capital and brought diverse groups of stakeholders together.

The interviewees reflected on the relationship between HABS drawings and a multi-cultural audience. In this context, most interviewees discussed the readability of two- and three-dimensional drawings, as well as digital data, for different circles of stakeholders. Some respondents focused on the act of drawing and discussed digital translations on the process. Most interviewees concurred that HABS drawings are more than just an informative substance; it is also a compound of cultural, educational, and social values.

This quotation from Evans seems an apt conclusion to this chapter:

> According to ancient wisdom, architects make images from ideas. Theologians were fond of quoting St. Thomas Aquinas on this theme. An architect, wrote Aquinas, first has an idea of a house and then he builds it. God made the World in similar fashion. Aquinas' architect still haunts us: 'he thinks, therefore he draws.' He draws the bodiless, but fully formed ideas from the mind and puts them on paper… But Aquinas' architect is a figment. There may be such creatures, but they would not be possessed of much in the way of creativity, quite the contrary. Imagining with the eyes close, as if the whole world were held in mind, is an impossible solipsism. The imagination works with the eyes open. It alters and is altered by what is seen…[382]

[382] Robin Evans, "Architectural Projection," in *Architecture and Its Image: Four Centuries of Representation: Works from the Collection of the Canadian Centre for Architecture*, ed. Eve Blau and Edward Kaufman (Montreal Cambridge, Mass.: Centre Canadien d'Architecture/Canadian Centre for Architecture, Distributed by the MIT Press, 1989), 20.

CHAPTER VI

PHILOSOPHY OF TECHNOLOGY

Introduction

Technology can be defined as the production, usage, and knowledge of tools, techniques, crafts, and systems to solve a problem or serve some purpose. The purpose of this chapter is to define technology within its entire context, as well as is to provide a review of the discourse of technology. Only by describing how technology has been developed and valued, can the relation between the documenter and technologies be mapped. The discourses of Heidegger, Ihde, and McLuhan will be discussed in this chapter. These philosophers were chosen because they have dealt with the issues of technological mediation to a great degree.

Definition of Technology

Technology comes from the Greek word technē. In ancient Greece, the word technē referred to the skills employed in the pursuance of an art or craft. Greek philosophers Plato and Aristotle were genuinely appreciative of technē activities. Technē was both an art and a craft object; it could be a shield, a vessel for drinking, or a shoe. Art and technology were not separated. Thus, an object was judged not only for its usefulness, but also for its beauty. If an object was produced with purpose and care, along with Greek proportions, then it was an excellent example of technē. The Greeks celebrated politics and philosophy as the highest levels of human activities. The activities of technē occupy the lowest level in the hierarchy of human activities. Technē allowed the citizens of Greece the leisure to pursue the higher forms of human activity.[383]

In the 17th century, the word technē was combined with the suffix logia. The new word technologia then referred to the systematic study or knowledge of art production. During the 18th and 19th centuries, the word technologia continued to be used as a utilitarian way to describe the study of arts and manufacturers and later the applied sciences and practical arts. Beginning with the Industrial Revolution, the use of the term technology has encompassed the totality of the means employed to provide objects necessary for human sustenance and comfort.[384]

Merriam-Webster defines technology as the practical application of knowledge, especially in a particular area.[385] This definition hints that any technology should be an application. However, this definition is not enough to identify the phenomenon of technology. Does technology only correspond to the application of knowledge? Ihde answered this question by articulating the phenomenon of technology with three components. First, a technology must have a concrete component, some material content, to be reckoned as a technology. Second, a technology must enter some set of praxes, or uses. Third, a relation between technology and humans must exist in the course of application, design, production, or modification.[386] MacKenzie and Wajcman

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[383] Ihde, *Philosophy of Technology: An Introduction*, 26.
[384] Canizaro, "Drawing Place: An Inquiry into the Relationship between Architectural Design Media and the Conceptualization of Place," 115-16.
[385] Merriam-Webster, "Technology," http://www.merriam-webster.com/dictionary/technology.
[386] Ihde, *Philosophy of Technology: An Introduction*, 47.

added a fourth layer to the definition of technology: the use of technologies also requires skilled knowledge for enactment.[387]

McLuhan defines technologies as extensions of human bodies, such as clothing, housing, cars, etc.[388]The need to amplify human powers in order to cope with various environments expedites technological extensions, whether of tools or furniture. The wheel becomes an extension of feet, and tools for hands, backs, and arms. Furthermore, in the current technological culture, the advanced information and communication systems have not only become an extension for human bodies, but extensions to humans' nervous systems as well. Technological instruments simulate, exaggerate, and fragment our physical powers through the exertion of force, the recording of data, and the speed of action and association.[389] This new human environment has an invisible character. It can be felt although not noticed in changing sensory ratios and sensory patterns.

According to Canizaro, people use the term technology in a very broad sense.[390] People refer to any tool such as a telephone, computer, or a car as technology. However, this common sense explanation of technology is "overly reductive and physically biased because the definition ignores the social relationships and cultural transformations that are intertwined in any technology" He advocated that in order to go beyond the hardware definition of technology, the social context of technology should be considered. This

[387] MacKenzie and Wajcman, *The Social Shaping of Technology: How the Refrigerator Got Its Hum*, 3.
[388] Marshall McLuhan, Stephanie McLuhan, and David Staines, *Understanding Me: Lectures and Interviews* (Toronto, Ont.: McClelland & Stewart, 2003), 57.
[389] Ibid., 48.
[390] Canizaro, "Drawing Place: An Inquiry into the Relationship between Architectural Design Media and the Conceptualization of Place," 116.

approach involves the entire system of tools, materials, and networks that is guided by a set of human practices and purposes.

Technology entered the discourse of modernity in the late 18th century.[391] Technology was interpreted as a catalyst of progress, and perceived as an instrument to enhance humanity. By the end of 19th century, progressivism became technological determinism, as shown by the work of Karl Heinrich Marx (1818-1883) and Charles Darwin (1809-1882). In this context, technology was deemed to be autonomous and a neutral instrument serving the ends without any valuable content of its own. It was believed that technology did not alter the ends, but shortened the path. With this shift to materialism, technology was seen as ground to advance humanity to freedom and happiness.[392] New technologies simply provide a more efficient means for accomplishing pre-existing ends.

The destructive results of WWII drastically changed the perception of technology. Technology was no longer praised for modernizing humankind; rather, it was blamed for the cultural crisis. Hence, a romantic trend emerged against technological determinism. Technology was discussed as more than a neutral tool, and the means and ends could not be separated. The swell of technology was not innocent at

[391] The human connotation of technology is largely unmapped due to the idealism of the Western culture. As the tradition of the Western culture ideologically refers to the ancient Greeks who lived in aristocratic societies in which the highest forms of human activities were social, political, and theoretical rather than technical, the humanities and social sciences rejected the discussion of technology as a discourse. When scholars took technology seriously in the modern period, the essence of technology was initially bound to a common sense instrumentalism with neutral means. For that reason, technological activities were subsumed under economy, and no particular philosophical explanation or justification was associated with the phenomenon Feenberg, *Questioning Technology*, 1.

[392] Ibid., 1-2.

all. Technical mediation was pervasive and embodied values that shape people's lives.[393] Yet, as technology's advance became the way human progress was measured, it was realized that technological optimism should not be accepted without criticism. Decisions about the use of technology had the power to change humans' lives forever, such as the use of the atomic bomb in WWII.

Heideggerian View of Technology

In the midst of the immense technological revolution that changed the old European civilization into a mass structure based on science and technology, philosophers began to reflect on the nature of technology in order to understand both the promise and threat that it poses for humans. Heidegger used the ancient Greek idea of technē and took it to a new phase, where he discussed technology as a mode of revealing. He conceptualized technē as a process for the exposition of the production of an artifact. Accordingly, he suggested that technē brought out the concealment of an object and revealed the forces in the nature.[394] According to Heidegger, modern technology is no longer neutral as technē. Technology is imbued with so many values that it obscures humans' ability to get to the truth and blocks humans' ability to understand their own being.[395]

Modern technology is based on a systematic arrangement that reveals enframing (Gestell) of being as a conceptual and experiential reduction:[396] "Enframing means the

[393] Feenberg, *Critical Theory of Technology*, 5.
[394] Heidegger, *The Question Concerning Technology and Other Essays*, 12.
[395] Silman, "Is Preservation Technology Neutral?," 8.
[396] Feenberg, *Questioning Technology*, 184.

gathering together of the setting-upon that sets upon man, i.e. challenges him forth, to reveal the real, in the mode of ordering, as standing-reserve."[397] Heidegger illustrates his discussion of enframing by comparing a silver chalice made by a Greek craftsman to a modern dam on the Rhine River. To make the chalice, the silversmith must gather the four causes: (a) the *causa materialis*, the material out of which the chalice is made; (b) the *causa formalis,* the shape in which the material enters; (c) the *causa finalis*, the sacrificial rite in which the form and material of the chalice determined accordingly; and, (d) the *causa efficiens,* the effect of the finished chalice.[398]

Heidegger asserted, however, that modern technology de-worlds its materials and summons nature to submit to extrinsic demands. Heidegger stated,

> The hydroelectric plant is set into the current of the Rhine. It sets the Rhine to supplying hydraulic pressure, which then sets the turbines running. This turning sets those machines in motion whose thrust sets going the electric current for which the long-distance power station and its network of cables are set up to dispatch electricity… the is dammed up into the power plant. What the river is now, namely, a water power supplier derives from out of the essence of the power station. [399]

Modern technology makes an unreasonable demand of nature that energy can be extracted and stored. Instead of a world of authentic things capable of gathering a rich variety of context and meanings, such as the Greek silversmith producing the silver chalice, modern technologies challenge nature to get the greatest possible use of everything and humans are left with an "objectless" heap of functions.[400]

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[397] Heidegger, *The Question Concerning Technology and Other Essays*, 20.
[398] Ibid., 6.
[399] Ibid., 16.
[400] Feenberg, *Questioning Technology*, 184.

The technological understanding of being demands that everything be resources, for raw materials, which he refers to as "standing-reserves."[401] Heidegger argued that human beings are already incorporated into the technological system as mobile standing-reserves.[402] In the technological age, the drive of the "standing- reserves" is towards maximal efficiency, flexibility, and interchangeability, just like "successful" human resources in today's world who are flexible and able to deal with shifts in the marketplace, pluralities of cultures, and changes in social norms. In their adaptability, humans share a style of being with the rest of the standing-reserves because everything is now valued in terms of its flexibility and efficiency.[403]

Revealing does not happen beyond human control. A tool is an entity, but only through an examination of human interaction. Humans use objects, give them meanings, and free the tools from their servitude physical matter. [404] Every technological tool is ordered to stand-by to be immediately at hand and ready for a future ordering. Heidegger's account of tools is based on "readiness-to-hand" and "presence-at-hand."[405]

Humans do not recognize tools as an aggregate of physical mass, but rather as a range of functions or effects on which they can rely. For example, instead of recognizing the "light-bulb" as an existing glass object, humans make use of this tool indirectly, in the form of a "well-lit room." In most cases, humans only focus on the outcome. They do not question the aggregates in cement, but the recognize product: a surface that is

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[401] Heidegger, *The Question Concerning Technology and Other Essays*, 18.
[402] Feenberg, *Questioning Technology*, 184..
[403] Mark A. Wrathall, *How to Read Heidegger* (London: Granta Books, 2005), 101.
[404] Graham Harman, *Tool-Being: Heidegger and the Metaphyics of Objects* (Chicago: Open Court, 2002), 16.
[405] Martin Heidegger, *Being and Time*, ed. John Macquarrie and Edward S. Robinson (Oxford: Basil Blackwell, 1962), 103-04.

easy to walk on. The tools are expected to be “ready-at-hand” when needed. For the most part, tools assume their role without even entering a human’s awareness.[406]

Heidegger proposes that human beings do not usually encounter other entities as discrete visible objects.[407] Human interaction with tools comes through using them, simply counting on them. When the tool breaks down, then humans realize its “presence-at-hand.” For instance, when a hammer breaks, it loses its usefulness and appears as merely there, present-at-hand. In other words, if a tool is in the mode of being “present-at-hand,” most likely it has to be fixed or replaced.

Heidegger discussed that technology is autonomous. In other words, technology is self-governing and independent. Furthermore, the effects of technology have already escaped the human control. According to Heidegger, autonomous technology violates both the essence of being a human and nature. Heidegger’s critique is certainly relevant to a world armed with nuclear weapons and controlled by vast technologically based organizations. Enframing technology absorbs more of its environment, creates a bigger demand, until it eventually escapes human control and purpose. However, it should not be forgotten that Heidegger lived during WWII, with all its brutality, and witnessed how technologies were used for mass destruction. Thus, technology holds more threat than promise to Heidegger. He relentlessly discussed how technological mediation could transform being human. In this context, he idealized Greek philosophy was the remedy to the technological dilemmas that the world was experiencing. Heidegger was afraid

[406] Harman, *Tool-Being: Heidegger and the Metaphyics of Objects*, 18.
[407] Ibid., 18.

that as humans engage with technological tools, they start to lose sight of what is sacrificed, and they just become controlled machines.

In fact, just a quick look at the consuming world of today reveals the constant need for self-validating advancements in technology. However, when modern technical processes are brought into compliance with the requirements of the environment or human health, they incorporate their contexts into their very structure. Heidegger's nostalgia is not enough to understand modern technologies because technology gathers further contexts beyond mere instrumentalization. As Feenberg asserted, "Our models should be such things as re-skilled work, medical practices that respect the person, architectural and urban designs that create humane living spaces, computer designs that mediate new social forms."[408] In this context, Ihde's account of phenomenological technology as well as McLuhan's discussion of the "medium is the message" contributes to bringing Heideggerian doctrine forward to the contemporary use of technologies.

Ihde's Views on Technology

Heidegger's discussion of technology as a way of dominating human lives in an invisible environment was not the only philosophical approach to technology. The 1960s also witnessed the rise of the Critical Theory of Technology. This theory analyzed new forms of oppression associated with modern industrialism and argued that they are subject to new challenges. Herbert Marcuse (1898-1979) and Michel Foucault (1926-1984) are two distinguished philosophers in this period who analyzed the role of

[408] Feenberg, *Questioning Technology*, 199.

scientific ideologies and technological determinism in the formation of modern hegemonies. They rejected the idea that there is a single path of progress based on technical rationality, and opened a dialogue for philosophical reflection on social control of technological development. They also argued that modern forms of domination are essentially technical.[409] Heidegger's doctrine of technology had a great influence on Marcuse and Foucault. They agreed that technologies are not just means subservient to independently chosen ends, but form a way of life or an environment. Technologies are forms of power. However, Marcuse and Foucault separated from the Heideggerian view of technology by introducing a more socially specific notion of domination. Heidegger argued that technology is autonomous, but Marcuse and Foucault do not really claim that. Rather, they related technical domination to social organization, arguing that technology has no singular essence, but it is instead socially contingent and could therefore be reconstructed to play different roles in social systems.[410]

One of the proponents of the critical theory of technological development, Ihde constitutes a significant discussion in this study. He argued that technologies are culturally embedded.[411] In the course of the human technological history, from pre-historic to modern days, there are universally occurring cultural praxes that revolve around the same processes, including cooking, storage, warfare, and shelter. For example, archery was developed independently in different parts of the world, in diversified cultures, and was used for different technological purposes such as hunting

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[409] Feenberg, 6.
[410] Ibid., 7.
[411] Ihde, *Philosophy of Technology: An Introduction*, 50.

and warfare. Even though archery involves the same technology -- bow and arrow -- in fact, they are used in different cultural contexts. Certain tribes in jungle areas use a pinch method to fire the arrow up into a target. However, the ancient longbow of the Anglo-Saxons is fired by a four-finger bowstring pull.[412]

Anthropologically speaking, Ihde argued that humans relate to their environments, whether it is a small village, sub-tropical rain forest, or a dense city center. In the larger scale, humans not only modify their local environments, but also the Earth. Technologies allow humans to amplify these modifications. [413] [414] Ihde asserted that this non-neutral, transformative power of humans enhanced by technologies is integral to human-technology relations.[415]

Ihde advocated that once people accepted the fact that the concept of technology is always related to humans, then they have to recognize the latent values of technology. Then any cultural disparities will also come to play determining diversified values embedded in technology.[416]

Heidegger asserted that humans can no longer control technology, and autonomous technology has a momentum of its own. However, Heidegger recognized

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[412] Ihde, 50.

[413] Low-technologies have made major modifications to the environment. The deforestation and overgrazing activities of the ancient Mediterranean peoples, Phoenicians, Greeks and Romans, led to the current climate and ecology of the Mediterranean. The once richly forested basin was transformed into rocky hills over the centuries, the water sources and springs long ago dried out. The environmental degradation does not depend on if a modern or high-tech processes being used, both change the nature to enhance human's survival. However, the amplificatory powers of modern technologies could cause a loss in a shorter time compared to the centuries required for lo-technologies to modify the environment Ibid., 52..

[414] The recent oil spill in the Gulf Coast (2010) is a concrete example of the amplifying power of technologies. The will of the humans to modify the environment implicated an environmental crisis in the global scale.

[415] Ihde, *Philosophy of Technology: An Introduction*, 51.

[416] Ibid., 53.

technological tools as a mere reflection of human agency, serving the individual's purposes. Thus, there is a dilemma in Heidegger's thinking that technology advances autonomously while human agency is the only key for the existence of a tool. The resolution could come with focusing on the technological tools more than subservient objects that exist according to the human's will. With the intense level of technological mediation in today's world, objects themselves are already more than "readiness-to hand" and "presence-at-hand." The interplay between humans and tools is not about humans handling the tools. Any type of equipment is not effective because it is capable of a function or an effect; instead, the transformation occurs on the side of the tool. A tool is not effective because humans can use it. On the contrary, it can only be used because it is capable of an effect.[417]

In place of describing technology as autonomous, Ihde discussed the social context that act upon it. As technological artifacts are introduced into society, society is transformed in unpredictable ways. In the meanwhile, technological developments are also formed by cultural dynamics. Ihde's discussion departs from Heidegger's monolithic force of "Technology" through his exploration of the role of technologies in people everyday lives, as well as in the current culture.

Ihde asserted that humans are surrounded by technological media, albeit almost unnoticed. Once people start exploring human-machine relations, they realize the vast

[417] Harman, *Tool-Being: Heidegger and the Metaphyics of Objects*, 20.

multiplicity and extent of these relations.[418] This phenomenological stance provides humans with a clearer understanding of the technological tools.

Even a simple reflection of an individual's typical day reveals the pervasive presence of technological media in his or her life -- the alarm clock, coffee pot, running water, heater, telephone, computer, car, traffic lights, etc. However, humans' familiarity with these machines precludes them from understanding the human-machine relationship in a rigorous and descriptive way. In order to discern the hidden meanings of these relationships, Ihde suggested that humans define and investigate their experiences with the machines.[419] In basic terms, machines influence an individual's experience in two distinct ways. The first correlation defines the medium between the individual and the experience. As an example, Ihde conceptualized writing on the board with a piece of chalk. The individual experiences the surface *through* the tip of the chalk. The second type of exposure considers how people experience through a machine. For instance, a dentist cannot see or feel the microscopic presence of the marks or the cracks on the tooth with a naked touch. Therefore, he needs fine instruments to probe across the surface of a tooth.[420]

Ihde described media as extensions to human bodies. There are three types of extension relationships: embodiment relations, where the machine is taken into self-experiencing; hermeneutic relations, where the machine becomes the other; and background relations, which indicate the relationships between the machines. For

[418] Ihde, *Technics and Praxis*, 6.
[419] Ibid., 7.
[420] Ihde, 9.

example, observe how an expert driver parallel parks a car. When parallel parking, the driver needs few visual clues to back the car into the parking space. The driver feels the extension of himself through the car as it becomes a symbiotic extension of his body. On the other hand, how a user interacts with a computer constitutes a hermeneutic relationship with the machine. The user establishes a readable conversation with the machine. Any time the user operates the computer, it poses a command that appears on the screen telling the user what to do. Here the machine becomes the other, where the user interacts with the computer within the experience of the machine. In both embodiment and hermeneutic relations, the individual's experience with the machine is distinct. In the embodiment relationship, the individual embodies a dimension of himself through the machine, while in the hermeneutic relationship the user is confronted and involved with the machine. However, a background relationship indicates a complex technological society where there is a constant surrounding presence of machines, yet people often do not notice their presence. Examples of background relationships include setting the thermostat for more air circulation in a room, or using the toaster to make toast. In these relationships, individuals have a momentary interaction with the machines; they adjust or start the machine so it can do its own work. Humans live in the midst of these relationships, yet they often not notice the machines' presence.[421]

In these three types of human-machine relationships, there is an important mutual characteristic. In each case noted above, the individual's experience is in some way

[421] Ihde, 8.

transformed through the media.[422] For instance, in the chalk example noted above, what happens if the individual replaces the chalk with a finer instrument? How the person using the chalk experiences the smoothness or roughness of the blackboard will change. As in the car example, what happens if the driver replaces the car with a bigger vehicle? Then, the driving experience will be entirely transformed.

Mediation amplifies certain characteristics of the object. Amplification reveals features that are only partly available, or perhaps not available to the naked eyes. For example, a microscope reveals micro-features of an object that are not visible to the naked eye. Telescopes are a medium that can reveal objects that are far away, such as the rings of Saturn or the mountains of the Moon.[423] However, while the medium extends and amplifies an individual's experience with his or her environment, it also reduces other features of the object. For example, the amplification of the telephone is apparent. Regardless of which part of the world an individual is in, the telephone extends his or her hearing. However, in this mediated environment, the telephone conversation reduces the richness of being face-to-face while speaking to each other. The phone reduces the other person to a voice and the user cannot experience the same gestural and visual presence of the other person that would happen if they were face-to-face.

Ihde's account of technology also included reflections on "instrument embodied science."[424] Intense technological instrumentation distinguishes classical and contemporary science. For the most part, classical science was limited to "speculation,

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[422] Ibid., 8.
[423] Ihde, 21.
[424] Ibid., 35.

theory, deductive cleverness, and primitive measurements."[425] These aspects are still part of contemporary science, yet science research has come to depend on instrumentation such as electron microscopes, spectrographs, and information processing computers for all the work. All the scientific explorations were made possible through the development of technological systems and embodiment of knowledge gathering through instruments. Technological instrumentation has allowed inquiry to be extended in ways never imagined by ancient scientists; it has amplified both macro and micro features of the world. However, Ihde argued that when scientists use these instruments to expand and enhance their cognitive and sensorial capacities and thereby gain true knowledge of the world, they are no longer relying upon their own direct empirical observations and are depending on these mediating instruments to tell them about the world.

Ihde was concerned that while instruments and technologies provide scientists with a seeing, they also condition the possible ways that scientists can come to understand something. In the particular case of scientific research, there appears to be a large contrast in the amplification-reduction relationship. For example, high-end technologies such as spectrographic representation reduce the visible to what can be called mono-dimension. This high amplification feature of the instrument makes it especially valuable for knowledge gathering in scientific research. However, the object disappears as far as recognizability is concerned. In the end, the instrumentally delivered text is only readable by the scientist.[426]

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[425] Ibid., 36.
[426] Ihde, 37-38.

McLuhan's Views on Technology

During these discussions on technological mediation, McLuhan put media and media technologies on the academic map via public discourse during the 1960s. McLuhan discussed media as an invisible environment that influenced the way humans communicate, think, perceive, and organize. He believed that as humans shape technological tools, the tools also shape humans.[427]

Merriam-Webster's dictionary defines medium as something in a middle position, a means of effecting or conveying something, or a condition or environment in which something may function or flourish.[428] To mediate means to bring accord out of by action as an intermediary or to act as an intermediary agent in bringing, effecting, or communicating.[429] For instance, a three-dimensional laser scanner is a medium that represents the historic structure in a digital format. Likewise, in an archaeological excavation, a shovel mediates the process of digging. Furthermore, drawings and models are diversified media to give presence of the visual representation of the heritage asset.

McLuhan described the "medium" as anything that goes between the individual and the world. In his widely recognized book, *Understanding Media: the Extensions of Man*, he examined a variety of phenomena such as speech, paper, print, photograph, wiring, bicycles, electric light, telephone, games, clothing, housing, cities and weapons as media.

[427] McLuhan, *Understanding Media: The Extensions of Man*, 23.
[428] Merriam-Webster, "Medium," http://www.merriam-webster.com/dictionary/medium.
[429] Merriam-Webster, "Mediated," http://www.merriam-webster.com/dictionary/mediated.

McLuhan stated that technological mediation has reached the point that it has become a complete extension of a human's body and mind. He argued that in the modern world, with the expanding use of technological media, now humans translate their thoughts and experiences at a level of intensity that the expression exceeds them. McLuhan referred to this phenomenon as the technological extension of consciousness.[430] This technological extension transforms everything, including human beings, into information systems.

Technologies construct society itself and constitute a new type of cultural system that restructures the entire social world as an object of control. McLuhan stated that technological media are mechanizing the society. Yet, mechanization of society cannot occur without the mechanization of its members, and he warned that humans might lose their free will.[431] Human consciousness fades away with intense use of technological media, and their new technological consciousness becomes a primary means of achieving, using, and distributing information. In the case of continuous use of communication media such as radio, TV, world-wide-web, these modern technologies become human nervous systems. Once humans surrender their senses and thinking to the private manipulation of those who would benefit from using an individual's eyes, ears, and nerves, they will have no rights left.[432]

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[430] McLuhan, *Understanding Media: The Extensions of Man*, 64.
[431] Barbara Jo Lewis, "Children of the Mechanical Bride, Additional Abstractions of Human Stereotypes," in *The Legacy of Mcluhan*, ed. Lance Strate and Edward Wachtel (Creskill, NJ: Hampton Press, 2005), 213..
[432] McLuhan, *Understanding Media: The Extensions of Man*, 73.

Technological environments influence humans' perceptual approach to the world.[433] All human experience involves a temporal dimension. The things people experience change and move; they have duration. People move around, shift focus, walk around objects, rotate them, etc. In short, humans experience the world through time.[434] McLuhan decided that different technological environments lead to distinct conceptions of space and time.[435] Thus, these new technologies introduce a new language that puts humans' senses in a virtual arrangement of space and time. McLuhan refers to these virtual arrangements as anti-environments, which reveal new meanings and new perspectives of the world.[436] For example, if an individual sees the opening of a rose by time-lapse cinematic technique that reveals the hidden beauty of the unfolding process of a flower, then he may never again experience flowers in a vase or garden in a simple way.[437] McLuhan felt that "the medium is the message" because different technological anti-environments lead to distinct conceptions of space and time. The medium shapes and controls the scale and form of human association and action. [438] Digital technology, ushered in by the ever-expanding growth of the information society, is forming a new culture.

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[433] Edward Wachtel, "Did Picasso and Da Vinci, Newton and Einstein, the Bushman and the Englishman See the Same Thing When They Faced the East at Dawn?, or Some Lessons I Learned from Marshall Mcluhan About Perception, Time, Space, and the Order of the World," in *The Legacy of Mcluhan*, ed. Lance Strate and Edward Wachtel (Creskill, NJ: Hampton Press, 2005), 123.
[434] Ibid., 125.
[435] Ibid., 124.
[436] Frank Zingrone, "Virtuality and Mcluhan's "World as Art Form," in *The Legacy of McLuhan*, ed. Lance Strate and Edward Wachtel (Creskill, NJ: Hampton Press, 2005), 45.
[437] Ibid., 45.
[438] Susan B. Barnes, "The Global Village Versus Tribal Man: Tthe Paradox of the Medium and the Message," in *The Legacy of McLuhan*, ed. Lance Strate and Edward Wachtel (Creskill, NJ: Hampton Press, 2005), 284.

McLuhan illustrated his discussion by using the metaphor of the human body. Oral cultures primarily perceive information through the ear; in contrast, literate cultures perceive it through the eye. A shift in perception from the ear to the eye changed the way people understand the world.[439] McLuhan believed that humans' perceptions changed again during the 20th century, to a sense that time and space are integrated, a belief that causes and effects are not distinct, and a history that is not as linear and more mythic.[440] Hence McLuhan's emphasis on the medium as the message because media directly shapes information and the way it is understood. Today, the way reality is perceived depends on the structure of the medium that delivers the information. The form of each medium is associated with a different arrangement, or ratio, among the senses, which creates new forms of awareness. These perceptual transformations, or new ways of experiencing created by each medium, occur in the user regardless of the program content.[441] Therefore, as McLuhan stated, any time a new medium is introduced into a culture, critical attention should be paid to the content and context of the medium. McLuhan's most famous paradoxical statement, the medium is the message, is a mandate to ignore the content of the messages being sent through a medium and to analyze the biases embedded in the medium itself. By examining media in terms of paradoxes, humans can think about media in new ways.[442]

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[439] Ibid., 285.
[440] Wachtel, "Did Picasso and Da Vinci, Newton and Einstein, the Bushman and the Englishman See the Same Thing When They Faced the East at Dawn?, or Some Lessons I Learned from Marshall McLuhan About Perception, Time, Space, and the Order of the World," 133.
[441] Susan B. Barnes, "The Global Village Versus Tribal Man: Tthe Paradox of the Medium and the Message," in *The Legacy of McLuhan*, ed. Lance Strate and Edward Wachtel (Creskill, NJ: Hampton Press, 2005), 285.
[442] Ibid., 284.

McLuhan spoke of technology in contradictory terms, stating that the new electronic technologies simultaneously contain possibilities for emancipation and domination.[443] This new type of technology is the end of a uniform visual culture based on mechanical technologies, as well as the beginning of a new cultural that requires man to face the challenge of electric simulation of consciousness. Depending on how humans face these challenges, electric technologies could dominate or emancipate. Similarly, these challenges could bring humans together or separate them.[444]

Conclusion

Heidegger viewed technology as a revealing phenomenon that unfolds and arranges the world. The Heideggerian view of technology provides critical insight for discovering how technologies influence documentation practice. Ihde's amplification/reduction view of technology pointed out how mediating technology amplifies certain aspects of an object, while reducing other features. Ihde's thinking is vital in determining the tangible and intangible qualities that technological tools bring to and take from fieldwork. McLuhan's statement "the medium is the message" defined how the medium alters the perception of information and how it is understood. His discussion is significant in helping us discover the cognitive process of heritage documentation and the ways that technological environments influence humans' perceptual approach. This study has examined the technological mediation from a

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[443] Ibid., 283.
[444] Ibid., 284.

documenter's point of view. These issues will be extensively discussed in the following chapters.

CHAPTER VII

MEDIATED ENVIRONMENT OF THE HABS CULTURE OF DOCUMENTATION

Introduction

World War II (1939-1945) was a threshold for the expanding role of technological instrumentation in the study and preservation of works of art and architecture. The practice of preservation embedded in traditional working class artisanship and empirical knowledge shifted to intense scientific work and technological instrumentation.[445] The discoveries and inventions that came from warfare (radar technologies, electronic computational devices, photogrammetry, etc.) were stimulated by basic research theories and findings, which are now part of historic preservation practice. In fact, photogrammetry was even used for architectural documentation during WWII. The Germans made stereo-photographic recordings of their valuable buildings before the great destruction of the war. Sadly, their careful architectural documentation was ruined when the invading Russians discovered the plates, cleaned off the emulsion, and used the plates for window glass.[446]

Heritage professionals have enjoyed immense improvements in technological instrumentation since WWII. The role of digital technologies has become so vast that now it is impossible to imagine a documentation project without using computers, digital

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[445] Paul Philippot, “Restoration from the Perspective of the Humanities,” in *Historical and Philosophical Issues in the Conservation of Cultural Heritage*, ed. Nicholas Stanley-Price, Mansfield Kirby Talley, and Alessandra Melucco Vaccaro, *Readings in Conservation* (Los Angeles: Getty Conservation Institute, 1996), 217.
[446] Peterson, “Photogrammetry for HABS,” 29.

cameras, GPS units, and total stations. Even basic documentation procedures have undergone technological mediation. Although traditional technologies such as drafting equipment, tape measures, and plumb bobs are still part of the toolbox needed for documentation projects, heritage professionals are now comfortable with a host of digital technologies for recording historic assets.

The purpose of this chapter is to discuss how technological mediation transforms the documentation process, as well as the documenter's understanding of cultural heritage. It examines the utilization of two surveying strategies used in HABS projects. Even though the examination of a series of tools could be considered for the case study, due to physical constraints this study will focus on an analogue and a digital strategy, the hand survey and three-dimensional laser scanning. CHC projects that prepare deliverables in accordance with HABS standards were used in this study.

Hand Survey and Recording

The hand survey is the manual acquisition of accurate measurements of built structures using conventional tape measures and scale bars. A measuring team should include at least three documenters, two to take measurements and a third to record them. For large structures, teams of several people are more efficient than one large recording team. In this case, the most efficient approach is to "divide and conquer" with multiple teams breaking up the work by floor, wing, or elevation. A supervisor, instructor, or project leader should coordinate the multiple efforts to provide consistency and quality control of field notes.[447] Bob Brinkman, who participated in the CHC documentation project of Fort Pulaski National Monument in 2000, stated, "[surveying] is easier and more efficient with a number of teams… teams of four would have a system of place…" [448]

Hand measurement brings a host of issues to the planning scheme of the fieldwork because the surveyor examines the historic structure through direct field observations. First, organizing the fieldwork during the daytime is essential to be able to gather hand measurements. Second, creating a safe working environment is critical as part of good working practice.[449] The documenter should be cautious regarding any possible field hazards, especially in unoccupied and derelict buildings. Buildings that have been empty and shut up for some time may prove to be dangerous because of deterioration, vandalism, or both. Before the survey, the documenter should examine the structure carefully for hazards such as rotten floorboards, upstanding nails, joists, and staircases that will not support weight, unguarded openings in floor, bare electrical cables, sharp protruding pipes, loose masonry, etc. The documenter should wear sensible and comfortable clothing during the work and safety helmets and boots if necessary. Because old buildings could pose serious health risks including tetanus, vermin, or fungus, the documenter should be aware of these threats while acquiring measurements in the field. Wearing a mask is prudent in dusty atmospheres, as is keeping oneself clean by carrying soap, towels, and water in order to able to wash before eating and drinking.

[447] HABS, "Historic American Buildings Survey Guide to Field Documentation," 3.
[448] Brinkman, *Interview*.
[449] Peter Swallow, David Watt, and Robert Ashton, *Measurement and Recording of Historic Buildings* (London: Donhead, 1993), 54.

Extreme weather conditions also preclude the fieldwork. The documenter can not work in the field if there is heavy rain, snow, and winds. Intensively hot and cold weather also creates a challenging working environment for the documenter. Hence, the documentation team has to organize the fieldwork in accordance with the weather conditions of the place. In this context, Brinkman suggested that if the team has to work during the hot summer days, beginning the fieldwork as early as possible is a successful working strategy. He stated that in a documentation project, working in the field between sunrise and noon allocates enough time to finish recording while protecting the team from hazardous effects of the sun.[450]

Hand measuring requires a systemic approach in the field in order to gather all the required dimensions. One way to ensure that all pivotal measurements are recorded in the field is to determine the number of drawings, their accuracy, the scale used, and the sheet layout prior to hand measuring.[451]

Measured Drawing Set

A comprehensive set of finished measured drawings includes site plans, plans, elevation drawings, and section drawings. If necessary, the set also consists of large scale and interpretive drawings. The site plan includes enough of the surrounding area to establish the setting for the structure being recorded. Plan drawings are horizontal cuts through a structure that portray arrangement and progression of spaces so that an observer can perceive what is being recorded. Plans are typically measured through the

[450] Brinkman, *Interview*.
[451] Burns, “Measured Drawings,” 101.

lower sash of double-hung windows and above chair rails, but cut lines are usually dropped to show fireplace openings at their maximum depth. Plans are generally drawn and measured at approximately four feet above the floor. However, the height at which measurement strings are taken may jog to pick up important features.

Elevation drawings show facades, room elevations, and other vertical elements of a structure projected into a vertical plane. These show structures as the documenter sees them, upright and straight ahead, but without perspective. Buildings resemble elevation drawings more than any other measured drawing. The illusion of depth is provided by varying line weights, not by diminishing size as in a perspective drawing.[452]

Section drawings are vertical cuts through a structure or site that show the vertical arrangement of spaces and objects at a particular plane. A section is a series of room elevations in accurate relation to each other, but separated by walls, floors, and ceilings. The location of each section cut is indicated in the plan so on each floor plan the sections can be related to each other. Section drawings are useful because they provide vertical information, floor-to-floor heights, ceiling heights, roof height, and the vertical progression of spaces. They are also valuable for structural details, interior decorative finishes, and the relation of functions.[453]

In a typical HABS project, field sketches, dimensions, and notes are drawn on archival quality (bond) graph paper with eight divisions per inch, with grid lines printed in non-reproducible blue. Only one side of the paper should be used. HABS projects typically use 17” x 22” sheets, which can then be folded half (8-1/2” X 11”) in order to

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[452] Burns, “Measured Drawings,” 122.
[453] Ibid., 126.

fit into standard HABS field note covers. [454] Each field note must be labeled in the lower right corner with the name of the building or structure, the identification of the type of sketch, the name of the delineator, the date, and the HABS project number.[455] All field notes are transmitted to the Library of Congress for future reference.

The final HABS/HAER/HALS measured drawings have common elements of identification including the title block, dimensions, material indications, and annotations. The title block includes the name of the project or the sponsor, name of the structure, address, the HABS/HAER/HALS number, and the sheet number. Information in the drawing includes the name of the delineator, date of the drawing, graphic scales in both English and metric units, and a north-pointing arrow on the plans.[456] Large-scale drawings explain how objects fit or work together. A door or window detail may include a plan, interior and exterior elevations, as well as jamb, lintel, and sill sections.[457] Interpretive drawings can be axonometric and isometric projections that help explain volume and mass.[458]

Figure 9 indicates a final drawing of St. Andrews Episcopal Church, Bryan, Texas, which was prepared in tandem with HABS format. St. Andrews is a Gothic Revival structure with a concrete foundation, masonry walls, wood joist floors, and an exposed wood truss roof. The building was constructed during 1912-1914. It is still used as a religious sanctuary.

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[454] HABS, "Historic American Buildings Survey Guide to Field Documentation," 4.
[455] Ibid., 4.
[456] Burns, "Measured Drawings," 115.
[457] Ibid., 126.
[458] Ibid., 126.

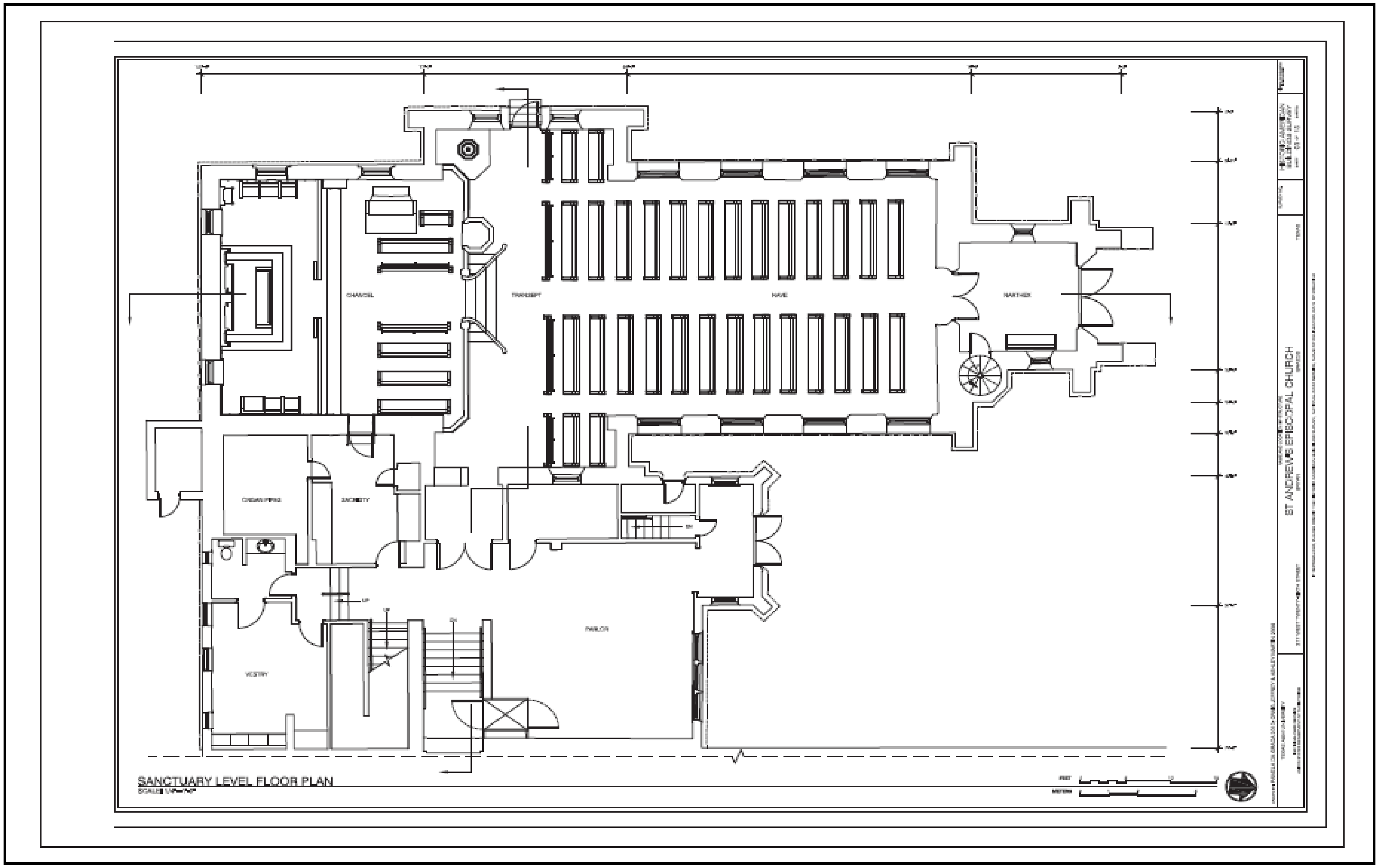

Fig. 9. The sanctuary level floor plan of St. Andrews church was delineated by the CHC team in 2010. (Copyright-free image, Center for Heritage Conservation.)

Sketching the Field Notes

Sketching the building is the first step to create measured drawings. Before sketching, the documenter walks around the outside of the building to get a feeling for the general shape. The documenter takes account of windows, doors, any rectangular block, bay, ell, wing, irregular addition, porch, or exterior stairs. He then considers the cut-line for plans and sections, and pays attention to things below the cut-line of the plan. Anything that goes under the cut line, including a windowsill, a belt course, a water table, or handrails, should appear in the sketch.[459] The documenter selects the cut-lines for the sections to convey the significance of the structure; the sections should show all vertical variations. Doors, windows, stairs, and any important architectural components should also be noted. Therefore, the cut-line may be moved to pick up important features. The task of sketching should be divided by architectural elements such as floors, elevation, or wings. In order to maintain consistency and avoid repetition in the sketches, each team member should be assigned to a particular set of details (i.e., doors, windows, fireplaces, staircases, etc.).[460]

Once the documenter knows the basic shape and all the significant architectural elements, then, he can design how to fit the structure on the graph paper. The documenter begins to sketch by lightly blocking out where the building's corners should be. At least an inch and a half should be left all the way around the block for writing exterior dimensions.[461]

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[459] HABS, "Historic American Buildings Survey Guide to Field Documentation," 5.
[460] Ibid., 4.
[461] Ibid., 5.

Heritage documentation is a team effort. Therefore, everyone on the team should be able to read everyone else's field notes. All the sketches should be legible but they do not have to be perfectly proportional. However, sketches should be drawn large enough to accommodate long strings of dimensions neatly. This may require that complex elements be simplified or the scale exaggerated so that there will be enough room to write dimensions legibly. In the cases of complicated spaces, such as staircases and areas with built-in cabinetry, or details, such as door and window jambs, the documenter can draw these on a separate field note at a larger scale. However, one should clearly reference these separate sketches to the master plan.[462]

For large or complicated structures, the documenter can lay out one drawing (for example, a plan) over multiple sheets of field notes. However, the delineator should carefully reference each drawing to the others.[463]

After the documenter decides the layout of the sketches on paper, then he can walk around the building again, but this time with her clipboard to sketch the outline as he goes. In order to maintain a decent sense of scale, he can use rough units out of parts of the building, such as windows. Windows tend to be uniform and have a size that is understood easily. Furthermore, because they are present on both the outside and the inside, the documenter can continue using them as a unit of measure when he begins to lay out the rooms on the plan.[464]

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[462] HABS, 4.
[463] Ibid., 4.
[464] Ibid., 5.

When the documenter is done with sketching the plan of the exterior, then he can proceed with the interior. Drawing the interior plan is similar to working on the exterior. The documenter begins to walk through the building in order to see how the different rooms relate to each other and to the outline. He should take notes of the location of the cut lines and the architectural elements below the line. The documenter should take into consideration the sills, chair rails, baseboards, thresholds, plinth blocks at the bottom of doorframes, etc.[465] Next to the sketch he should represent certain kinds of overhead lines. These are drawn on the plan using a dash-dot line, and include ceiling hatches, stair openings, beams, joists (if exposed), arches and vaulting or other indications of a change in ceiling height. Things that are typically ignored include dropped ceilings, plumbing and mechanical systems. Features that are hidden or missing should be indicated by a dashed line. For example, a missing door should be drawn with its swing with a dashed line.[466]

When the documenter completes sketching the exterior and interior plans, then he can start working on the elevations. Sketching elevations is similar to drawing the plan. When sketching, it is useful to exaggerate the scale of complicated features, like windows and doors, as they require the most dimensions later. It is not necessary to draw every line of a profile in elevation. Only the outermost edge needs to be drawn because it will be measured.[467]

[465] HABS, 6.
[466] Ibid., 6.
[467] Ibid., 7.

It usually is not necessary to draw each brick course or row of siding, unless these are determined to be uneven. Instead, the documenter can draw and number the courses that line up with significant features of the elevation such as windowsills and lintels, and divide the courses evenly when he is creating the final drawing. In addition, the documenter should remember to count and note the rows of shingles on the roof. He should focus on the eave and soffit details because these provide the foundation for determining the slope of the roof. Sometimes these need to be drawn separately at a larger scale as a detail. Gutters and downspouts are typically omitted from elevation drawings unless the gutters are built into the eaves. [468]

Sketching the sections is similar to working on elevations. Yet, the documenter should take into consideration the architectural lines through the section cut-line. He should represent the contours of the door and window frames, any ornamentation, beams, joists, etc.

Measuring Plans, Elevations, Sections, and Details

Brinkman suggests that in order to record systematically, the documentation team should start working at the outside of the building, and begin to record clockwise. First, they should record the perimeter, and then continue with the walls. Once the entire exterior is represented, then the team should pursue to the interior. After all the

[468] HABS, 7.

documentation is over, then they should go over the measurements and look around the building to see if something missing. [469]

The first step in hand recording is to establish datum lines and planes from which to locate the measurement points geometrically. In hand measuring, all measurements are assumed to be in either horizontal or vertical planes. When direct horizontal measurements are not possible, inclined dimensions can be taken and converted to horizontal dimensions using trigonometry.[470] In some structures, it may be possible to use the floor as a datum plane if it is found to be level. If the floor is level, a convenient height for measuring is at waist level. If the floor is not level, then the team has to establish a datum line. For most small structures, a horizontal datum line can be established by leveling a taut string with a carpenter's spirit level. By repeating the process, the documenter can carry the datum line around a structure.[471] Wherever possible, linear measurements should be taken as running dimensions rather than a series of separate measurements to successive points of detail. This procedure reduces cumulative error, as each individual dimension will usually be rounded up or down to the nearest ten millimeters. Taking running dimensions is also a quicker procedure that facilitates rapid and more accurate plotting.[472] Figure 10 shows the hand recording team working on St. Andrews Episcopal Church in Bryan. One team member acquires the measurement with the tape measure and determines the vertical alignment with a plumb bob. The other team member sketches the plan with the acquired dimensions.

[469] Brinkman, *Interview*.
[470] Burns, "Measured Drawings," 107.
[471] Ibid., 106.
[472] Swallow, Watt, and Ashton, *Measurement and Recording of Historic Buildings*, 69.

Fig. 10. The CHC team worked at the St. Andrews Episcopal Church during the documentation campaign in 2008. The team members gathered horizontal measurements to produce the plan drawing. (Copyright: Center for Heritage Conservation.)

However, establishing the datum line and acquiring running dimensions from irregular surfaces such as log structures constitute a challenge for the documenter. In these cases, the structure does not have well defined edges. The surveyor has to take into consideration at which point on the surface to start measuring. Each decision where to place the zero end of the tape culminates in the acquisition of slightly different field data.

Plans

In a typical HABS drawing, the major entrance is located at the bottom of the sheet. Hence, if the documenter orients the plan in accordance to the appearance of the final drawing, it will facilitate the recording and delineation process. Dimensions can be written in red pen with archival ink.

In the HABS records, each measurement is demonstrated with three numbers, separated by periods, representing feet, inches, and eighths of an inch. This eliminates fraction lines and provides greater clarity.[473] For example:

Three-feet, one and one quarter inch = 3'-1¼” = 3.1.2

When the team begins to measure, the documenter should place the zero end of the tape in the most convenient corner and pull the tape to the first feature. The tape should be taut, and where possible, chest height.[474] When there is any obstruction along a surface (pipes, conduits, ducts), the documenter should keep the tape as close to the

[473] HABS, “Historic American Buildings Survey Guide to Field Documentation,” 8.
[474] Ibid., 8.

wall as possible by threading it behind these features if he can. If it is impossible, then he can stand the tape out from the obstructions to get an overall measurement, and then measure any openings or other features from the most convenient zero.[475] Measuring a surface in pieces leads to accumulated error over long distances. Therefore, the documenter should take running dimensions in one continuous string whenever possible.

Wherever possible, the surveyor should take confirming dimensions from one room to another through door openings. These will help determine wall thicknesses and link the rooms together in plan later on. If a room is clearly out of square--that is, if opposite walls are not equal in length--then it can be helpful to take diagonal measurements from corner to corner. [476] For example, Cowan who participated at the CHC project to record the Harris-Martin House in Anderson, Grimes County, Texas in 1995, recalls that measuring the building was a challenge because there were no right angles. “We established string lines throughout the building… Then we went in and measured each wall surface relatively to the string line laying everything out with triangulation… We measured each point from at least two other points. That way we always had multiple triangles to keep the drafting constant...” [477]

The surveyor should be careful for measuring difficult details such as stairs. One should measure both the first step and the highest step possible from the same zero, and then divide evenly by the number of treads. It is not necessary to measure individual steps unless they are obviously irregular. The documenter should always measure to the

[475] Ibid., 9.
[476] HABS, 10.
[477] Cowan, *Interview*.

nosing and not to the riser underneath. Any newel posts and handrails should always be located.[478]

When measuring architectural elements such as fireplaces, the surveyor should first locate the opening of the fireplace in a general string of dimensions. Then he should measure the perimeter of the firebox at its deepest point, and locate and measure the hearth in relation to the firebox opening. Then he can measure the related features such as mantel of the fireplace.[479]

When measuring flooring, if the floor is determined to be regular, the number of floorboards or tiles can be counted and then evenly spaced in the final drawing. A vignette is generally sufficient for most buildings. If the flooring is irregular, each floorboard or tile should be measured on strings separate from those used to measure the walls. These dimension strings generally are taken from the baseboard and should be noted as such.[480]

Elevations and Sections

The surveyor should measure the elevations and sections with continuous vertical dimension strings. It is important that all vertical strings be located in reference to a horizontal datum. The datum may be an actual feature of the structure, such as a horizontal brick course or the bottom edge of a siding board, as long as the feature is consistently level around the entire building. Otherwise, it may be necessary to create a

[478] HABS, "Historic American Buildings Survey Guide to Field Documentation," 10.
[479] Ibid., 10.
[480] HABS, 10.

datum using a string and line level. Dimensions that tie into the datum are generally taken at the corners of the building and at each opening. These define the overall geometry of the building.[481]

In most cases, the surveyor can cast the datum along a sill. However, in the absence of any convenient features it may be arbitrary. The point can be marked with a pencil or tape according to building material. On the sketch, the documenter can show the datum with a dash-dot line. It takes three people to use a line level. The first person holds one end of the string at the mark, while the second person runs the string to the first door or window, pulling it taut. The third person centers the line level between the two ends and determines if any vertical adjustments are needed by the second person. Once the string is level, the documenter should draw a second mark at the door or window frame and take any vertical dimensions to it.[482]

A water level (consisting of a water-filled tube, like a hose, with transparent ends through which the water level can be viewed) can also be used to demarcate a horizontal datum plane that can be carried from room to room or from the interior to the exterior. The water level system works on the principle that water seeks its own level. However, if the user spills some of the water, the user should reset the level to compensate.[483] Vertical datum lines and planes can be established by running a plumb line up or down from known points.[484]

[481] Ibid., 12.
[482] HABS, 12.
[483] Burns, "Measured Drawings," 107.
[484] Ibid., 107.

Cowan recalled that during the documentation of Union Trading Company in Fort Davis, Texas, 1996, in order to tie together the structures, the team had drop the datum line around some buildings due to the topographic inconsistencies. He said,

> We set up level lines with strings in all the buildings to tie them together. Several buildings were already arranged on the line. But some of the other ones were isolated. We tried to project the same level line to all the buildings. We connected the line through the windows and doors. [Due to the elevation variations of the topography], in some structures we determined a lower level line. We determined the major building line and dropped the individual line four feet down accordingly. Then we tied them altogether. We ended up in five drawings, in the sections showing all the topography differences. [485]

Details

Doors and Windows. When the surveyor is measuring doors and windows, he has to make sure that the profile at the head of door or window is identical to the profile in plan, if not additional measurements may be required. At this point, only the outermost edge of the profile for the window or door needs to be measured. Windows must be measured with the sashes completely closed so the meeting rails are in line with each other. There are generally three sets of dimensions required to measure a window for an exterior elevation. The first set of dimensions places the window opening in relation to the datum, the second set locates the upper sash, and finally the lower sash is measured.[486] When measuring doors, the surveyor has to measure them related to the frame. He should always place zero either at the top of the frame or at the threshold. It usually takes two sets of dimensions to measure a door. The first set locates the door opening in relation to the datum and the second set picks up door panels and hardware.

[485] Cowan, *Interview*.
[486] HABS, "Historic American Buildings Survey Guide to Field Documentation," 13.

The surveyor also has to take the panel profile of the door if it was not taken for plan details.[487]

Window and door details should be keyed to the plan. It is helpful to use a W or D prefix, for example, the first window that the documenter detailed would be labeled W1, the first door D1. As the documenter goes around the plan, doors and windows that repeat should have the same label. When capturing a door or window detail for the plan, it is best if one draws all profiles relating to that door or window together on the same sheet. For example, a door detail set should contain profiles of the doorframe, the door panels (if any), and the threshold. A window detail set should contain profiles of the window frame, the sash and muntins (if any), and the interior and exterior sills. This prevents confusion over what has and has not been detailed.[488]

It is vital to capture the overall dimensions of a door (thickness and width) and locate any panels. Windows should be measured for the overall width of the sash, if the lights are regularly spaced it is not necessary to measure to each muntin. The surveyor should also include any trim elements (crown moldings, picture rails, chair rails, baseboards, wall paneling, wainscot, etc.). These details should also be keyed to the plan.[489]

A molding comb or profile gauge is best for recording moldings like door and window frames, balusters, handrails, baseboards, and chair rails. To use a profile gauge, the surveyor first straightens it by pressing it against a flat surface so all of the pins

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[487] Ibid., 14.
[488] HABS, 19.
[489] Ibid., 15.

extend out of one side in a neat row. Next, it is positioned against the surface the surveyor wants to capture and steady pressure is applied. It is important to make sure the pins do not slide out of alignment and bunch in a crevice or a corner. This can be tricky on smooth surfaces like glass or over-painted wood, and may require the documenter to occasionally pull and straighten pins while taking the profile.[490] Once the outline is captured, the comb is placed flat against a sheet of field note paper to trace it, making sure the profile is aligned with the grid. Profiles larger than the comb should be taken with multiple, overlapping impressions.[491] Digital photography can also be useful in capturing details that a profile comb cannot. The surveyor should take overall dimensions of the details being photographed so that the image can be scaled correctly later. Alternately, one can use a reference scale. The reference scale should be kept as straight as possible against the surface. The CHC team used a reference scale for the photographic documentation of St. Andrews church in 2010. Figure 11 shows the scale in front of the building.

To reduce distortion when taking a photo of a detail, the camera should be held parallel to the surface. The detail should be at the center of the capture, and ample room should be left toward the edges, as this is where the most distortion occurs. The surveyor should be standing away from the detail and zoom in so that he is not using lowest end of the camera's magnification or the wide-angle portion of the lens.[492]

[490] Ibid., 15.
[491] Ibid., 15.
[492] HABS, 16.

Fig. 11. A reference scale was placed next to the entryway of St. Andrews church when the CHC team documented the church in 2010. Note the scale located at the right side of the door. (Copyright: Center for Heritage Conservation.)

Roof. In order to obtain roof measurements, the surveyor has to maintain some steps. The slope of the roof can be determined by measurements taken at the gable end. It is best to visualize the gable end as a triangle where the three corners need to be located horizontally and vertically in order for the elevation to be drawn. If the roof peak is off center, a plumb bob can be used to locate the peak horizontally. If the roof is hipped, the roof slope and height will be more difficult to obtain. A measurement along the slope of the roof from shingle edge to the ridge as well as a horizontal length of the ridge can provide some accuracy. If the roof rafters are exposed in an attic space, measuring them in section may enhance the accuracy of the exterior roof dimensions as it will be possible to obtain the rise and run of the roof over a greater distance. Dormers, chimneys, and other relevant roof information should be measured horizontally from the roof edge as well as vertically.[493]

Field Observations. While in the field taking measurements, it is a good idea to write a basic description of the structure, and to record field observations. It is through just such an exercise that characteristic elements are identified, patterns of use determined, and discrepancies in construction that hint at changes over time are observed. Sometimes the significance of various features are not readily apparent now, but may be revealed through later insight or research, so the documenter should take note of them. It may be helpful to have a checklist of the various building elements to ensure if the documenter has considered them all.[494]

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[493] Ibid., 14.
[494] HABS, 17.

Along this same line, Cizek refers to these field journals as “students’ postcard of experience.”[495] He encourages his students to keep project journals where they compile all types of field observations with sketches, notes, images, and notations about the conditions of materials. Cizek advocates that keeping mementos is crucial to develop an understanding of a place.

The Translation of Field Notes to Measured Drawings

Carefully prepared field notes facilitate the production of final measured drawings, as well as estimate the accuracy of the completed drawing. For example, Figure 12 demonstrates the field notes produced during the documentation work of the St. Andrews Episcopal Church, Bryan, Texas in 2008. The surveyor annotated all the vertical measurements on the sketch. Each sketch has to resemble the actual building as much as possible. The drafter used graph paper to provide the scale. Figure 13 illustrates the finished measured drawing derived from the field notes. As these two drawings indicate, the field notes contain many more dimensions than are labeled on the final drawing.

[495] Cizek, *Interview*.

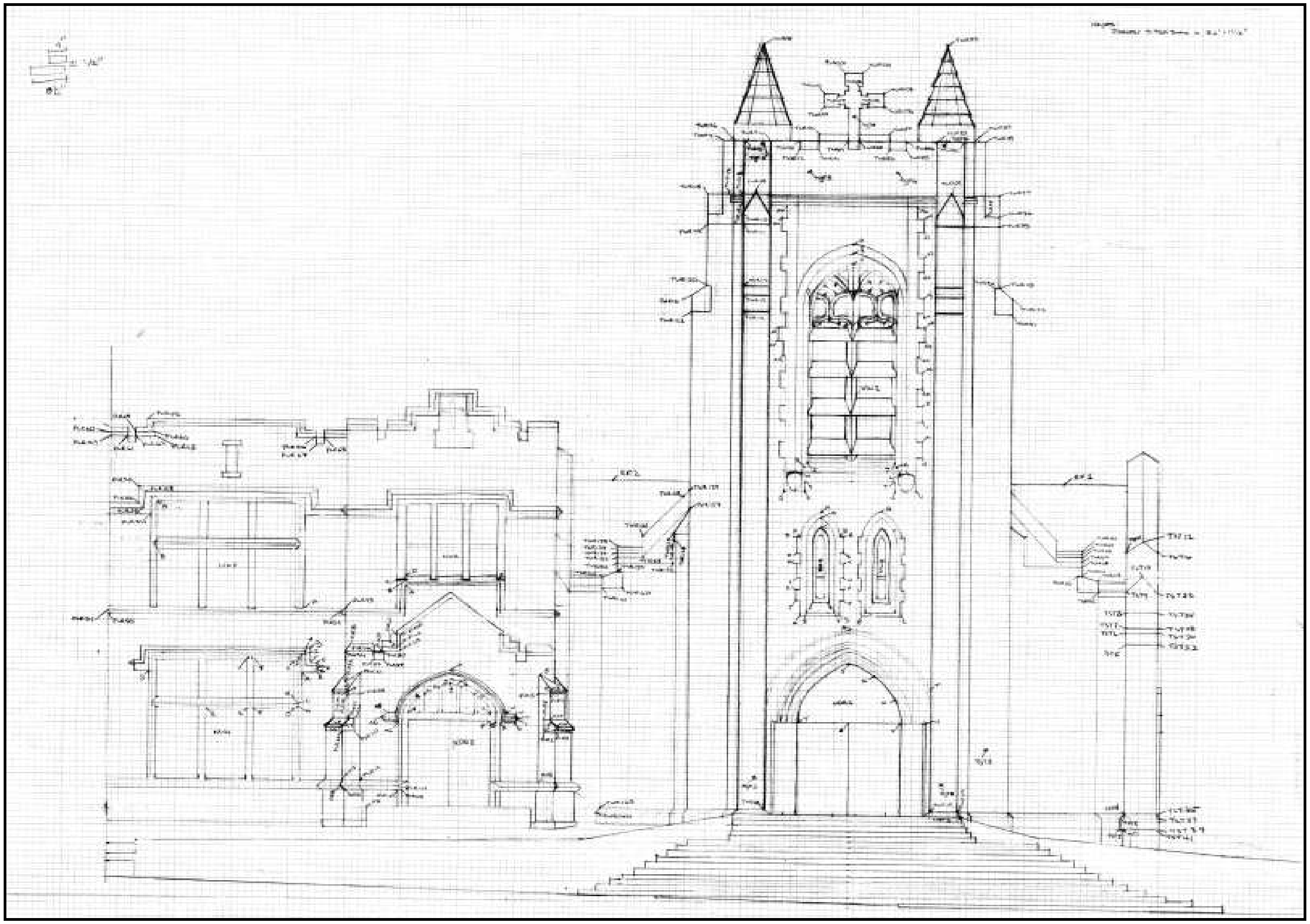

Fig. 12. The field note sketch of the north elevation of the St. Andrews Episcopal Church was created during the 2008 fieldwork. (Copyright: Center for Heritage Conservation)

Fig. 13. The final north elevation of the church was completed in 2010. This drawing does not include all the dimensions labeled in the field notes. (Copyright-free image. Center for Heritage Conservation)

Producing the measured drawings from field notes is a skilled work. The delineator carefully transforms the field measurements to drawings. In selecting the details to be drawn and selecting the lines to record them, the documenter is testing the fit of patterns and seeking the forms that define architecture.[496] However, by the same token, the delineator would never know certain parts of the structure since no data was collected during the field work. When the surveyor records the structure, he interprets the forms that convene the significance of the architecture. He selects field measurements accordingly while eliminating the rest of the dimensions. Hence the delineator has to interpret the measurements that were already defined during the fieldwork. Furthermore, the delineator does not have any field notes from the parts that data was not collected.

Ideally, the surveyor also delineates the measured drawings. However, due to time and budget restrictions, the drawing process is often passed to different delineators. In this case, the field notes should be comprehensible even to those who have not participated in fieldwork. However, Brinkman warns that surveyor's careful observation of the building and its environs gauges the production of the drawings.[497] In sites such as Pueblitos of Dinetah, documented in 1999, every detail in the site is crucial to create reference points for the measured drawings. The pueblitos are small multi-roomed masonry dwellings that do not possess any geometrical features where the delineator can describe distinct architectural features. The delineator has to know exact shapes of the

[496] David Andrews et al., *Measured and Drawn: Techniques and Practice for the Metric Survey of Historic Buildings*, 2nd ed., ed, by Jon Bedford and Heather Papworth (Swindon, UK: English Heritage, 2009), 27.
[497] Brinkman, *Interview*.

stones, nature of the stonework and the relation of the building elements in order to portray these characteristics to measured drawings. Thus, in these critical sites, the production of drawings becomes challenging if the delineator has not participated in the fieldwork.

During the documentation project of the Harris-Martin House in Anderson, Grimes County, Texas, Cowan, articulates how the team manually drafted the measured drawings as:

> …After we recorded everything, field notes, large-format [photographs], sketches, and other photographs, then we sat down in the drafting room. We attempted to reconstruct a building in two-dimensions on paper… We drafted on the same size paper that we were going to submit to HABS. Once we laid out everything on paper, and verified all the measurements, we arranged those [measurements] to best communicate the information we were trying to convey building in a HABS drawing. We had limited a number of drawings to use. We really wanted to maximize the information on the number of sheets we had. We [produced] the drawings by hand… We took those drawings and traced them on Mylar by pen… We used different line-weights and line-types to give the three-dimensional feeling… At the same time, we had a little bit of technology. We had an electronic lettering machine which has a little arm and a little keyboard a little bigger than a scientific calculator. We did everything hand-drawn but did the lettering with the electronic machine…[498]

Unlike Cowan's manual drafting experience, nowadays, all the drafting takes place in the digital domain. Schara discusses that as long as the level of details and accuracy of drawings corresponds to the HABS standards, HABS does not have to concern with how the drawing component is executed.[499] The student architects students learn how to use a series of digital drafting conventions at architecture schools. Furthermore, architectural firms use a host of drafting software. Given this,

[498] Cowan, *Interview*.
[499] Schara, *Interview*.

HABS/HAER/HALS does not require or recommend the use of any particular CADD software nor of any specific file format.[500] However, HABS/HAER/HALS recommends the drafters to use the CADD Layer Guidelines developed by the American Institute of Architects (AIA)[501], as adapted to the specific needs of a particular project.[502]

Nonetheless, in order to maintain the legibility of the drawings and sustain the quality of the final products, HABS does recommend some line-weights to be used for drawings that will be plotted at 1/4”=1'-0.”[503]

- 0.1mm for joint lines, such as floor boards or brick coursing (no change of surface plane), fine ornamentation, topographic lines on site plans
- 0.2mm for light edges (small change in surface planes)
- 0.3mm for medium edges
- 0.4mm for heavy edges (indicating major depth in plan or elevation)
- 0.5mm for material cut lines in plan and section, building outlines in elevation
- 0.6mm for g round lines in elevation

Furthermore, HABS warns the drafters to avoid pre-defined hatch patterns for surfaces (such as brick coursing or roof shingles in elevation, or herringbone brick paving in plan). These patterns do not represent the actual conditions. All these architectural items should be measured and drawn accordingly. In addition, the drafters

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[500] “HABS Guidelines Recording Historic Structures and Sites with HABS Measured Drawings,” HABS, accessed July, 06, 2011, http://www.nps.gov/history/hdp/standards/HABS_drawings.pdf.
[501] “AIA Cad Layer Guidelines: U.S. National Cad Standard Version 3,” American Institute of Architects,accessed July, 06, 2011, http://www.cadinstitute.com/download/pdf/AIA%20Layer%20Standards.pdf.
[502] “HABS Guidelines Recording Historic Structures and Sites with HABS Measured Drawings.” HABS, accessed July, 06, 2011, http://www.nps.gov/history/hdp/standards/HABS_drawings.pdf.
[503] HABS., 13.

should not use solid grey tones to render surfaces, as they reproduce poorly when drawings are scanned for digitization and reproduction.[504]

HABS drawings should be drawn at a scale that is large enough to provide useful information. HABS recommends 1”=20'-0”, 1”=30'-0”, 1”=40'-0” for site plans, 1/4”=1'-0” is a useful scale for most building plans, elevations, and sections, and details such as doors, windows, and fireplace mantels are often shown in elevation and/or section at 1”=1'-0” or 1½”=1'-0.”505

Final CADD drawings should be plotted on 4-mil (0.004”) thick Mylar using a laser plotter. Other types of plotters, such as inkjet plotters, do not meet the standards of the Library of Congress for archival stability.[506]

Surveying with Three-dimensional Laser Scanning

Laser scanner surveying is the science of obtaining three-dimensional measurements of the historic structure using scanning equipment.[507] Preferably, the scanning team consists of two people. However, in large sites or a complex of structures, having a team of 3-4 people facilitates moving the equipment around the site. The scanning equipment includes of laser scanner, accompanied with extra battery, laptop computer, digital camera, and targets. If the project requires tying the scanned data with a real coordinate system, then documenter can utilize a total station and GPS.

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[504] Ibid., 13.
[505] HABS, 17-18.
[506] Ibid., 22.
[507] In this section, I am using time of flight long range scanner as a case study.

Once the documentation team decides to use a laser scanner, the team has to deal with logistical and legal issues. The transportation of this sensitive device to the project area becomes an operational challenge. If the project is abroad, legal regulations and bureaucratic procedures add a tedious layer in the operational scheme of project planning. In the author's experience, in order to ensure the continuation of work without any unexpected delay, the team has to obtain the legal permissions and resolve any logistical challenges prior to the fieldwork. In order to avoid the shipping expenses and delays, team can to carry the scanner and accompanying equipment with them on the plane. However, traveling with this type of sensitive tool became challenging at the airport customs. The team will be exposed to strict security regulations when entering and leaving the country.

Apart from the logistical, the utilization of a laser scanner brings a new host of issues to the planning of the fieldwork. Preferably, a site visit before scanning helps to alleviate field contingencies and improve project coordination. During the site visit, the heritage professional has to consider alternative work schedules in case of time and access restrictions. For instance, if the site is in a heavy traffic or tourist area, scanning in the night hours may be a good solution.

The laser scanner cannot record elements that are obscured by adjacent features, or vegetation.[508] In particular, work settings such as cramped underground burial chambers, or physically inaccessible cliffs, the secure position for the scanner footing

[508] "Producing HABS/HAER/HALS Measured Drawings from Laser Scans: The Pros and Cons of Using Laser Scanning for Heritage Documentation," Heritage Documentation Programs, accessed July, 06, 2011, http://www.nps.gov/hdp/standards/laser.htm.

might be possible from only few locations. In addition to this, the scanner does not collect any data beyond its range such as the tops or undersides of structures. In the site visit, the documenter has to determine all these issues. If possible, the team has to remove the vegetation before scanning. If not, the documenter has to consider alternative recording strategies such as photography, hand survey, and photogrammetry to capture the obstructed views. In some cases, the team can utilize an elevation mechanism to capture areas that are inaccessible from the ground. Louden and Hughes asserts that during the scanning campaign of Bluff Dale Bridge in July 2003, they benefited tremendously scanning from a lift-truck. Scanning from a position above the metal structure eliminated moving the equipment on the components of the bridge that were too hot to touch and any possible interaction with poisonous snakes.[509]

The weather conditions also impose limitations on the scanning work. Extreme weather conditions such as heavy rain, winds, and humidity preclude accurate scanned data. For example, scanning in heavy rain can refract the laser beam and yield to erroneous results. Moreover, the tool loses connection with the computer or shuts itself off after long operating hours in the hot and humid air.

During the site visit, the documenter has to design the scan plan. The scan plan involves determining the scanner positions and organizing the layout of the targets on the site to ensure adequate overlap of at least four targets from each scan position.[510]

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[509] Louden and Hughes, “Bridging the Gap: Using the 3-D Laser Scanning in Historic-Building Documentation,” 43.
[510] Ibid., 39.

In order to cover the exterior of a rectangle solid one story high vernacular structure, four to eight scanner positions are necessary. The scanner should be located facing each elevation as well as around the corners of the structure. This way, when two adjacent scans are being fused, the merge gives the depth information of the architectural details. To obtain an accuracy of 3-6 mm, the scanner should be located 2m-100 away from the structure.[511] However, if the house has additional architectural features such as a porch, bay or wing, further scan positions are required. In order to capture a detail, scans positions the surface and diagonal to the surface are required. After the exterior scans, the documenter can pursue with the interior ones.

In order to record the Gothic Revival St. Andrews Church in Bryan, the CHC team utilized a LMS-Z390i Riegl Scanner, which is a long-range terrestrial 3-D scanner used to document buildings, sites and medium to large objects. Figure 14 illustrates the 3-D laser scanner that the CHC documentation team used during the St. Andrews Episcopal Church, Bryan, Texas in 2008. Before scanning, the team members strategically positioned the targets on the site, creating at least four targets from each scan position. Targets constitute the reference points to put each scan together. The targets may also be surveyed with GPS to tie the data with real world coordinates. During the scanning process, the user defines the scan area, point spacing, and distance to the object. When moving to the next scan, the user has to overlap 20 percent in each scan to join the scans together. Each individual scan may hold up to one million data

[511] Barber, Mills, and Heritage, *3-D Laser Scanning for Heritage: Advice and Guidance to Users on Laser Scanning in Archaeology and Architecture*, 7.

points. The number of points depends on the point spacing and the size of the scanned data defined by the user.[512]

Fig. 14. The CHC documentation team used this 3-D laser scanner during the documentation of St. Andrews Episcopal Church in Bryan, Texas in 2008. (Copyright: Center for Heritage Conservation)

[512] Louden and Hughes, “Bridging the Gap: Using the 3-D Laser Scanning in Historic-Building Documentation,” 39.

One of the key factors in scanning is being aware of what point density (sampling resolution) and measurement accuracy is required to generate the level of ‘deliverable’ the documenter requires in the project. Point density describes the number of laser points that hit the surface. In other words, it is the distance between neighboring range measurement points. Resolution refers to the smallest possible distance between points on the surface of the object being scanned and is limited by the accuracy of the ranging device (the timing device), as well as the accuracy of the scanner angular-measurement devices.[513] Accuracy relates directly to the scanned object's optical qualities or reflectivity. Due to the refraction effect of the laser beam traveling through different media such as air and glass, high-gloss surfaces excessively disperse the beam. This deficiency becomes problematic when surveying the glass or reflective metal surfaces, it creates 'noise' in the scan or, in cases such as the gilded torch on the Statue of Liberty, no information at all could be collected.[514]

Accuracy and resolution influence the quality of the acquired data. Using a point density of less than the quoted measurement accuracy generally will not provide useful information. For example, sampling every 1mm when the measurement accuracy is 5mm is not going to provide the information. When preparing a scanning survey, the documenter should know the smallest-sized feature that needs to be detected. In a site plan, the smallest feature could be the overall structures in-situ. In a building survey, architectural elements such as the masonry bricks, roof shingles, and flooring could be the smallest. In a detail scan, the wallpaper pattern or wooden carvings could be the

[513] Louden and Hughes, 39.
[514] Ibid., 39.

smallest detected. Hence, the point density and accuracy may not be the same over the entire survey, and the documenter should employ different point densities in different areas. Table 2 demonstrates suggested point density and measurement accuracy for different objects. It is a useful exercise to begin the survey with a panoramic scan to capture the overall site, and continue with building and detail scans.[515]

Table 2. Suggested point densities (sampling resolutions) for various features[516]

Feature size	Example feature	Suggested point density
10000mm	overall site	500mm
1000mm	structure	50mm
100mm	stone masonry	5mm
10mm	archaeological findings	0.5mm
1mm	weathered masonry	0.05mm

Furthermore, during scanning, if the documenter captures images of the historic scene from each scanner position, these images facilitate post-processing the scanned data. The documenter can utilize the digital photographs to crosscheck the targets in the scanned data while aligning the scans. Furthermore, the documenter can analyze distinct architectural elements that need to be delineated from the images.

The Translation of Scanned Data to Drawings

In heritage projects, the utilization of laser scanner has substantially transformed the process of the delineation of the measured drawings. For example, in hand recording,

[515] Barber, Mills, and Heritage, *3-D Laser Scanning for Heritage: Advice and Guidance to Users on Laser Scanning in Archaeology and Architecture*, 10.
[516] Adapted from Ibid., 10.

the location of the section that extensively conveys the characteristics of the site is predetermined prior to the fieldwork. Point measurements are taken accordingly on site. In this process, team members constantly collect measurements and produce sketches. On the other hand, once the laser scanner captures the heritage site, the scanned data has millions of points. The user clips the 3-D point-cloud to represent the desired 2-D view such as the plan, section, or elevation, and the delineator meticulously generates the measured drawings.

After scanning, the documenter has to register a number of separate scans from different scanner locations to acquire the full coverage of the structure. Registration is the fusion of several point-clouds in one coordinate system. The scanner software either links the targets or matches coordinate points in the surface geometry to combine the individual point-clouds. If the collected data needs to be referenced to a real world coordinate system, then it will be necessary to provide external survey measurements by using a total station or GPS.

However, some inhomogeneities of accuracy reside in the registration phase. During the registration, the operator works with statistical data, and accepts some standard deviation value to mesh the scans. Standard deviation shows the amount of dispersion from the average value. A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data points are spread out over a large range of values. In scanning applications, the standard deviation depends on the distance of the scanner to the measured surface. However, the scan points for registration are typically not distributed in the maximal measuring distance of scanner since that will make the standard deviation too big. Not integrating the distant measured points to the calculation of standard deviation leads to the decrease of the accuracy of the scan data.

Furthermore, each registration methodology alters the standard deviation of the scan data, which leads to a different 3D model. In other words, the surveyor's decision of overlapping individual scans or using mutual targets in the scans alters the accuracy of the model. In most cases, the operator has to accept a standard deviation value -- take for example for a single measured distance standard deviation is about 5mm— which does not meet the level of accuracy of a documentation project. Thus, the documenter has to monitor how closely the scan data represents the real world measurements. Therefore, the surveyor generally combines different recording methodologies to cross-check the accuracy of the scan data, and fill the data voids.

The product of the registration process is one 3-D point-cloud that includes all the individual scans. This final point-cloud represents a measurable representation of the scanned object, structure, or site. Figure 15 illustrates the point-cloud for St. Andrews Episcopal Church in Bryan, Texas. Most scanners are provided with standard software for registration, visualization, treatment, and manipulation of the data.

These software programs display the x, y, z coordinates of surface points already scanned and represent them according to the intensity of the return of the laser beam. A variety of software such as RISCAN PRO, Cyclone, and Raindrop Geomagic allow the user to put the scans together, view the point-cloud, perform many modeling and management operations on the scanned points (i.e., convert points to surfaces, take measurements and create dimension lines), or export the points to other formats.

After registering the scans, the user only has to clip appropriate views from the 3-D point-cloud and work on these pieces. Rather than extruding standard forms or joining end shapes, researchers often use AutoCAD (or other drafting software) to trace each element of the structure on the point-cloud. The major challenge of any documentation project lies in the translation of the 3-D point-cloud to 2-D measured drawings. The labor cost of translating the data into drawings is still significantly higher than the actual cost of scanning.[517]

[517] Louden and Hughes, "Bridging the Gap: Using the 3-D Laser Scanning in Historic-Building Documentation," 39.

Fig. 15. The above left image demonstrates the overall look of the structure in 3-D point-cloud. The above right image shows the interior space. As the image demonstrates, scanned data consists of millions of data points. The below left image is a good example of how point-cloud can be sliced to produce plan representation. The image shows the planimetric cut. The below right image shows the section slices to determine the vertical measurements of the cross-sections. (Copyright: Center for Heritage Conservation.)

The final 2-D products continue to be quite subjective because they must still be interpreted by the delineator, who selects a group of points to draw from the millions of points in the scan. In addition to the fact that scanned data provides a highly accurate model of the structure, there may be data voids in the point-cloud due to physical obstacles in the field. These obstacles include thick vegetation or other structures blocking the view of the scanner. In any case, the delineator still processes the scanned data, and makes the final decisions about what to draw based on information from photographs and the other survey data in the field. Figure 16 shows the final 2-D drawing of the St. Andrews Episcopal Church in Bryan, Texas. It took nearly two years to finish the entire HABS drawing set. This drawing was completed in 2010 with the rest of the set.

Scanner use for large-scale measuring projects has proved to be necessary in the quest for reduced cost, increased safety, and accuracy in fieldwork. For a simple cost comparison, a typical HABS summer team spends four to six weeks gathering field measurements by hand survey. However, a large building or complex of buildings can be scanned in four to six days. A two-person field crew can capture up to 500 points per day surveying with a total station or other electronic distance-measurement (EDM) equipment. On the other hand, the documenter can record up to 1 million data points in minutes. Yet, the drawing time remains approximately equivalent to production time for data gathered by either of these methods.[518]

[518] Louden and Hughes, “Bridging the Gap: Using the 3-D Laser Scanning in Historic-Building Documentation,” 38.

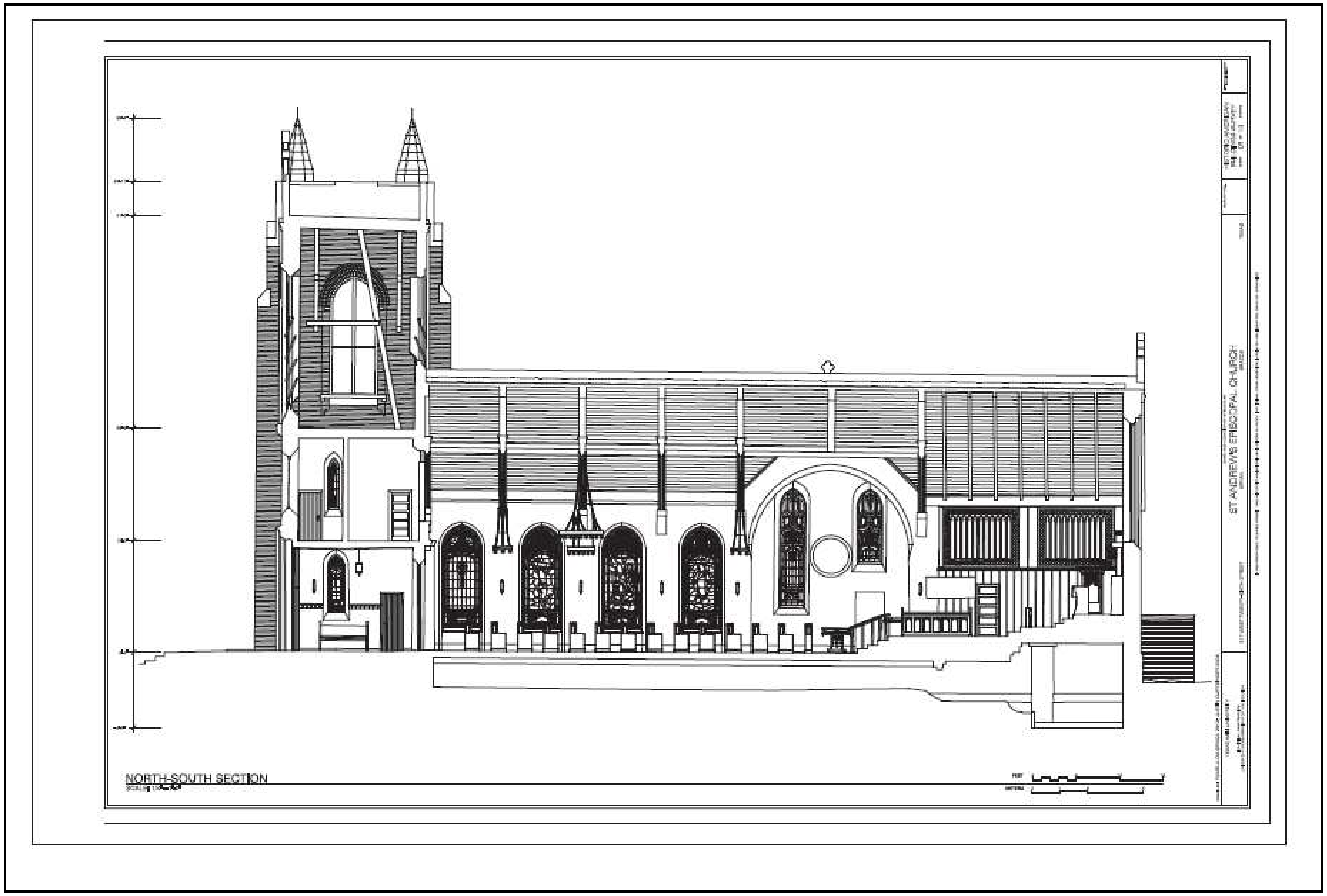

Fig. 16. The north-south section of St. Andrews was generated by using the point-cloud. (Copyright-free image. Center for Heritage Conservation).

Managing and storing digital data is a challenging issue in laser scanning. Scanner survey generates data at a number of stages. In order to be able to reprocess data later, the documenter should ensure that the most appropriate data is available. Table 3 illustrates the stages of data process.

Table 3.Types of data deriving from laser scanning[519]

Raw Observations (as collected by the scanner)
Raw XYZ (As determined by the scanner)
Aligned XYZ (Determined by processing software/process)
Processed model (As chosen by the user)

Raw observations are not universally available, and data formats differ between manufacturers. However, raw XYZ data can be transposed for reprocessing scanned data in any time in the future such as re-alignment of the scans, or re-modeling. However, in order to ensure that scanned data can be used in the future, Barber et al. suggests that the proprietary observations should also be maintained with the digital data. These can be field notes, sketches, and diagrams generated on site, the raw and processed data, and a working digital copy of the deliverables.[520]

Thoughts on the Technology and HABS Documentation Discourse

Heidegger discusses technology as a revealing phenomenon that unfolds and arranges the world. In this context, any recording technology transforms the

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[519] The diagram is acquired from Barber, Mills, and Heritage, *3-D Laser Scanning for Heritage: Advice and Guidance to Users on Laser Scanning in Archaeology and Architecture*, 15.
[520] Ibid., 15.

documentation work by dictating its own principles and procedures to the project. For example, the utilization of the laser scanner has indisputably accelerated and facilitated the collection of data in the field. However, the use of laser scanner directly alters the form of information, how it is collected and understood. The different form and arrangement of the scanned data from hand recording is creating a need for a new type of expertise among heritage professionals who now face a host of new kinds of decisions when planning and implementing a cultural heritage project. The logistical challenges of the transportation of the scanning equipment to the field, the utilization of the scanner while controlling the field contingencies, the decisions of how to translate the scanned data into project products are just few of the issues that the heritage professionals have begun to address in the heritage projects.

Hand recording consists of intense manual work. The documenter produces proportional field sketches that resemble the architecture. Then he develops strategies how to collect measurements accordingly. For instance, in order to measure a door detail, the documenter most likely will use a tape measure, hold it against each feature on the surface, and write down the measurements on a graph paper. The surveyor will utilize a right-angle square or survey diagonal measurements to ensure accuracy at right angles, a molding comb or profile gauge to record moldings of the doorframes, and a plumb bob or level to check verticality. However, in order to obtain measurements from challenging surfaces such as a roof, one has to consider further field contingencies. In this case, he has to climb to the roof to obtain the necessary measurements. If climbing is not possible, he can use photographs to detect crucial points and some proportions. If the elements of the roof structure are exposed in the attic, then the surveyor can coordinate these interior measurements to the exterior roof dimensions.

On the other hand, when the documenter utilizes a laser scanner in the field, rather than developing strategies to create field notes, he strategically determines the system parameters in the scan plan. The surveyor positions the scanner and accompanying targets in the site, actuates the point density and accuracy to meet the project requirements. In order to ensure the quality of data, prior to scanning, he has to determine any obstructed views or existing high-gloss surfaces. In this context, if necessary, he can employ additional recording technologies to fill the gaps in the scanned data.

Without a doubt, laser scanning has revolutionized heritage documentation. Heritage professionals can now comfortably scan almost all types of surfaces that were not available with hand recording. McLuhan discusses that technology introduces new scale, pace or pattern into the human affairs.[521] McLuhan's account of technology overlaps with the expansion of heritage documentation with scanning. First, with the utilization of laser scanner, all types of surfaces from artifacts, to single structures and historic landscapes can be measured, and accurate base information is provided with increased accuracy and safety. Second, laser technologies have changed the pace of recording. Scanning technologies have allowed great advances in obtaining measurements and producing highly accurate representations in real time. Scanning survey reduced the weeks-long hand recording campaign to a couple of day's labor.

[521] McLuhan, *Understanding Media: The Extensions of Man*, 24.

In this context, Schara discusses that "new technologies have certainly changed the ability of [HABS] to undertake big documentation projects." [522] In projects such as the HABS documentation of the Milwaukee Soldiers Home, the vast scale of the complex necessitated laser scanning that involved collecting data automatically. In these types of projects, traditional means of data gathering requires an extended fieldwork, which is not feasible within the limited project budget.

For Heidegger the threat of technology lies in the transformation of the human being, by which human actions and aspirations are fundamentally distorted. Technology enters the inmost recesses of being a human and transforms the way humans know, perceive, and will.[523] Along this same line, McLuhan discusses that the danger of technological mechanization resides in the transformation of its members into resourceful machines without the ability to think.[524] In this context, the drive for the mastery of the laser scanner in heritage documentation emerges from the desire of a more efficient, more accurate, safer, and a cheaper documentation project. However, following Heidegger's warning, analyzing how the extensive push of laser scanning alters the documenter's understanding and aspirations of cultural heritage is worth mentioning.

Whitacre asserts that once the documenter sits in front of the building, studies, measures and draws, he develops a personal relationship with the historic structure.[525]

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[522] Schara, *Interview*.
[523] Michael H. Heim, "Heidegger and Mcluhan: The Computer as Component," in *Philosophy of Technology: The Technological Condition: An Anthology*, ed. Robert C. Scharff and Val Dusek (Malden, MA: Blackwell Publishers, 2003), 542.
[524] Lewis, "Children of the Mechanical Bride, Additional Abstractions of Human Stereotypes," 213.
[525] Whitacre, *Interview*.

He would internalize the details as he compiles them together in the sketches and then in the measured drawings. Given this, previous HABS project participant, Brinkman defines hand survey as an "impression" that the documenter is "getting a sense of place." [526] Being at the historic setting and drawing the asset constitutes an impression that gets the documenter to the essence of cultural heritage. The documenter "almost re-lives of the experience of a person who originally assembled the structure." [527] Cowan, also a previous HABS project participant, stated that the documenter is at the point where the craftsman hammered the last nail of the structure. Documentation becomes an intense thought process where the delineator re-constructs the historic scene on the paper.[528]

However, laser scanner provides a detachment and a posture of un-involvement with the surface to be recorded. After the documenter organizes the scan plan in accordance with the project requirements, he can survey the entire site a couple of hundred meters away from the surface. According to McLuhan, the physical separation of the user from the operation possesses significant advantages, because now humans can carry out the most dangerous operations without being physically involved.[529] In this context, scanning has expanded the ability to record settings with possible field hazards. The increased safety on site also lowers the risk of injury and makes the scanner use an appealing test case for heritage projects.

On the other hand, the detachment from the historic surface reduces documenter's direct engagement with the heritage setting. The automated data collection

[526] Brinkman, *Interview*.
[527] Cowan, *Interview*.
[528] Ibid.
[529] McLuhan, *Understanding Media: The Extensions of Man*, 20.

eliminates the process of producing field notes as well as the use of sketching and hand measuring techniques. Warden and Woodcock warn that while adopting automating documentation technologies often preferred in the professional world, "it risks alienating students from both the material cultural fabric and the abstract thinking so important to its creation it."[530]

Yet, the scanned data inherently contains detailed material, ornamental, structural, and weathering information that cannot be included in a sketch without great effort. In some cases, the information is so intense that it cannot be included in a sketch without any abstraction or reduction of the details. Hence, because of systematic scanning the documenter can acquire building information with minimal time on-site and then extract this information from the point-cloud later in more controlled conditions. Lavoie discusses that laser scanner is an important conservation tool because "[the documenter] can scan the building and see every fault, crack, deflection, detection and monitor." [531] However, she added, "the need for more intense documentation in the area of conservation is not [HABS] call."

The tangible and intangible qualities between hand recording and scanner survey, can be explained by Ihde's amplification/reduction structure of technology. As noted in the previous chapter, Ihde discusses that mediating technology amplifies certain aspects of the object, while reduces the rest of the features.

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[530] Warden and Woodcock, "Historic Documentation: A Model of Project Based Learning for Architectural Education," 113.
[531] Lavoie, *Interview*.

In hand recording, the documenter intentionally selects patterns that define the architecture and collects the field measurements accordingly. Hence, these field notes culminate in 2-D drawings which amplify certain aspects of the structure. However, this attitude reduces the accuracy of the documentation project since no data is being collected from the rest of the building. In other words, the final drawings do not include all physical qualities of the historic structure. Furthermore, the documenter is physically separated from the part of the structure that no data was acquired.

The use of laser scanner provides the documenter sharp accuracy and precision, and allows him to gather information quickly. However, during the registration process, the documenter primarily works with statistical data and accepts a standard deviation value to combine the scans. However, each mode of registration alters the standard deviation of the point cloud which culminates in a model with a different level of accuracy. In some cases, the standard deviation -- take for example for a single measured distance standard deviation is about 5mm-- does not meet the accuracy requirements of the documentation project. In order to provide highly accurate drawings, the documenter has to consider how close the scan data represents the actual measurements. In most cases, the surveyor uses a combination of recording methodologies to cross-check the accuracy of the scan data.

The scanning application also dilutes the empirical observations of the surveyor. The documenter began to experience the historic setting through the scanned data. In other words, as McLuhan poses, the scanned data becomes an anti-environment.[532] The

[532] Zingrone, “Virtuality and Mcluhan's “World as Art Form,” 45.

anti-environment of scanning introduces a new set of language that puts documenter's senses together in a virtual arrangement of space, and influences surveyor's perceptual approach to the heritage asset.

Any technology gives only a mono-dimension of the object. Hence, in most heritage projects, the utilization of a host of scanning technologies has already become a necessity. For example, the advantage of time-of-flight scanners is that they are capable of operating over very long distances, such as a couple of kilometers. These scanners are thus suitable for scanning large structures like buildings or geographic features. Conversely, the disadvantage of time-of-flight range finders is their accuracy. Due to the high speed of light, timing the round-trip time is difficult and the accuracy of the distance measurement is relatively low, in millimeters. However, the triangulation range finders are exactly the opposite. They have a limited range of some meters, but their accuracy is relatively high. The accuracy of triangulation for range finders is tens of micrometers.

Furthermore, time-of-flight scanners accuracy can be lost when the laser beam hits the edge of an object. The coordinate relative to the scanners position for a point that has hit the edge of an object will be calculated based on an average and therefore will put the point in the wrong place. For that reason, two different sets of location information for one laser pulse are sent back to the scanner that creates noise in the scanned data. When using a high-resolution scan on an object the chances of the beam hitting an edge are increased and the resulting data will show noise just behind the edges of the object. Scanners with a smaller beam width will help to solve this problem but will be limited by range, as the beam width will increase over distance. In this case, a third technology such as a total station or photogrammetry can be used to determine the exact measurement of the edge.

McLuhan poses that technologies create their own world of demand.[533] Nobody wants a cell phone until there are cell phones. Alternatively, nobody wants to watch a movie if there are no movies. McLuhan's statement is evident in the heritage-recording field. The use of technologies has not always been orderly or rational but often guided by market demands rather than scientific justification. As cultural heritage professionals import scanning technologies extensively from other disciplines in the last decade, this situation triggers a bigger demand for these technologies in the sector. Now, it is desirable to use a laser scanning in every cultural heritage project regardless of the context and resources of the work. Louden and Hughes warn that although scanning technology can be an invaluable tool for certain projects for recording complex and often inaccessible structures with an automated surveying device, laser scanning is not a panacea or a quick fix for all documentation needs.[534]

Ihde describes technological media as extensions of humans. He exemplifies these extensions as embodiment relations in which the machine is being taken into self-experiencing, and/or hermeneutic relations where the machine becomes the other. Take for example, how the documenter uses the 3-D laser scanner to obtain measurements from physically inaccessible locations. The surveyor does not actually climb to the

[533] McLuhan, *Understanding Media: The Extensions of Man*, 72.
[534] Louden and Hughes, "Bridging the Gap: Using the 3-D Laser Scanning in Historic-Building Documentation," 45.

structure to collect physical data. He develops a symbiotic relationship with the scanner, because he trusts the scanner's readings of the measurements. Hence, the tool becomes an embodied extension of the documenter. On the other hand, how he interacts with the scanner exemplifies the hermeneutic relations with the device. As the documenter uses the scanner, he establishes a readable conversation between her and the machine. As he operates the scanner software, the software poses a command, which appears on the screen telling her what to do. Here the machine becomes the other where he establishes an explicit conversation between her and the computer within the experience of a machine. In both embodiment and hermeneutic relations, the documenter's experience with the machines is distinct. In the embodiment relations, he embodies a dimension of herself through the machine and in the hermeneutic relations, he is confronted and being involved with the machine.

Ihde discusses that human's experience with the world is in some ways transformed through the use of media. Ihde's discussion is reflected on the act of drawing which is stemming from layers of interpretation. The interpretation begins in the field during data collecting and continues in the delineation process. If the recording method is hand measuring, then the documenter starts interpreting in the field by collecting the measurements manually. Each recorded point is a result of the documenter's interpretation of the cultural asset that culminates in plans, sections, and elevations. Each drawing is a manifestation of the documenter's approach of heritage documentation as well as individual drafting skills. If the recording method is a digital tool such as 3-D laser scanner, then the interpretation of the documenter begins in the field through selection of point spacing, position of the scanner, the targets in the field, and continues with the registration process. Each change in the system parameters ends up in a different point-cloud with different accuracy and resolution. The interpretation of the documenter continues while translating the cluster of points to 2-D drawings. It is the documenter who consciously selects parts of the point-cloud as meaningful elements of the final drawing. Then the delineator traces the pre-determined slices to produce the drawings.

Conclusion

Cultural heritage acts as a fragment of information, having a special place in time and space as a survivor of the past. The process of documentation represents a social desire to give a clear statement of the significance of cultural heritage. In terms of documentation, deciding what to document and what not do involves an active process of value and meaning that is assigned to the heritage asset. The curatorial selection of what is significant to document, what should be remembered and forgotten, what categories of meaning are given and how the deliverable can be used signify the cultural asset. In this context, hand survey techniques as well as scanning technologies act entirely in service of the heritage asset. Both strategies merge in the operational scheme of a documentation project, as well as meaning of cultural heritage.

Technological instrumentation provides the heritage professionals with sharp accuracy and precision and allows them to gather information quickly. Yet, every instrument also filters data. Then, how the researcher can be sure about the type and quality of the information being received if the data already was reduced? Only by knowing about what is reduced, and not just about what is amplified, better enables us to develop the counter-measures necessary to overcome those inclinations.[535]

The quality of the deliverables depends on the knowledge and experience of the documenter. Without a skilled person, the laser scanner is just another technological tool that collects mathematical data. By the same token, the process of hand surveying culminates in a compilation of dimensions that would be useless if the documenter does not know how to use them. It should not be forgotten that heritage professionals are the specialists who seek the answers in heritage documentation inquiries not the technologies themselves.

[535] Canizaro, "Drawing Place: An Inquiry into the Relationship between Architectural Design Media and the Conceptualization of Place," 126.

CHAPTER VIII

CONCLUSION

This chapter constitutes the major contribution of this study. It is the presentation of the issues that found in the literature review and the analysis of the documentation projects, participant observation, and in-depth interviews. The previous chapters provided the understanding of the HABS culture of documentation, the role of drawing in heritage documentation, and the effects of technological mediation in the projects. Of interest were the specific patterns of the documenter's access to the historic environment through the act of drawing and the use of technologies.

Drawing

Chapter V presented a discussion of the act of drawing, which constitutes a basic form of human expression. In the architectural realm, this unique representation has evolved to meet current drawing conventions and architectural culture. In ancient times, architects created construction-embedded drawings and inscribed the architectural details directly onto the surface of structure. However, when intense mathematical thinking was introduced during the Renaissance, architectural drawings evolved into a two dimensional projection of plans, sections, and elevation. The 18th century saw a profound shift from a Renaissance world driven by myth, religion, and ritual to a world ruled by modern science, which acquired knowledge through scientific and mathematical precision and culminated in the implementation of the scientific method to the processes of architectural culture.[536] Drawings became a tool of visually accurate depiction and less a tool of artistic expression.[537] Hence, drawings unfolded as a form of algebraic analysis with a definition of structures in space in line with X, Y, Z axes.

In contemporary practice, architects still use a descriptive set of projections. However, when computational mediums were introduced to the practice in the 20th century, the act of drawing evolved into a form of processing information. Users can enter data through a variety of means and visualize the drawings with a host of software. Recently, the utilization of 3-D mediums created another pattern in architectural practice; professionals can now evaluate the means of integrating 3-D digital representations into drawing conventions.

During the course of the development of drawing methodologies, the urge to reflect on the surroundings has remained constant. For example, many Renaissance authors gave particular attention to the production of drawings of antiquities. Through these drawings, they explored questions related to durability and the need for regular maintenance, as well analyzing the causes of failure and the repair of structural defects. A link was thus maintained with the past and a base was provided for the development of a new attitude and respect for ancient builders.[538] Similarly, in the 18th century the Beaux-Arts Academy included a well-organized curriculum based on the process of producing measured drawings of classical precedents as a learning tool.[539] The students at the Academy documented their surroundings with measured drawings to acquire

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[536] Canizaro, 84.
[537] Ibid., 85.
[538] Jokilehto, *A History of Architectural Conservation*, 26.
[539] Canizaro, "Drawing Place: An Inquiry into the Relationship between Architectural Design Media and the Conceptualization of Place," 82.

design, material, and structural sensibilities. Lavoie asserted that the HABS culture of documentation is the continuation of the Beaux-Arts tradition.[540] Early HABS administrators touted the benefits of the program's educational work to the architects and draftsmen they employed. As stated in 1937:

> This [benefit] is not only in [gaining] knowledge of the early structures themselves and of their architectural details, but also in [their] draftsmanship and an improved ability in designing both in the Colonial styles and others because of a closer knowledge of the functions of the different parts of the building and a sense of proportion which the early architecture of this country possessed to a remarkable degree, and which is brought home to the field workers through the measurements and drawings which they make.[541]

Even though the HABS drawing philosophy has been sustained since the inception of the program, the drawing styles have changed due to current drawing conventions and technological applications. For instance, the Beaux-Arts drafting technique and presentation was reflected in HABS drawings with copious details, notes, and recessive dimensioning that filled much of the sheet. After WWII, a more modernist approach influenced HABS drawings. The Beaux-Arts style of drawings was replaced with sheets devoid of the clutter of notes, dimensions, and details. These salon drawings had a more pristine approach that emphasized the elevations and plans rather than details.[542] In addition, HABS teams began to use photogrammetry to produce drawings. The images made on stereo-pairs were converted to accurate scale drawings with the kind of plotting equipment used to produce contour maps. Due to the complexities of

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[540] Lavoie, *Interview*.
[541] Memo (author unknown), Historic American Buildings Survey, "Need for the Program," 14 August 1937, HABS File, RG 69, National Archives, cited in Lavoie, "A Complete Resume of the Builder's Art, the Early HABS Surveys," 25.
[542] Cliver et al., "HABS/HAER at the Millennium: Advancing Architectural and Engineering Documentation," 34.

using ink as a drafting tool, HABS teams also began using the Cronaflex method. A pencil drawing on paper was photographed to produce a negative and then a positive film, which had the appearance of an ink drawing. In the 1980s, computers began to influence how drawings were produced and delineated, and electronic CADD files started to replace hand-drafted drawings. With the use of photogrammetry and CADD, the documenters could store each point in two or three dimensions in the computer.[543] Komas defines this drawing style (from the 1980s to the present) as mixed because it is a result of blending previous styles with the use of technological advances. Recently, the intense use of 3-D technologies has HABS professionals experimenting with new ways to produce drawings.

HABS drawings are used for multiple purposes: as a permanent record of the historic structure, an educating tool for students and young architects, an infrastructure for preservation work, a means to cultivate public awareness of cultural heritage, and as part of scholarly work. In regards to the effectiveness of HABS products in all these uses, some respondents felt that 2-D drawings provide a limitless vantage[544], while others preferred 3-D digital means.[545] However, the heart of these discussions revealed that it is very hard to determine a certain type of product as a panacea fix for all the prolific uses of HABS drawings. Both methodologies (2-D drawings and 3-D digital products) have benefits and drawbacks with regard to certain uses. For example, the interviewees indicated that the digital drawings are not reliable for archival purposes due

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[543] Cliver et al., 34.
[544] Edgington, *Interview*, Lavoie, *Interview*; Lockett, *Interview*; Schara, *Interview*;Whitacre, *Interview*.
[545] Lockett, *Interview*, Lee, *Interview*.

to unsolved issues of digital data preservation. Yet most of the respondents concurred that once these issues resolved and the Library of Congress begins to accept digital format, the concentration of digital drawings will increase.[546]

Drawing is prized for mediation that allows reliable and real contact with the existing context of a structure. The respondents asserted that immersion in the historic setting of a structure and producing drawings teaches the documenter skills that are unmatched by the structured drawings produced with computers. Most respondents also agreed that the knowledge of architecture, structure, and construction gained from involvement in the drawing process is a huge benefit. The hands-on aspect of producing drawings involves the engagement of the body and of all the senses. It both forces and allows the documenter to understand the reality of architecture.

The interviewees said that the act of drawing is especially beneficial for student architects.[547] Issues that do not come up in the classroom arise on the documentation site. Drawing the historic context allows the students to see structure, detailing, design issues, and construction strategy in the hands-on atmosphere. Cowan stated that in architecture schools, most of the architectural classes are about architectural sculpture, 3-D design, spaces, and form. The other classes are about technical information regarding structural and mechanical calculations to sustain structures. For this reason, drawing historic structures fills the gap between abstract and scientific quantification of architectural design. [548]

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[546] Lee, *Interview*, Rosenthal, *Interview*, Valenzuela, *Interview*.
[547] Brinkman, *Interview*, Cowan, *Interview*, Lavoie, *Interview*, Schara, *Interview*.
[548] Cowan, *Interview*.

The respondents argued that the digitization of environments alters the documenter's experience.[549] Using CADD to produce a measured drawing constitutes a very straightforward example. The 'copy' button in CADD allows the delineator to draw similar lines with a keystoke. With this button, the delineator can copy hundreds of lines anywhere on the drawing. Without a doubt, it is a very powerful tool of the digital realm, yet what does it say about the essence of the building? Is it simply a series of lines or a set of commands? Such digital drafting has the subtle effect of altering the subject. An existing built environment becomes something that can be infinitely morphed in any shape. Hence, in this case the reality or entity of the artifact can be easily lost though these digital means.

During the interview discussion, 3-D laser scanning became an undercurrent theme. The ability to acquire a point-cloud in such a short time and to use this singular source for a vast multitude of purposes has solidified the use of scanning technologies in the process of documentation.[550] A 2-D drawing gives a limited view of the structure; hence, the drafter has to compile more vantages (plan, sections, elevations, and details) to reveal the complete sense of the building. However, a 3-D surrogate provides an infinite number of vantages, unlike diagrammatic 2-D drawings. The user can clip any view from the point-cloud (countless plans, sections, and elevation details) and work on those pieces exclusively. Furthermore, the delineator can use the interactive 3-D representation to demonstrate aspects that are difficult to show in 2-D drawings, such as any important movement.

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[549] Lavoie, *Interview*, Schara, *Interview*.
[550] Browne, *Interview*, Lee, *Interview*, Lockett, *Interview*, Schara, *Interview*, Smith, *Interview*.

The respondents also discussed the production of 2-D drawings from scanned data, which is difficult to negotiate.[551] Due to the documenter's unfamiliarity with the software, which is different from any other digital media, producing drawings becomes problematic. The process requires too much protocol and uses up the same amount of time needed to make drawings as any other media. The user has to gain the skills to use the software properly, as well as the skills needed for conventional drawing. The level of detail and quality of the drawing still depends on the expertise of the drafter.

The interviewees addressed HABS drawings as an important means to promote cultural heritage.[552] The federal government's effort to produce drawings cultivates recognition of the value of historic structures among local communities. In many cases, this interest culminates in the protection of the historic structure. Furthermore, the drawings themselves become mediators to be used in websites, pamphlets, flyers, books, and journals to distribute heritage information.

Considering the vast multitude of stakeholders, the readability of the drawings constitutes a fundamental issue. Some respondents asserted that 2-D drawings are more coherent to a wider audience.[553] Because the documenter has already elicited the significance of the structure on the drawings, the diagrammatic abstraction keeps the viewer focused on the important assets of the structure.[554] In addition, it is challenging to a nonprofessional to observe the cultural values embedded in a 3-D digital model unless

[551] Lavoie, *Interview*, Schara, *Interview*.
[552] Lavoie, *Interview*, Valenzuela, *Interview*, Edgington, *Interview*.
[553] Lockett, *Interview*, Schara, *Interview*, Whitacre, *Interview*.
[554] Whitacre, *Interview*.

he knows where to concentrate. The situation becomes more challenging if the person has little or no any experience with computers.

On the other hand, the proponents of 3-D digital media argued that 2-D drawings provide the viewer with an impossible vantage in real life. The 2-D drawings are difficult to engage experientially. They might be difficult for the user to read unless he has special training.[555] The viewer has to combine the set of 2-D drawings in his mind to get the grasp of the structure. For example, plan drawings provide an idea of the site, directions, and locations. The plans present a footprint of the buildings, as well as the circulation and functional relationships within a structure. Section drawings give the scale and the relationship between the spaces floor to floor. These kinds of drawings also provide information about human scale versus the building, as well as exterior versus interior. Elevation drawings exhibit exterior details of the structure. They also provide the scale and relationships between details.

The proponents of the 3-D means stated that the viewer of the digital model sees a plastic form of space rather than a two-dimensional drawing. Through digital means, the viewer can observe the whole building and environment in its context. The digital mediums allow the viewer to experience a three-dimensional architectural space, but require little or no interpretation on the part of the observer. Consequently, the viewer does not have to convert two-dimensional drawings into a three-dimensional figure in his or her mind.

[555] Edgington, *Interview*, Lee, *Interview*.

Drawing constitutes so much of the architectural culture that it would be rare to see any documentation practice where the medium of drawing is absent. Yet, the future of drawing is linked to substantial use of digital media, in particular 3-D applications. The preservation practice has already embraced versatile digital means. At present, the professional’s major concern is how to use scanned data effectively in a documentation project. This is why the interviewees indicated the need to refine the scanned data, so that the documenter can record the same level of intensity and details that HABS drawings have.

The current concerns regarding the transition between 2-D drawings to 3-D data points to the actual predicament facing the profession. The dilemma lies in the question of what will happen if the act of drawing is totally abandoned in the documentation process. Obviously, the benefits of developing intimate access to the historic setting will escape the documenter. He will be physically separated from the historic structure, as well as the concepts, relations, and values that have governed architecture.

Drawing is a thinking tool. Architects externalize their ideas in the form of a drawing. They develop their ideas through an intense process of analysis, exploration, discovery and verification on paper. Clearly, if the act of drawing is abandoned in heritage documentation, the documenter will be deprived of the continuous mental process orchestrated by his hands, eyes, and brain. The ability to maintain manifold interpretive dimensions in manually performed intellectual work will be lost.

If the act of drawing is a tool of disclosure, the product is grounded on both the process of making the drawing and the process of seeing the drawing. These interrelated processes inform each other in order to build up comprehension of what is seen and drawn.[556] Thus, the viewer of the drawings will be deprived of the cognitive experience that helps him acquire the essence of cultural heritage. The details in a measured drawing serve as instruments for the realization of the significance of the structure. Therefore, the viewer's perception will be obscured by the absence of carefully delineated details of the architecture.

Technology

During the course of study, personal strategies were found in which the documenters felt digital technologies enhanced their ability to document. Most respondents spoke directly to the performance of technologies. All the interviewees concurred that digital applications should be integral to the documentation projects. Lockett summarized the situation, stating, "Digital tools have a home in historic preservation."[557]

During these discussions, most of the respondents considered laser scanners to be very important tools. Furthermore, Browne asserted that laser scanning has already changed the culture of working at architectural and engineering firms.[558] The architects, surveyors, engineers, and service providers now have to learn how to collaborate through the scanned data. Browne felt the advantages of laser scanning have created such a demand in the industry that the market will shortly be looking for students with

[556] Judith Mottram, "Marks in Space," in *From Models to Drawings: Imagination and Representation in Architecture* ed. Marco Frascari, Jonathan Hale, and Bradley Starkey (London , New York: Routledge, 2007), 196.
[557] Lockett, *Interview*.
[558] Browne, *Interview*.

scanning experience in addition to surveying and CADD knowledge.[559] Some respondents agreed that the laser scanner is not a replacement for other data recording methods, just another tool that brings a different perspective to documentation.[560] However, the discussions indicated a future shaped by the principles of 3-D data. Lee asserted,

> [Heritage professionals] never know what new tools are going to come up. Whether it is a laser scanner or photogrammetry, I think the essence of both of these tools is point-cloud… I think point-cloud will continue for a very long time since it can define surfaces in 3-D space. Our world is 3-D… I would say that the cameras will produce point-clouds. It does not matter which tool is going to collect, but point-cloud as a data type will stay for a while. It is so simplistic. [With the point-clouds] you get coordinates, you get numbers… [561]

The interviewees' perception of documentation technologies diverges based on the magnitude of the use of these technologies in the future. Two major categories were observed. On one hand, some participants support a complete shift to digital means, and anticipate technologies are the key to a rich future for documentation.[562]

Other respondents still have strong opinions regarding the value of digital technologies, but they also support the merit of "having a pencil at hand and the confidence in how to use it."[563] In this context, the knowledge of how to undertake an effective documentation project constitutes a major part of the practice. Cowan stated that in most documentation projects there are time contingencies as well as limited resources to invest on innovative technologies. In these cases, it is the documenter who

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559 Browne, *Interview*.
560 Ibid, Lockett, *Interview*.
561 Lee, *Interview*.
562 Browne, *Interview*, Lee, *Interview*.
563 Warden and Woodcock, "Historic Documentation: A Model of Project Based Learning for Architectural Education," 118.

has to come up with unique documentation strategies and "knock it out in a day." Generally, the documenter has to obtain all the critical field data with the tools available and translate this information into deliverables.[564]

In terms of the structure of the use of digital technologies, the interviewees' responses were mixed. Some had an economic model in mind, while others preferred and academic model. Lavoie stated that with a limited budget, it is hard to experiment with new technologies.[565] In documentation practice, these types of experiments are not always possible, considering the high cost, limited budget, and time that is required to implement new technologies.[566] Rosenthal simply said, "The cost of playing the game is too expensive." [567] Generally, heritage professionals can only afford a few advanced technologies, and they have to employ the same tools to hybrid project requirements in order to maintain economic feasibility within their practices. Hence, while the commercial sector prefers not to undertake work that spans long periods, universities such as Texas A&M University have excelled in long-term documentation projects because research constitutes a strong component in such projects. The academic base supports the emergence, development, and investigation of different technologies. Within this context, researchers can experiment with the most advanced technologies to test the capacity, feasibility, and accuracy of the new technologies. For example,

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[564] Cowan, *Interview*.
[565] Lavoie, *Interview*.
[566] Akboy, "*The Application of New Survey and Documentation Technologies for Cultural Heritage Sites: Case Study Analyses of the Digital Statue of Liberty, New York City and the Ottoman Fortress of Seddülbahir, Gallipoli Peninsula*," 99.
[567] Rosenthal, *Interview*.

Whitacre commented, "[NPS] does not have those capabilities in house so we work with universities that have those capabilities" [568]

The respondents pointed out that one of the major merits of heritage documentation is engagement with cultural heritage. Lavoie stressed that the challenge of technological mediation lies in maintaining the documenter's involvement with the historic fabric. She warned,

> As we go into the digital age, the stress and need should be about getting engaged with the building. I think, [technology] is a good tool and has values, but we spend less time in the field and more time in the office. [569]

The interviewees felt that producing sketches of the structure mediates documenter's experience. Hence, Warden and Woodcock stressed the significance of sketching during documentation:

> Sketching requires time, judgment, and interpretation. The sketch rarely emerges perfectly but is massaged and reworked many times, with success measured against the norm of the building. That norm is also virtual in nature, because a true elevation experience is impossible. The person making the sketch must constantly reconcile abstract differences between the building and the sketch and this process forces the sketcher to engage the building through questions pertaining to dimension, proportion, and scale. [570]

Brinkman asserted that the documentation team has "more on the ground engagement" with the historic setting than the local inhabitants do. [571] In some cases, such as the Pueblitos of Dinetah, in Rio Arriba County, New Mexico, the actual site is so remote that local people cannot even visit it. They have a vague idea about the condition

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[568] Whitacre, *Interview*.
[569] Lavoie, *Interview*.
[570] Warden and Woodcock, "Historic Documentation: A Model of Project Based Learning for Architectural Education," 113.
[571] Brinkman, *Interview*.

of the site. Consequently, the documentation team gives the community an actual link with the reality of place. Brinkman felt this type of situation culminates in intense communication between the team and the local populace about heritage documentation.

Throughout the interviews, most of the respondents discussed the value of digital 3-D surrogates for creating a simulated experience of the historic setting. For people who have not been at the site or who are not planning to go, “walking through the site, and flying around the world” opens new perspectives to cultural heritage.[572] Furthermore, the interviewees praised the educational and research value of the digital copies. The physical properties of a site preclude the historic structure from being exhibited in a museum or studied in a classroom setting in its existing scale. However, the digital version can be put to myriad uses in a museum, classroom, or laboratory. The digital model could be a museum display, a historic preservation project, or an interactive demonstration used for teaching students about cultural heritage.

It is my belief, however, that there is a conceptual difference between the documenter’s first-hand encounter with the artifact, and his use of the digital surrogate to obtain information. In this case, the digital model provides important heritage information, thus it is vital for heritage projects. Yet, it is an interpretation of the existing artifact and not the actual structure. The documenter’s experience is limited to the level of information the 3-D media holds and communicates. It is important to keep in mind that such virtual experience will always remain a simulation, and therefore, a different form of mediation than the real physical structure.

[572] Whitacre, *Interview*.

One of the undercurrent concerns in the interviews was the issue of archiving digital data. The respondents concurred that the Library of Congress will not accept any digital files until some industry standards are established. Right now, HABS professionals store all project data at the office. However, the challenge lies in "how far can [HABS] go in retrieving old digital data? Can [HABS] even open the CADD files from the Lincoln Memorial made fifteen years ago?" [573]

It is because of this issue Lavoie stated that for HABS work, field notes are vital.[574] The drawings with dimensions are first-hand information from the heritage asset, and professionals can always access these tangible field notes and drawings that were inscribed on paper. However, when the documenter collects field data digitally, it does not provide the same stability. Due to the unresolved archival issues regarding preservation of digital data, the field data can vanish because of catastrophic loss, unintentional alteration during migration of the data, or upgrading of software to newer formats. Even printing the digital data is not a true solution to the problem because many digital documents, such as 3-D data, cannot be meaningfully printed at all because it loses much of its uniquely digital attributes and capabilities if it is printed. Furthermore, the documenter has to worry about how to lay out the dimensions and determine the scale in the 3-D data. Once the digital data is printed, it is no longer directly machine-readable, which means it can no longer be copied perfectly, transmitted digitally, searched, processed by computer programs, etc.[575] Despite these issues, the respondents

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[573] Lavoie, *Interview*.
[574] Ibid.
[575] Rothenberg, *Avoiding Technological Quicksand: Finding a Viable Technical Foundation for Digital Preservation. A Report to the Council on Library and Information Resources*, 9-10.

felt confident that these archival issues will eventually be resolved because of rigorous collaboration efforts between the Library of Congress, HABS/HAER/HALS, universities, and research institutions.

Something else discovered during this study was the 20th century thinkers' discourse on technology, which overlapped the discussion of documentation technologies. Investigation of the impact of mediated practices has not received a great deal of attention in documentation discourse, due in part to the difficulty in examining aspects of the technological practice that are taken for granted. As Heidegger proposed, humans do not much consider the tools and techniques they use, except when they break down.[576] People expect the tools to be "ready-at-hand" when needed, and prefer tools to disappear from their direct awareness during the act of work. For example, the use of a pen, paper, tape measure, computer, total station, or laser scanner is best when they facilitate work, i.e., when they become completely transparent when used for documentation. However, when the tool breaks down, it loses its transparency and appears "present-at-hand."

Investigation of mediated tools outside their "ready-at-hand" and "present-at-hand" status revealed two significant issues. Ihde stated that tools and techniques grant allowances while also constraining certain actions.[577] In addition, through transparent engagement with media, the user passes over, or ignores the unintended transformations of the task and product. For example, as stated in Chapter VII, laser scanning allows the practice of recording a structure in just a couple of hours while constraining the

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[576] Heidegger, *Being and Time*, 103-104.
[577] Ihde, *Technics and Praxis*, 21.

documenter’s immersion in the historic setting. The documenter can improve the accuracy of the field data, increase his or her ability to edit and share heritage information, and enable repeated use of existing work. However, the documenter gives up a lot of personal investment in the craft of experiencing the structure through his or her empirical observations.

The process of heritage documentation is typically mediated by the use of an ensemble of tools. The opposite is also true. The use of any form of media is to engage in a process of mediation. For example when the documenter uses a camera, he is mediating between the senses and the surface being recorded. He uses a camera because it enhances his or her ability and capacity to capture. However, it also slightly distorts perspective and proportion, and only captures a 2-D presence of reality. The camera filters out all the existing details that exceed its frame.

A measured drawing is also a commonly used form of media that allows the representation of the features of a structure. The measured drawing is a surrogate for the real place, telling the viewer what he needs to know about the asset such as the layout of the building, elevations, or the roof truss system. However, the delineator cannot include all the information on the drawings. Rather, the documenter selects important architectural information and compiles it in plans, elevations, sections, and other detailed drawings accordingly. However, these simple depiction failures mask a fundamental issue of media, which is that all tools allow only certain kinds of depiction. In the measured drawing, through the reduction that makes depiction possible, some features are structurally excluded and avenues of vision are therefore cut off.

Ihde, in particular, was concerned with the intense technological instrumentation needed in scientific research.[578] Scientists use and depend on technologies for all their work, much as the documenters depend on digital tools, to gain true knowledge of the world. If the scientist is no longer depending on his or her own empirical observations and relies solely on instruments, then how can he be sure of the quality of the information being filtered by the instrument? Ihde's criticism is also true of heritage documentation. Every form of documentation media has a field of possibility that is also its limitation. Therefore, in order to proceed to a prolific integration with digital technologies in any project, the documenter should be aware of what has been filtered out in the representation --what he does not see. This understanding involves a shift from seeing documentation technologies as simply functional tools, to seeing them as a part of the process that involves context of use. Such contexts limit the range of possible expression or action allowed by that tool or media. A drawing can only depict those things that can be rendered through its two-dimensional system of projection. A camera can only record what falls in its field of view. A laser scanner does not capture any information beyond its range.

Along the same line, McLuhan's interest was in documenting the consequences of humans' use of media and to prophesize about the effects of the emerging new media. He believed that all types of media profoundly change the structure of human interaction and experience in the world.[579] Of particular value to the current study is his

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[578]Ihde, *Technics and Praxis*, 37-38.
[579] Wachtel, "Did Picasso and Da Vinci, Newton and Einstein, the Bushman and the Englishman See the Same Thing When They Faced the East at Dawn?, or Some Lessons I Learned from Marshall Mcluhan About Perception, Time, Space, and the Order of the World," 123.

conceptualization of media, “the medium is the message.” Every human action is mediated one way or another, much the same as documentation activities are mediated. The form of the medium determines the way in which the message is perceived. McLuhan stated that such technological tools and processes act as extensions of humans’ bodies for what they enable them to do.[580] A tape measure acts as an extension of human hands by allowing the documenter to obtain measurements. Similarly, pen, pencil, and computer all extend the documenter’s capacities, thereby enhancing the practices of writing, drawing, and thinking.

McLuhan was concerned that humans are inclined to focus on the obvious and ignore the changes that are introduced subtly or over long periods. Whenever there is a new technology, people consider first what it will do, as well as the advantages and disadvantages of the tool. However, after some experience with the tool, people discover there are some effects of the tool they were entirely unaware of in the beginning. Many unanticipated consequences of technologies stem from the fact that people do not consider possible effects in their planning. New technologies work unnoticed and implement a “change of scale or pace or pattern” to human activities. The “message of the medium” is not the content or use of the technology, but the change it brings to cultural and social dynamics.

Throughout this study, many of the interviewees advocated the advantages of laser technologies in heritage documentation, and anticipated a future with intense scanning applications. As the abilities of laser scanners enable documenters to acquire

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[580] McLuhan, McLuhan, and Staines, *Understanding Me: Lectures and Interviews*, 57.

information from any type of historic surface remotely, future technology development suggests a discipline that is less dependent on direct human control. This could mean that heritage professionals may never know exactly what a documentation project without any human monitoring might have entailed. Perhaps most obvious is the potential achievement of “relief in a certain amount of fieldwork.” [581] However, even as heritage professionals rely increasingly on technological mediation, it is questionable if a computer script could resolve all contingencies in the field. After all, computers do not have the same capacity as human ingenuity to anticipate difficulties encountered on site.

Heidegger believed that autonomous technology restructures everything into a new framework or a configuration, and dominates how humans come to see and know the world around them. In Chapter VII, the comparison of hand recording and laser scanning surveying provided significant examples of the Heideggerian account of technology. The projects demonstrated that the utilization of the laser scanner has indisputably accelerated and facilitated the collection of data in the field. On the other hand, the use of laser scanners directly alters the form of the information as well as how it is collected and understood. The new form and arrangement of scanned data has also created a need for a new type of expertise among heritage professionals because they face a host of new kinds of decisions when planning and implementing a cultural heritage project. The logistical challenges of transporting the scanning equipment to the field, using the scanner while controlling field contingencies, and deciding how to

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[581] Schara, *Interview*.

translate the data into project products are just few of the issues that professionals must address in the projects.

Heidegger was acutely aware of the fact that technological transformations could instigate intense philosophical discussions. He considered the functionalization of man and society to be a destiny from which there is no escape. However, his ambition was to explain that technology is a cultural form through which everything in the modern world becomes available for control.[582]

Heidegger, McLuhan, and Ihde felt technology is an overwhelming force that challenges humans' relations with the world, and technological mediation tends to hinder the essence of being human. What characterized the visions of all three men is the crucial role that technology plays in defining reality, in operating as an invisible backdrop within which the content or entities of the world appear. It is my belief that heritage documentation is a significant venue in this highly technologically mediated world, and that it can represent values and meanings regarding what makes people human.

Without a doubt, digital technologies have opened up new project possibilities, as well as expanding the "[documenter's] expectations from a documentation project."[583] However, the rigor of attaining increased precision and eliminating human mistakes during the documentation process could lead to a complete separation of the documenter from the historic environment, thus trapping heritage documentation in technological instrumentation. On the other hand, heritage documentation is an intellectual pursuit

[582] Feenberg, *Questioning Technology*, 183.
[583] Lockett, *Interview*.

built on scientific research, knowledge, memory, and experience. It deals with the physical remains and cultural context of the past. Hence, whatever technology the heritage professional uses to document the historic environment, his or her personal, social, or cultural engagement with the historic setting should be integral to all efforts.

The Future of HABS

HABS occupies a unique position in the historic preservation realm in the United States. The organization's work spans diversified state, federal, private, and educational agencies while orchestrating vast multitude of projects with different scales and scopes. HABS started as a documentation program to safeguard architectural heritage for future generations and its mission has broadened in regards to historical epochs. After WWII, the program evolved into an education platform for student architects. With the passage of the National Heritage Preservation Act in 1966, the federal government broadened the definition of national historical significance to include structures of state and local importance. HABS became the central program for this new emphasis. In 1983, with the publication of the Secretary of the Interior's Standards, HABS/HAER documentation methods became the benchmark for recording preservation activities by government agencies.

HABS is a cultural institution morphed by architectural culture. The changes in drawing styles from Beaux-Arts to methods used today exemplify the intertwined nature of the program with the current architectural philosophies. In addition, HABS' efforts to utilize innovative technologies demonstrate the need to keep up with current documentation methodologies, as well as continuing to utilize manual fieldwork and measured drawings. However, advances in the documentation realm have created a demand for 3-D applications and images. In this context, in order to ensure HABS remains a viable institution in the future, there are some practical considerations to be undertaken.

The most prominent pattern to emerge in the course of this study was the need to classify HABS into discrete categories. All the respondents have specific ideas regarding HABS and heritage documentation. However, all these notions were mixed and their adequacies foiled by their combination with others. Of greater complexity are the ways in which this mixing and combining of notion of HABS documentation were carried out in practice in regards to drawing and technology. Three categories concurrent with the interviewees' beliefs arose from this study: (a) documentation for posterity, (b) documentation for student architects, and (c) documentation for preservation projects.

HABS documentation is made for posterity. In other words, HABS drawings are available for the public to see. Given this, HABS documentation is designed to reach out to as many stakeholders as possible. The HABS collection, along with HAER and HALS collections, are copyright-free resources that anybody can access from the Built in America website. The collection continues to grow and is the most highly accessed online collection at the Library of Congress.

The respondents agreed that 3-D digital representations are increasingly gaining momentum by facilitating distribution of heritage information and engaging more stakeholders.[584] At present, HABS already provides 3-D scanned data to the project sponsors for facility management and preservation purposes.[585] Until now, HABS collaboration with the Library of Congress has orchestrated a profound heritage campaign revolving around 2-D drawings. This official partnership should persist and continue to promote 2-D drawings as a communicative and representative tool. Yet, in terms of reaching different circles of people, HABS must utilize additional venues to distribute 3-D information. HABS 2-D drawings, supported with 3-D data, can be used at universities, exhibitions, museums, digital collections, etc. By investing in ways to distribute 3-D information, HABS could be a central figure in future digital documentation.

In the midst of contemporary digital architectural culture, HABS is one of the few institutions that provide hands-on training to architectural students. Consequently, HABS efforts are crucial in continuing the drawing tradition and providing a platform to connect documenters to historic settings. HABS should persist in encouraging students to sketch and analyze buildings through drawing them, as well as continuing to encourage intense manual fieldwork. Student interns should be exposed to hand measuring and producing field notes while working on supervised documentation projects.

One of the acute shortages in the field of historic preservation is that of heritage professionals who are specially trained in digital technologies. HABS has already become a de-facto school for many of the heritage professionals. However, HABS

[584] Whitacre, *Interview*; Lee, *Interview*.
[585] Lockett, *Interview*.

should also focus on channeling student architects into the effective use of technological media. In addition to the interns, HABS must reach out to more students and young professionals through universities, research facilities, workshops, and symposiums. By providing a platform for students to improve their technological skills and to learn how to implement them effectively in documenting cultural heritage, HABS can have a hand in remedying this shortage of trained professionals.

HABS documentation has a wide audience in preservation practice. Many professionals use HABS drawings because of their quality and accuracy.[586] Contemporary preservation work is substantially mediated by digital drawings. The necessity to morph the data into other formats as project requirements unfold and to distribute information electronically, encourages professionals to use digital drawings. In this context, manual drafting may not be the most efficient scheme of a preservation project. If a heritage professional has to use a manually drafted HABS drawing, he may have to digitize the drawing. For that reason, HABS professionals have extensively used CADD since the 1990s to distribute the electronic drawing files to interested preservation parties. In terms of maintaining the widespread use of drawings in preservation purposes, HABS should continue producing digital drawings in the future.

Digital technology applications undeniably constitute an important aspect of preservation practice. Technology has challenged drawing methodologies, recording, and documentation strategies. Now, a new era has begun with heritage professionals' intense use of 3-D applications. The private practitioners consulted in this study asserted

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[586] Edgington, *Interview*; Schara, *Interview*; Valenzuela, *Interview*.

that the sector is in desperate need of industry standards and guidelines for digital mediums, in particular for laser scanners.[587]

Generally, professionals pursue two venues to obtain scanned data. Documentation professionals undertake scanning by implementing their personal surveying experience, and this venue maintains more of a trial and error strategy approach. In addition, they commission a firm or organization that is specialized in scanning to obtain the data.[588] However, because the documenter lacks the scanning practice, he can become dependent on the scanning agency to manipulate the data. The situation is similar for HABS in-house projects. At present, HABS use of innovative technologies is confined mostly to the headquarters in Washington, DC Usually a HABS branch teams up with the Washington office to conduct the scanning campaign and produce the drawings, but sometimes it will outsource the scanning to universities or private non-governmental agencies.[589]

All the respondents emphasized the importance of creating guidelines for using 3-D laser scanners.[590] The procedures for scanning an industrial complex, a vernacular structure, or a statue, and generating the drawings seem straightforward. However, the means of acquiring the project requirements are intrinsically different. The interviewees indicated an urgent need to produce a set of guidelines for recommended practices for using laser scanning technology and standards that the point cloud data should meet in

[587] Edgington, *Interview*; Valenzuela, *Interview*.
[588] Browne, *Interview*; Smith, *Interview*.
[589] Whitacre, *Interview*.
[590] Edgington; *Interview*; Lavoie; *Interview*; Lee, *Interview*; Lockett, *Interview*; Valenzuela, *Interview*.

diversified documentation projects. The consensus was that HABS should be a leader in these efforts of development of guidelines and standards.

Recommendations to Heritage Professionals

Heritage documentation is a mediated practice based on the premise that professionals use an ensemble of technologies (paper, pen, scanning technologies, etc.) as well as surrogates for architecture (drawings, digital models, etc.) during a project. Even though types of mediums have changed over time, the utilization of media has always been integral to the field of documentation. However, Warden warns that, at present, technology is "[outpacing] documentation methodology and challenging academic and professional practice to keep up."[591]

The characteristics and possibilities of digital media develop so rapidly that any listing is bound to be outdated. Three dimensional laser scanners are definitely target in heritage documentation. Much criticism has been leveled both against and for this medium. However, the professionals' technology predictions are futile. Nobody can foresee what will happen in the next ten years in this field. In fact, given the rate of change in the last decade, even ten months seems overly ambitious. Therefore, it is extremely important to maintain a balanced practice by using multiple forms of media, rather than concentrating only on one tool.

All heritage projects involve issues of logistics, time, and cost, and each of the methodologies has its own advantages and drawbacks. The practical result of intelligent

[591] Robert Warden, "Towards a New Era of Cultural-Heritage Recording and Documentation," *APT Bulletin* 40, no. 3/4 (2009): 8.

project planning is that most projects typically involve a combination of the various field documentation methodologies, including traditional hand measuring and digital technologies. Each of the devices described is simply an item in the documenter's tool kit. While advances in digital technology have revolutionized the documentation process, ultimately, as with any technology, selective and appropriate use of the available tools is what results in a successful documentation project.[592]

It is certain that 3-D images will be a part of the future. These surrogates have practical advantages over 2-D drawings in terms of demonstrating photographic reality and being able to constitute a part in any digital domain as well as offering the promise of far greater universality. However, the vital issue that threatens documentation projects is the temptation to leave the 3-D data as it is and not produce drawings by hand. This jeopardizes all the tangible and intangible qualities that the act of drawing brings to the process of documentation as well as to the documenter's intellectual development.

Technologically mediated documentation represents the domination of the desire for efficient production over humanitarian content. As the documentation field becomes increasingly mediated through digital technologies in order to provide the conditions for a more objective and scientific approach, the documenter is increasingly separated from the historic setting. Evidently, time and budget constraints mean that contemporary practice cannot afford to spend long weeks needed for hand surveying or hand drafting, as has been done in the past. In this context, digital technologies facilitate fieldwork, as well as facilitating editing and distribution of heritage information. However, there is a

[592] Lavoie and Schara, "Reinforcing Our Structure, Enhanced Standards, Methodologies, and Outreach," 80-81.

need to overcome current stagnation in the practice. This can only be achieved by acknowledging drawing as a means of analytical thinking that makes the invisible qualities of architecture visible. The heritage professional has to establish a balance between instrumentality and acquiring the powers of architecture. Although the scheme of a project is digitally mediated in many aspects, the documenter has to allocate personal time to become immersed in the historic setting through the act of drawing. He continues to measure and sketch both the significant features and general context of the asset. Otherwise, the architectural worlds created in the past slip further away from documenters' awareness and beyond their intellectual capabilities.

Further Issues

Due to the physical limitations of this study, not all significant issues facing heritage documentation and HABS could be addressed. However, further research is recommended regarding the conceptualization of HABS in the international preservation arena, the relationship between HABS and private practice, the physical understanding of HABS drawings by K12 students, the student architects' perception of 2-D and 3-D representation, and the archival issues of the digital data.

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APPENDIX A

RECRUITMENT EMAIL

Dear __________,

I am writing this email in order to get your guidance for my dissertation called The HABS Culture of Documentation with an Analysis of Drawing and Technology.

I am a PhD candidate at the Department of Architecture, Texas A&M University. I am an architect who has been working on diversified cultural heritage projects including the Pointe du Hoc Project, Normandy, France (2008), and Digital Statue of Liberty Project, NYC, USA (2006). I am, in particular, interested in the utilization of digital technologies in heritage recording and documentation. My dissertation, aims to map the state of the art surveying in the heritage field, understand the use of digital data in documentation, investigate how digital technologies transform documenter's engagement with cultural heritage and identify their effects on the act of drawing. The methodology of the study consists of in-depth interviews. The interviews are being conducted with HABS professionals, academicians and private practitioners who have been using digital tools in their projects.

_________ suggested that your extensive knowledge and practice experience in digital documentation projects would be a tremendous insight to my study. I believe your conceptualization of heritage recording and documentation, how you approach digital means and drawing in this understanding would be a tremendous contribution to my study broadening my perspective.

I was wondering if you could allocate time for an interview at your best convenience.

Thank you so much for your guidance.

Best regards,

Serra Akboy

PhD Candidate

Department of Architecture

Texas A&M University

3137 TAMU

College Station, TX

APPENDIX B

CONSENT FORM

The HABS Culture of Documentation with an Analysis of

Drawing and Technology

You have been asked to participate in a research project studying the utilization of digital tools in heritage recording and documentation. You were selected to be a possible participant because you have been extensively involved in diversified documentation projects.

If you agree to participate in this study, you will be asked to answer questions regarding your experience in documentation projects, your conceptualization of the digital tools in these projects and your understanding of the HABS documentation standards. This study will take 60-120 minutes.

The risks associated in this study are minimal, and are not greater than risks ordinarily encountered in daily life. The possible benefit of participation is that this study will allow the participant to voice his/her ideas regarding documentation in an academical setting and be a part of a study that has been exploring ways to bridge the gap between HABS documentation standards and private practice.

Your participation is voluntary. You may decide not to participate or to withdraw at any time without your current or future relations with Texas A&M University being affected.

This study is going to be confidential and the records are going to be used in my dissertation. The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only Robert B. Warden (professor) and Serra Akboy will have access to the records.

If you have questions regarding this study, you may contact Serra Akboy, 9797039011, serraakboy@yahoo.com, or Robert B. Warden, 9798457850, Rwarden@archmail.tamu.edu.

This research study has been reviewed by the Human Subjects' Protection Program and/or the Institutional Review Board at Texas A&M University. For research-related problems or questions regarding your rights as a research participant, you can contact these offices at (979)458-4067 or irb@tamu.edu.

Please be sure you have read the above information, asked questions and received answers to your satisfaction. You will be given a copy of consent form of your records. By signing this document, you consent to participate in this study.

___ I agree to be audio recorded.

___ I do not want to be audio recorded.

___ I agree to be video recorded.

___ I do not want to be video recorded.

Signature of Participant:

Date:

Name of Participant:

Signature of Researcher:

Date:

Name of Researcher:

APPENDIX C

CONTENT ANALYSIS AND SORTED CATEGORIES

Drawing

The documenter learns about the building by drawing it.

Drawing forces one to realize details.

Drawing existing structures provides an understanding of material, construction, and structural issues.

Drawing is a communication tool.

In the digital age, the stress should be given to the act of drawing.

Student architects should be exposed to the act of drawing.

Drawing is a means of engagement with the historic environment.

It takes too much time to produce “hard-line” measured drawings.

HABS outreaches student architects by the Peterson prize.

2D Drawing

2D drawings are the most important record of a building.

2D drawings are the building.

Measured drawing is the best way to communicate a building.

2D representation is the best way to reveal the significance of the heritage asset.

2D representation is not enough to represent inherent characteristic of cultural heritage.

2D drawings are hard to interpret unless one has an architectural training.

2D drawings are for architects.

2D drawings are easy to interpret by lay-people.

Elevation drawings are more readable to lay-people.

It is hard to show movement in a 2D project.

It is hard to represent archeological sites with 2D drawings.

It is hard to represent industrial sites with 2D drawings.

2D drawings lack the presentation of movement.

Level of detail and quality depends on the skill of the drafter.

3D Models

The user has to have computer knowledge and skills to utilize a 3D model.

The user can visualize the heritage environment as close as to the real setting through the digital model.

3D models are useful to provide the virtual experience of the historic environment without visiting the actual place.

3D models are beneficial for education and heritage tourism.

3D models do not reveal the significance of the site; the viewer just views the model.

3D models provide more experience of the historic setting than the 2D drawing.

Animations are useful to show dynamic features such as movement of machinery.

New generation of student architects is used to work with 3D data.

BIM is becoming more crucial in the heritage practice.

Architectural firms started to have BIM departments.

3D models are good for gaining a better understanding of the spatial environment of a built environment.

3D models are the best way to understand a space.

3D models are good at portraying the structure from inside, outside, at a distance, and which give you a connection to site.

3D models help to communicate spatial experience.

3D models are the best way to understand a place.

3D models are good for showing the whole building and environment in its three dimensionality.

3D models are good for providing an infinite number of perspectives.

3D models are discussed as having a high level of immutability, meaning they have a believable presence, and are thus a convincing form of representation.

Digital Data

There are no standards for digital data.

Each digital tool comes with its proprietary (closed source) software to process the data. One has to have and how to use the accompanying software to view and use digital data.

The utilization of digital data has to be defined in heritage documentation.

Digital data is easy to access during the project; it facilitates data sharing.

Young generation is used to work with digital data.

Digital data is a skill dependent medium. It requires pre-requisite skills in hardware as well as software.

Process relies on existing knowledge of digital process.

The structure of the medium alters how one deals with the subject at hand.

Technology

Advanced technologies have been constantly changing documentation practices.

It is hard to establish guidelines to the advanced technologies because they are so new.

It is hard to establish guidelines to the advanced technologies because they change so rapidly.

Cutting-edge technologies are expensive.

Advanced technologies create a safer field work environment.

Advanced technologies expand the documenter's expectations from the project.

Advanced technologies expand the scale and scope of heritage projects.

Digital technologies reduce the direct engagement of the documenter in the field.

Digital technologies offer new solutions to heritage inquiries.

Digital technologies create a virtual environment; in which the user has a different sense of experience.

Virtual heritage environment can engage younger generation to cultural heritage.

Future of heritage recording and documentation will be more digitally mediated.

Technologies expanded the expectations of the documenter from a project.

Technologies open new work flows in a project.

Technologies generate new working ideas in a project.

A substantial learning curve is required to implement new technologies in heritage projects.

Technology is useful to circulate the data in the agencies; double-check; do corrections and red-lines.

Heritage Recording and Documentation

Heritage recording and documentation is an interdisciplinary setting.

One can not save every historic asset; but it is fundamental to capture the story for future generations.

Heritage recording and documentation is to create an understanding of cultural heritage.

Heritage recording and documentation is to understand how a building type has evolved as well as within the historic context.

There is a necessity to develop standards and guidelines.

Documentation should not be kept in the drawers; but should be shared with people.

Technologies make gathering the field data faster and easier.

In heritage documentation, advanced technologies are not always the solution.

It is hard to get some features digitally.

There is no one certain flow of scheme of documentation work; it is always different; it always changes.

Different media or forms of mediation allow and restrict the flow of ideas differently.

Heritage recording and documentation provides memorable experiences to the documenter.

The documenter is at the place where the craftsman nailed the last nail.

Issues that never come up in the classroom arise on the job site. Structure, detailing, design issues, and construction strategy are all debated in the hands-on atmosphere.

HABS

HABS started in 1930s to represent the building as best as possible.

HABS started as a last defense to modernism.

HABS started as a last defense to industrialism.

HABS is the continuation of the Ecole of Beaux-Arts.

HABS started as an architects program, but has evolved to a cultural institution with more responsibilities.

HABS collection is a great resource for anybody to learn about American culture.

HABS utilizes current recording and documentation practices.

If HABS falls behind current methodologies, people can not contribute to the collection.

HABS has to use current methodologies, to expand the collection.

HABS do not have the resources to experiment with every technological tool in the market.

HABS do not have the resources the institutional infrastructure and to create standards and guidelines for new technologies.

HABS should continue providing an education platform to student architects.

HABS should be a leader in educating architecture students.

Education is not HABS concern; HABS should focus on documenting historic structures.

HABS should be a technology leader.

HABS should be the archival leader of the entire documentation.

HABS opens a world of opportunities to students.

HABS Documentation

HABS documentation is for posterity.

HABS documentation is to make a permanent record of the historic structure.

HABS documentation should outreach as much stakeholders as possible.

Through Library Congress, HABS publicizes heritage information.

HABS should explore digital media to outreach more stakeholders.

HABS should work out ways to easily use and view digital data with public.

HABS mitigation documentation is not the substitute for tearing down historic structure; we need to preserve them.

HABS documentation started with buildings with a cutoff date of 1860, similar structures; it has gradually expanded to encompass larger structures and complexes.

HABS is a great academic experience.

HABS Drawing

HABS drawings are used for restoration purposes.

HABS should add 3D data to the drawing set.

HABS drawing will not change in the future.

HABS drawing will be more 3D oriented in the future.

HABS drawings will incorporate color.

HABS drawing has an educated touch to illustrate the significant aspects of the architecture.

HABS drawings are created as a result of an intense historical research.

HABS drawings differ from construction drawings. HABS drawings do not have to demonstrate all the cracks, fault, deflection, and detection.

HABS drawings are a mixture of interpretation and reading other ideas into it.

HABS Standards

HABS Level I, II, III, IV is the federal standard for documentation.

HABS standards are for the final product-written history, large-format photography and 2D measured drawing-.

HABS has photography requirements on how to approach a building; however there is no formal guidance.

Private practitioners use HABS drawings for heritage projects.

Field-notes

Field-notes constitute a significant part of HABS documentation.

Field-notes are first hand field data.

Field-notes should be accessible.

No matter what field-notes on paper will be accessible.

During an intense restoration project, architects ask for the field-notes.

Scan data is problematic for HABS documentation since the documenter has to figure out how to conceptualize scan data as field-notes. She has to print out the 3D data and put dimensions.

Hand-recording

Hand-recording teaches gives one skills in structure and construction.

Hand-recording provides the knowledge of structure, construction and design gained from involvement in historic environment.

The digitalization of environments into bits necessarily transforms the documenter's understanding which can be gained through hand-recording.

Hand-recording involves the engagement of the body, and of all the senses.

Hand-recording gives the designer an actual link with the reality of place.

Hand-recording is time consuming.

Hand recording is labor intensive.

Large-format Photography

Large format photography is the best way to represent the historic structure.

Large-format photography is not enough to demonstrate the architectural significance.

Large format negative has a better resolution than a digital data.

The power of large-format photography lies in the archival stability.

The power of large-format photography lies in the ability to correct optical distortion at the time of capture.

Until digital photography becomes more stabilized, HABS should not abandon large-format photography.

Photogrammetry

Photogrammetry is not preferred in the historic preservation projects anymore.

3D Laser Scanning

Future holds more intense scanning applications in cultural heritage projects.

Laser scanner is just another tool in heritage recording documentation.

Laser scanner is becoming the de-facto recording and documentation tool.

Even though new tools come up; the qualities of scan-data (3D point-cloud) will prevail.

Scanning relieves the fieldwork.

Scanning is beneficial to record large structures, dilapidated buildings and landscapes.

Laser scanning broadened the documenter's capability to record challenging settings.

Scanning reduces the time spent in the field.

The process of generating 2D drawings from scan data is cumbersome.

During the process of creating 2D drawings from scan data, one learns about the building.

Stitching the plans take more time than hand-measuring.

Scan data is not good for plans.

The scanning software is cumbersome to use.

Scanning equipment is expensive.

Laser scanner does not collect field data beyond its range.

Gathering field data is similar in architectural and engineering projects; yet the ways of how to produce the final product is different.

Documenter can generate limitless drawings and models, using the same point-cloud.

Laser scanner has changed the working culture at the architectural and engineering projects.

With the scan data, there is the tendency of not creating 2D drawings.

One needs to have an architectural eye to use the scan data.

Laser scanner creates a safer field environment.

In oil and gas industry, laser scanning saves approximately half a million within a project.

In oil and gas industry, laser scanning saves 8 percent of the expenses in a project with a 2 million budget.

Scanning gives more accuracy.

The need for guidelines for scanning: there is little consistency in the institutions approach to scanning. Many programs differ in method, procedure, and even the theoretical basis upon which they rest.

CADD

CADD facilitates sharing drawings within a project.

CADD facilitates the scheme of a preservation project.

CADD has transformed the way the drawings are being produced.

CADD is beneficial to copy, and array details.

Student architects they master on CADD, but do not know how to do hand-drafting.

New generation of CADD has plug-ins to manipulate point-cloud.

Library of Congress

Library does not accept any digital data.

Library only accepts hard copies of HABS documentation.

HABS prepares final products in accordance to the standards of the Library.

Library does not have enough storage to keep the HABS documentation products.

Library will not accept any digital data unless there is a consensus of some standards and guidelines.

Library is slow to accept changes.

Library is slow to put all the HABS collection online.

HABS collection should be more interactive.

3D models should be added to the collection.

Archiving Issues of Digital Data

How to store digital data is problematic.

Library does not accept digital data due to the archival issues.

HABS does not have any facility to store and archive digital data.

At present, analogue products such as the large format negatives is the only archival solution.

Library, HABS/HAER/HALS, research institutions and private sector should collaborate to find a resolution to the archival challenges of the digital data.

ASCII format is useful to store digital data.

Professionals upgrade digital data to newer formats.

HABS stores digital data at the office; yet it is not a part of the formal documentation.

Professionals do not know if they can open digital files from ten years ago.

Private Practice

Each firm/organization has their own way of pursuing digital mediums.

Private practice does follow HABS standards.

Private practice does not follow HABS standards.

Private practice depends on the quality and accuracy of HABS drawings.

Private practice does not prepare drawings according to HABS standards.

Private practice does not have the time/money to produce HABS drawings.

In terms of laser scanning, private sector and HABS pursue similar data gathering strategies; yet they follow different methodologies for the final product.

Private sector should donate more drawings to the HABS collection.

HABS outreaches private practice by the Holland prize.

Best Documentation Practices

It is hard to determine best documentation practices.

Best documentation practices are an intersection of diversified entities and agents.

HABS is the best documentation practice.

The Association for Preservation Technology International (APT) is a good practice to connect diversified stakeholders.

Federal institutions, private practitioners, universities should collaborate to define technological applications in heritage documentation.

Federal institutions, private practitioners, universities should collaborate to define how to produce diversified final-product.

The production of 2D is the best practice.

The utilization of digital data is the best practice.

The production of the drawing does not have to be same way in every project.

Creating a digital record of cultural heritage is digitally preserving for the future.

Educational Setting for Historic Preservation

The program should be open for everybody.

Historic preservation is an interdisciplinary field.

Students should be exposed to a common ground of drawing as well as technology.

Students should know how to see architecture by producing drawings.

Knowing how to use advanced technologies provide the students a marketable skill.

Students should know which technologies exist in the market.

In the future, students will be expected to know how to undertake scanning.

Laser scanning is too expensive to incorporate in a college budget.

Media distorts the info it holds and communicates information.

Media influences the resulting work.

The documenter has control over how media influences her work.

VITA

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