Accessibility For All: Digitization in Museums

Shayna Diamond
diams01@mail.buffalostate.edu

Advisor
Dr. Cynthia Conides

First Reader
Dr. Cynthia Conides

Second Reader
Noelle Wiedemer

Department Chair
Andrew D. Nicholls, Ph.D.

To learn more about the History and Social Studies Education Department and its educational programs, research, and resources, go to https://history.buffalostate.edu/mst.

Recommended Citation

Follow this and additional works at: https://digitalcommons.buffalostate.edu/museumstudies_theses
Part of the Archival Science Commons, and the History Commons
Accessibility For All: Digitization in Museums

An Abstract of a Thesis in Museum Studies

by
Shayna Diamond

Submitted in Partial Fulfillment of the Requirements for the Degree of:

Master of Arts
December 2021

State University of New York
College at Buffalo
Department of History and Social Studies Education
Abstract of Thesis

Accessibility For All:
Digitization in Museums

The role museums have in society is an ever-changing one. As institutions of knowledge, culture, and humanity, they are subject to the same evolutions as the people they represent, educate, and serve. Thus, as digitization movements have swept the world, efforts to bring museums into the digital age have increased. This paper discusses digitization in the museum context, addresses the digitization of collections and exhibitions, and examines how digitization tools open those resources for public access – in particular for people with disabilities. The aim of this topic is to demonstrate how said digitization can best be utilized for the benefit of both the institution and the public they serve.
Accessibility For All: Digitization in Museums

A Thesis in Museum Studies

by Shayna Diamond

Submitted in Partial Fulfillment of the Requirements for the Degree of: Master of Arts
December 2021

State University of New York College at Buffalo Department of History and Social Studies Education

Approved by:

Cynthia A. Conides, Ph.D. Associate Professor Emerita of History Founding Director of Museum Studies Thesis Advisor

Andrew D. Nicholls, Ph.D. Professor of History Chair of Department of History

Kevin J. Miller, Ed.D. Dean of the Graduate School
Dedication Page

Nothing I do or say will ever be enough to adequately express the depth of my gratitude.

All I've done, all I am, and all I accomplish in the future is made possible with the guidance and support of my intensely loving family. They remind me I am only human; that I need sleep, sustenance, and love, like any other human; that I am capable of great things, regardless of this humble mortality. They encourage, amaze, inspire, and strengthen me.

Every word written here; every drop of blood, sweat, and tears shed; is in honor of them.

Just this one page could never be enough to adequately list and praise all those who aided and inspired me along the way – from family and friends to teachers and mentors. So I'll leave this with an excerpt from Kahlil Gibran’s *The Prophet* which calls to mind the many lessons I’ve been taught by these astonishingly wonderful people.

“Your hearts know in silence the secrets of the days and the nights. But your ears thirst for the sound of your heart’s knowledge. You would know in words that which you have always known in thought. You would touch with your fingers the naked body of your dreams. And it is well you should. The hidden well-spring of your soul must needs rise and run murmuring to the sea; And the treasure of your infinite depths would be revealed to your eyes. But let there be no scales to weigh your unknown treasure; And seek not the depths of your knowledge with staff or sounding line. For self is a sea boundless and measureless.

Say not, “I have found the truth,” but rather, “I have found a truth.”
Say not, “I have found the path of the soul.” Say rather, “I have met the soul walking upon my path.”
For the soul walks upon all paths.
The soul walks not upon a line, neither does it grow like a reed.
The soul unfolds itself, like a lotus of countless petals.”
# Table of Contents

Abstract of Thesis ........................................... i
Title Page ...................................................... ii
Dedication Page ................................................ iii
Table of Contents ............................................. iv
List of Figures .................................................. vi

Chapter 1: Introduction ......................................... 1
  Museums as Institutions Are Changing ..................... 2
  What exactly is Digitization? ................................ 5

Chapter 2: Literature Review .................................. 8
  Digitization Literature ...................................... 8
  Disability Accessibility Literature ......................... 11
  Digitization and Disability Accessibility Literature .... 15

Chapter 3: Computerized Connections ....................... 19
  Digital Details .............................................. 21
  Complications – Because There are Always Some ....... 26
  Benefits of Digitization .................................... 32

Chapter 4: Increasing Public Accessibility .................. 45
  Accessibility for People with Disabilities ................. 47

Chapter 5: Integration Success! ............................... 55
  Tweaking the Tools ......................................... 58
Chapter 6: Ensuring Integration: Case Studies 61

Theodore Roosevelt Inaugural National Historic Site 62

The Kingdom of Hawaiʻi 69

ʻIolani Palace 72

General Suggestions 80

Chapter 7: Conclusion 83

Image Citations 87

Bibliography 90

Appendices 97

Appendix 1 97

Appendix 2 98

Appendix 3 100

Appendix 4 102

Appendix 5 105

Glossary 106
List of Figures

Figure 1: Photograph of head-mounted virtual reality (VR) display and wired gloves from National Aeronautics and Space Administration’s Ames Research Center.

Figure 2: Matterport Pro2 3D Camera.

Figure 3: Photograph of tablet utilizing augmented reality (AR) technology at Museu de Mataró linking to Catalan Wikipedia.

Figure 4: Photograph of tablet utilizing augmented reality (AR) technology with anatomical model.

Figure 5: Image of QR Code structural example with highlighted functional elements.

Figure 6: NPS Accessibility Live Audio Description icon.

Figure 7: Photograph by Ben Davis titled “Seated Statue of Hatshepsut...by my couch”.

Figure 8: Photograph of entrance to the Cleveland Museum of Art.

Figure 9: Screenshot of TR Site entrance from Matterport VR tour.

Figure 10: Screenshot of TR Site dollhouse with Mattertags™ from Matterport VR tour.

Figure 11: Screenshot of TR Site audio STOP from Matterport VR tour.

Figure 12: Screenshot of TR Site presidential desk from Matterport VR tour.

Figure 13: Image of flag of Hawaiian Sovereignty; the inverted Hawaiian flag has come to symbolize a nation in distress and is the main symbol of the Hawaiian Sovereignty Movement.

Figure 14: Screenshot of ‘Iolani Palace entrance from Matterport VR tour.

Figure 15: Screenshot of ‘Iolani Palace grounds from Matterport VR tour.

Figure 16: Screenshot of ‘Iolani Palace Imprisonment Room from Matterport VR tour.

Figure 17: Photograph of musical compositions in Gold Room in ‘Iolani Palace.

Figure 18: Screenshot of ‘Iolani Palace King Kalākaua's Office from Matterport VR tour.

Figure 19: Portrait painting of Theodore Roosevelt.

Figure 20: Screenshot of TR Site Donations Box from Matterport VR tour.
Figure 21: Screenshot of TR Site Interactive Exploration Desk from Matterport VR tour.

Figure 22: Screenshot of TR Site Immigration and Poverty mural from Matterport VR tour.

Figure 23: Portrait painting of King Kalākaua by William F. Cogswell.

Figure 24: Portrait painting of Queen Liliʻuokalani by William F. Cogswell.

Figure 25: Screenshot of ʻIolani Palace Throne Room from Matterport VR tour.

Figure 26: Screenshot of ʻIolani Palace Crowns from Matterport VR tour.

Figure 27: Photograph of King Kalākaua's coronation crown composed of diamonds, opals, emeralds, rubies, and kukui nut jewels with velvet cap and taro leaves.

Figure 28: Photograph of Queen Liliʻuokalani’s quilt.

Figure 29: Photograph of Princess Kaʻiulani in 1897 wearing a pearl necklace.

Figure 30: Screenshot of TR Site Floor 1 from Matterport VR tour.

Figure 31: Screenshot of TR Site Floor 2 from Matterport VR tour.

Figure 32: Screenshot of ʻIolani Palace Floor 1 from Matterport VR tour.

Figure 33: Screenshot of ʻIolani Palace Floor 2 from Matterport VR tour.
Chapter 1: Introduction

“The liquefaction of hierarchies and social functions leads museums to open up; they are no longer closed systems as the used to be in the twentieth-century, but parts of wide systems of scientific, cultural, and territorial relationships. Users are no longer just consumers of cultural products, but they are becoming active subjects of content production and conveyance. The museum of the future either will be a collective work or will not exist. It will be developed and co-created with the larger communities, which will support it and share decisions on it. In this transition, digital innovation provides the infrastructure that multiplies the opportunities for exchange, accessibility and participation.”

Domenico Sturabotti

The role museums have in society is an ever-changing one. As institutions of knowledge, culture, and humanity, they are subject to the same evolutions as the people they represent, educate, and serve. Thus, as digitization movements have swept the world in the last few decades, efforts to bring museums into the digital age have increased. In this paper, I will define digitization in the museum context, address the digitization of collections and archives, and how digitization tools open those resources for public access – in particular for people with disabilities – and interpretation. The aim of this topic is to demonstrate how said digitization can best be utilized for the good of both the public and the institutions themselves.

This paper will be broken into seven chapters: the introduction, a literature review, digitization, accessibility, a guide on optimizing tools, an examination of two relevant virtual reality tours, and the conclusion. This introduction will address the changing role of museums as institutions, what digitization is, and what it means to museums. The literature review offers information on the authors and sources referenced throughout the paper. The digitization chapter will break down the benefits as well as potential complications and challenges inherent in digitization. The accessibility chapter focuses on how digitization increases public accessibility,

particularly in regards to those marginalized groups with disabilities or differing needs. The chapters on optimizing digitization tools and the case studies demonstrate how museums can ensure digitization methods are integrated properly with their pre-existing, traditional methods to achieve the best results using the 3D virtual reality tours as examples. Finally, the conclusion summarizes this paper and its arguments, offering advice to museum leadership on proper implementation and approaches for digitization efforts.

**Museums as Institutions Are Changing**

Along with the arrival of readily accessible internet in the 1990s, museums and other cultural institutions began to explore the possibility of creating online content and applications which could be viewed by this new, remote, international audience.² With limited tools such as Hyperlink Text Markup Language (known more commonly as HTML, a common coding language which easily describes and dictates the structure of a webpage) museums could use the universal, independent nature of Web browsers to provide tools and applications in their galleries and exhibitions as well as publishing in a more accessible, electronic format.³

This first step in disseminating information from their collections online was incredibly progressive of museums, and many have remained consistently dedicated to such digital efforts over the years. One example of such an institution utilizing digitization is the Smithsonian Institution's 12th Secretary, Gerald Wayne Clough who “launched a new era at the Institution.”⁴ Clough published a book through the Smithsonian Institution in 2013 titled *Best of Both Worlds: Museums, Libraries, and Archives in a Digital Age* which is available for free digitally in several formats including standard PDF and through Kindle on Amazon. The free availability of this

---

⁴ Smithsonian Institution, “Former Secretary G. Wayne Clough,” Smithsonian Institution, accessed 25 April 2021, [https://www.si.edu/about/secretary-wayne-clough](https://www.si.edu/about/secretary-wayne-clough).
book through digital means is a further emphasis on both the importance of accessibility and the abilities of digitization to distribute information. This book details the digitization efforts of museums and institutions like the Smithsonian as they work towards integrating technology more thoroughly into their operations and opening their collections, knowledge, and services to the world.

As of 2007, the International Council of Museums (ICOM) defined museums as “a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment.” This means an integral part of being a museum is to make our knowledge, heritages, and objects readily available to the public. Digitization introduces and strengthens the resolve to not only make these available to our physically immediate communities, but to the global community as well.

This importance of sharing with a global audience is undermined only by the fear of change, which can prevent museum professionals from seeing how broadening their audience only enhances their institutions. There is a threatening, self-perpetuating cycle of knowledge and heritage gathering dust and dying in the storerooms of museums and similar institutions, locked away from a public which hungers for understanding and learning. Regardless of the specific causes for this inaccessibility, it will prove itself to be the death of the depth of culture and knowledge in museums. To passively accept this needless death – particularly under the guise of “oh well, this is just how museums always have been” – is inexcusable. Simply because something has always been so does not mean it needs to remain so, and this particular type of

---

indifference is a dangerous mindset for the custodians of such invaluable collections. Passivity here is an active choice to reinforce the barriers which further marginalize and exclude the countless marginalized groups who have the same rights to the collected humanity within museums as those born and raised within ivory towers.

Museums cannot claim a moral or ethical standing in their mission statements if they are not fully committed to increasing accessibility to the greatest degree possible. One cannot be “in the service of society” and yet withhold valuable information and heritage. One cannot acquire, conserve, research, communicate, and exhibit “the tangible and intangible heritage of humanity and its environment” and simultaneously hoard that heritage where the very same “humanity” cannot access it freely. One cannot call their acquisitions “for the purposes of education, study and enjoyment” and yet knowingly accept limitations to the universal accessibility of those collections.

Many museums have demonstrated they are aware of this reality, putting dedicated effort into increasing their accessibility through digitization and other means. The centrality of the public and their communities is growing more and more important to museums, and when this relationship is properly fostered, visitors find themselves attracted to the museum's ability to tell stories they can empathize with and present information and objects with an intimate and authentic point of view.\(^6\) This capacity to affect people not only through thought, but through emotion enables museums to connect with their visitors, regardless of their background or limitations. These limitations, be they physical (such as financial walls, a lack of disability access in the building, etc.) or immaterial (such as inaccessibility for those of differing needs, learning styles, etc.), are becoming less and less substantial, in part through the integration of digitization.

Museums cannot remain locked in a past of antiquated methodologies, but must evolve—in some cases continue evolving—as institutions of knowledge, culture, and humanity. If museums can provide digital supplementation to their physical interactions, then their exhibitions, collections, archives, and immense wealth of information can be accessed by audiences worldwide, even during eras of unprecedented isolation (such as the global COVID-19 lockdowns). Just as museums have evolved and developed policies regarding acquisition, conservation, restoration, preservation, research, communication, and exhibitions, so too must they ascertain the importance of developing and implementing digitization policies and practices.

What exactly is Digitization?

“How do we deal with all the issues regarding what we collect and how do we collect all these digital materials? That’s a question for museums specifically, because our vision is about collecting the present so that we understand our past.”

- Janice Lane & Dafyddd James from the National Museum of Wales

As defined by the Oxford Dictionary, digitization is “the process of changing data into a digital form that can be easily read and processed by a computer”\(^7\). However, within the context of museums and similar institutions, this definition isn't quite thorough or broad enough. To put it briefly, digitization for museums is the preservation and sharing of the wealth of heritage and knowledge in museums through digital and technological means. This process can be done in part through the conversion of information into any of a wide variety of digital formats, creating results which can be presented and thus accessed through an even wider variety of means. This means digitization isn't just scanned documents and online exhibitions as it may once have been considered. It's both two dimensional (2D) and three dimensional (3D) images, object histories, [Footnotes]

---

7 Sturabotti, “Museum of the Future,” 64.
conservation reports, exhibition texts, related publications, physical location of objects, interactive displays, accessibility tools both physically and online, etc. and can include a seemingly endless variety of tools such as collections management systems, gamification, QR Codes, augmented reality, and virtual reality, which will be discussed in-depth as an example of successful integration later.

Other tools such as 3D scanning have sky-rocketed in popularity as well, resulting in initiatives such as Scan the World, hosted on the website MyMiniFactory which aims to “enable a decentralized ecosystem for 3D creatives that promotes creativity and freedom through our shared values.”

This “open source museum” is an “ambitious community-built initiative whose mission is to share 3D printable sculpture and cultural artefacts using democartised 3D scanning technologies, producing an extensive ecosystem of free to download digital cultural heritage.” They phrase it best themselves when they explain that “In making culture accessible, communities are encouraged to share their scans, stories, and creations with the goal to bring tangible heritage to the masses.”

Although many of these very popular 3D virtual reality environments and communities on the Internet have long since been supported by private companies, museums and other cultural institutions have spent the last decade or so beginning to explore these tools as well. Some of these communities, for example, have interests in genealogy, cultural history, performing arts, monuments, literature, and digital art which could lead to a mutually beneficial collaboration with museums. While some museums and similar cultural institutions might not have thoroughly embraced the idea of collaborating with a “nonprofessional online body” yet –

---

11 Economou, “A World of Interactive Exhibits,” 146.
similar to how some might not embrace the idea of utilizing digitization at all – many of those working in the direction of such digitization efforts see resulting success in the reach, value, and relevance of cultural heritage. Museums employing digitization initiatives have found undeniable success in increased accessibility through enabling virtual visitors to learn about their available exhibits, programming, and collections.¹²

Chapter 2: Literature Review

“No man can reveal to you aught but that which already lies half asleep in the dawning of your knowledge. The teacher who walks in the shadow of the temple, among his followers, gives not of his wisdom but rather of his faith and his lovingness. If he is indeed wise he does not bid you enter the house of his wisdom, but rather leads you to the threshold of your own mind.”

Kahlil Gibran

In order to discuss the intersection of digitization in museums and disability accessibility, throughout this thesis I will reference a variety of literature and case studies. These articles and books address digitization in museums, disability accessibility, and the combination of both—digitization in museums as it works to increase accessibility for those with disabilities. Though some authors have works in multiple areas, for ease of both reference and readability, this chapter will be broken down into these three sections. This chapter will briefly examine this literature and their respective authors to provide context to and validity of the findings and case studies.

Digitization Literature

Gerald Wayne Clough, author of several works referenced in this thesis, was the first alumnus to serve as President of Georgia Institute of Technology and held that position for fourteen years before becoming the Secretary of the Smithsonian Institution in March 2008.14 Clough aimed to “help this remarkable institution prepare itself for a new and revitalized role in the 21st century and to ensure that when [his] work was done, an orderly transition to new

---

leadership could occur”. Throughout his tenure, until his retirement in October 2014, Clough broke fundraising records, presided over a wave of institutional change and hires, oversaw the groundbreaking of the National Museum of African American History and Culture, and made accessibility through digitization a priority for the Smithsonian.  

With 19 museums and galleries, the National Zoological Park, and nine research centers, the Smithsonian Institution is the largest museum complex in the world – despite its quaint, informal nickname as “the nation's attic”. The Smithsonian's Digitization Program Office, founded in 2009, “supports discovery through digitization” and boasts “more than 155 million objects and specimens, volumes, and archives”. The program acknowledges that the scale and diversity of the Smithsonian's enormous collections present a unique digitization challenge, which they aim to address by establishing metrics to track their digitization progress, by using cutting edge, high quality processes and technologies to digitize collections, and by exploring ways to enhance the access, use, and impact of their digitized collections. On their website they explain that they “feel a great sense of urgency in bringing our collections online. With less than 1% of the collections on display at any one time, our digital collections provide building blocks and entryways to new journeys of discovery.”

Clough's book, *Best of Both Worlds: Museums, Libraries, and Archives in a Digital Age* greatly inspired the interest of digitization in museums. *Best of Both Worlds: Museums, Libraries, and Archives in a Digital Age* addresses “today's digital revolution” and how the massive and dazzling array of digital tools “offer opportunities for learning institutions all over

---

15 Boyle, “Clough to leave Smithsonian secretary post in fall 2014.”  
16 Boyle, “Clough to leave Smithsonian secretary post in fall 2014.”  
19 Smithsonian Digitization Program Office, “Welcome.”
the world to become more vibrant and accessible”. With chapters like “Fundamental to a Democracy”, “A Smithsonian for One and for All”, “A Changing Role for Museums”, and “Conclusion: Unlimited Possibilities”, Best of Both Worlds: Museums, Libraries, and Archives in a Digital Age provides a thorough basis for digitization in museums and is a must-read for deeper understanding on the innovative movement.

Jonathan Peter Bowen has worked “in the field of computing in both industry and academia since 1977”, and is a pioneering force in digital technologies in museums. Bowen is considered by many to be the “founding father” of webpages such as the Virtual Library museums page (Vlmp), the Virtual Museum of Computing (VMoC), and Museophile Limited, a company aiming to “help museums, through consultancy work and online resources such as the MuseumsWiki, including the Virtual Library museums pages”. These webpages and associated issues are all addressed in Bowen's article “Personalization and the web from a museum perspective.”

Additionally, Bowen's paper “Virtual Visits to Virtual Museums” addresses the opportunities made available to museums and individuals worldwide by the internet and digital tools, and specifically discusses “the rapidly changing technical facilities”. With an extensive

26 Bowen, “Virtual Visits to Virtual Museums.”
section of advice regarding digitization tools, the article explains that when used “wisely and sensibly”, such digital tools conveniently offer museum-related information to potential visitors. As it was published in 1998, this paper was especially useful in offering an older perspective of digitization and efforts to explore beyond the confines of the “traditional museum”. Having this enthusiastic tone demonstrates that those deeply rooted in the traditional model of museums need not be stuck there forever, and that there is certainly room not only for improvement but for integration of new digital tools and traditional methods.

Domenico Sturabotti is the Director of the Symbola Foundation, which was “created to unite and give strength to companies, communities and mind that focus on sustainability, innovation, beauty” and focuses on “innovation and development, beauty and creativity, human capital and territory”. Sturabotti, along with Romina Surace (also of the Symbola Foundation), is also the editor of the article “Museum of the Future: Insights and reflections from 10 international museums.” This article comprises of interviews with 10 museums and institutions internationally: Hermitage, Kiasma Museum of Contemporary Art, MAAT Museum of Art, Architecture and Technology, MUSE Museo delle Scienze di Trento, Musée du Louvre, National Museum Wales, Museo Nacional del Prado, POLIN Museum of the History of Polish Jews, Rijksmuseum, and the Victoria and Albert Museum. “Museum of the Future: Insights and reflections from 10 international museums” was a tremendous inspiration to the digitization theme of this thesis, and many of the quotes opening various chapters and sections are sourced from statements made by the directors, department heads, managers, and researchers within.

Disability Accessibility Literature

Dr. Diana Walters is a Museum Specialist with the Kenya Project of Cultural Heritage without Borders (“an independent Swedish non-governmental organisation dedicated to rescuing and preserving tangible and intangible cultural heritage affected by conflict, neglect or human and natural disasters”). With her background in education, the heritage industry, research, and PhD in museum studies, Dr. Walters “works with museums and cultural heritage as tools of engagement, development and inclusion across many CHwB programmes and activities”.

“Based on questionnaire surveys relating to responses to disability in museums in the United Kingdom and the United States, undertaken as part of a broader research enquiry” Dr. Walters' article “Approaches in museums towards disability in the United Kingdom and the United States” provides an overview of various attitudes towards “the question of disability within museums”. This article evidentially demonstrates the lack of adequate discourse regarding disability access in museums and the negative impacts this has on both the disabled community and museums themselves.

Richard Sandell, Co-Director of the Research Centre for Museums and Galleries, works to develop “collaborative research projects that explore and advance the social role and potential of cultural organisations”. In total, Sandell has published seven books, including *Museums, Equality and Social Justice* with Eithne Nightingale, and *Re-Presenting Disability: activism and agency in the museum* with Jocelyn Dodd and Rosemarie Garland-Thompson, which is referenced within this paper.

---

32 University of Leicester, “Professor Richard Sandell,” University of Leicester, accessed 23 October 2021. https://www2.le.ac.uk/departments/museumstudies/AboutUs/people/Prof%20Richard%20Sandell.
Jocelyn Dodd, also Co-Director of the Research Centre for Museums and Galleries, is “responsible for the strategic direction and development of the research centre and the delivery of externally funded team based research” as well as with research design, managing and contributing to research projects (including their national and international dissemination), contributions to teaching programmes, working to secure external funding, and more. Several of Dodd's numerous publications, which are utilized within this paper, were also written with Sandell, such as “Beggars, freaks and heroes? Museum collections and the hidden history of disability,” “Rethinking Disability Representation in Museums and Galleries: Supporting Papers,” and the earlier mentioned *Re-Presenting Disability: Activism and Agency in the Museum*.

“Beggars, freaks and heroes? Museum collections and the hidden history of disability” is about the neglected representation of disabled people’s lives in museums within their collections and displays. Through the research of a RCMG project, it was found that “wide-ranging collections of all kinds contain a wealth of relevant material” but that this material is “rarely displayed in a way which directly acknowledges its link to disability.” As expressed in the conclusion, the paper argues that “by contesting reductive stereotypes, addressing the “difficult stories” surrounding disability history, and presenting the diverse nature of the disability experience, museums “have the capacity to challenge our understandings of what disability has meant to society in the past and could mean in the future.” They close out their arguments with the warning that if museums “remain reluctant to engage with these issues, they run the risk of positioning themselves in opposition to a society which is elsewhere ready for change.”

---

33 University of Leicester, “Professor Jocelyn Dodd,” University of Leicester, accessed 23 October 2021. https://www2.le.ac.uk/departments/museumstudies/AboutUs/people/jocelyn-dodd.
“Rethinking Disability Representation in Museums and Galleries: Supporting Papers” discusses a wide variety of topics within the disability and museum fields, and are broken down into two parts: “Working Paper 1: Literature review: the representation of disability and disabled people” and “Working Paper 2: Visitor responses to the nine Rethinking Disability Representation museums projects”. The first working paper breaks down the social representation of disability such as “victims or superheroes”, compares the social model and the medical/individual model, historical and contemporary attitudes towards impairment and disabilities, theories on decoding disability representation, and more. The second working paper is significantly longer, covering research methodologies, demographic data, emerging findings, recognizing social barriers, learning opportunities, and the complexity of visitor responses.

The conclusion found in “Working Paper 1: Literature review: the representation of disability and disabled people” is that representations of people with disabilities “are shaped by the social, cultural, and political context”.35 Not only that, but the statement that these are not “static” representations, but are socially and culturally situated by the “non-disabled majority” was particularly eye-opening in how I approached the subject.36 Additionally, the visitor responses in “Working Paper 2: Visitor responses to the nine Rethinking Disability Representation museums projects” were a true inspiration and demonstrated the success as well as the necessity of centering such projects surrounding people with disabilities. In all, “Rethinking Disability Representation in Museums and Galleries: Supporting Papers” was crucial in guiding me toward a framework and tone for this paper that was actively anti-discriminatory and unambivalent.

---

Digitization and Disability Accessibility Literature

Eleanor Lisney is a renowned accessibility advisor, campaigner, aspiring creative practitioner, and public speaker within and regarding the disabled community. Lisney is a founding member of the Sisters of Frida CIC (an experimental collective of disabled women which aims to share experiences, mutual support, and relationships with different networks) as well as a co-founder of Culture Access CIC (an organization which focuses on “supporting access, bringing an inclusive edge intersectionally”). “Museums and Technology: Being Inclusive Helps Accessibility for All”, an article written by Lisney and Bowen, along with Maria Zedda (all noted as having different disabilities, themselves), “explores accessibility issues for museums in the context of growing dependence on technology”. Understanding that improving accessibility is a task of increasing awareness, the paper aims to provide those in the museum field with the invaluable perspective of a disabled person's point of view.

Pete Williams is a Post-doctoral Research Associate based in the Department of Information Studies at University College London and is currently undertaking a major research project entitled “Digital Lives”. Digital Lives is actively exploring how those with learning disabilities use digital technology such as mobile devices, computers, etc. in their everyday lives. The aim is to explore “The benefits, in terms of entertainment, self-expression and possible greater autonomy; and the barriers, such as usability issues, privacy or vulnerability concerns etc.” as well as “How the technology, and in particular the software/apps and interfaces, can be

38 Sisters of Frida Disabled Women, “Event We Are Sisters of Frida Saturday 25th September 12 noon – Join us!”
improved to enable the greater access to the benefits it offers.”42 The hope of Digital Lives is that the results can inform parents, carers, and supporters regarding how they can best use the technology with those with learning disabilities.

One of Williams' publications is an article titled “Using QR codes to aid accessibility in a museum”. “Using QR codes to aid accessibility in a museum” states that its purpose was to describe “visitors' reactions to using an Apple iPad or smartphone to follow trails in a museum by scanning QR codes” as well as “[draw] conclusions on the potential for this technology to help improve accessibility at low-cost”.43 Amongst their findings, they discuss some of the physical and technical problems encountered when using QR codes, possible options to overcome these obstacles, how such a system could be approached with a low equipment-cost, and how maintaining the information attached to QR codes as well as keeping up with technological changes is an on-going process. They also address the use of a “layered approach to information”, the particular appeal of video to “young people”, and how the ability to repeatedly watch a video or listen to audio was especially appreciated by visitors with learning disabilities. This article also addresses that while “the rise of visitor-owned mobile devices may release museums from providing much equipment”, there are no guarantees that every visitor will indeed have such a mobile device. Beyond that, they also comment that “while a loaned iPad can aid accessibility, a visitor using their own mobile-device has the advantage that it will already be set-up with accessibility options of their choosing and will be familiar to them in other ways too”.44

Dr. Alison F. Eardley, a psychologist and researcher of the Department of Psychology at the University of Westminster is focused on museums, access, and inclusion. Dr. Eardley studied English Literature with History at the University of Gloucestershire, received a conversion diploma in psychology for graduates at London Metropolitan University, an MSc in Research Methods in Psychology at the University of Reading, and was awarded her PhD by the University of London in 2004. Dr. Eardley has utilized her research to explore “imagination and imagery in the blind and sighted”, worked within an international, interdisciplinary team to explore “mental representation and movement in people with a disability”, focused on “spatial mental representation in the blind and sighted”, and “[examined] nonvisual spatial mental representation in the blind and sighted.”

Throughout this paper, several of Dr. Eardley's in-depth, researched-based papers are used to illustrate the use of digital tools not only increasing accessibility for people with disabilities within museums, but becoming a shared inclusive approach which considers the needs of all visitors.

One of these articles, “Enriched Audio Description: Working Towards an Inclusive Museum Experience,” discusses audio description (AD) within the museum context and its utility in creating “a verbal description to provide crucial or complementary information that provides access to visually coded messages.” In “Enriched Audio Description: Working Towards an Inclusive Museum Experience” Dr. Eardley explains how AD not only demonstrates superb creative potential for multi-sensory, immersive museum experiences, but also may enhance the experience of the museum as a whole. She demonstrates this with studies in

---

46 University of Westminster, “Dr. Allison Eardley.”
psychology and neuroscience which show direct, multi-sensory perceptual experiences can enhance cognitive processing, which is suggested to increase neural connections and thus play a significant role in our autobiographical memories.49 These autobiographical memories (memory for information which is related to the self) are generally agreed to be recalled by “reconstructing them from a pool of sensory traces in the full wealth of modalities”, which is only increased with additional sensory experiences, such as AD. Thus, the overall sense of “experience” that most visitors may express wanting from their trip to a museum can be strengthened and enhanced with such multisensory techniques, making the inclusion of AD beneficial not only for the visually impaired, but for their sighted peers as well.

Additionally, in 2021, Dr. Eardley, along with Rachel Hutchinson, published an article titled “Inclusive museum audio guides: ‘guided looking’ through audio description enhances memorability of artworks for sighted audiences.” This article discusses how the visuo-centric bias often exhibited by museums can be a challenge (both for those with visual impairments and those without) in their aim to offer visitors engaging and memorable experiences.50 Dr. Eardley uses the findings of this paper to present a positive picture for the future use of AD in museums and strongly urge museums “increase their audio resources and to incorporate AD in their creation.”51 The paper also concludes with a discussion of how these findings have important implications for the museum sector and the changing needs of visitors in a post COVID-19 world, particularly in regards to the creation of online resources.

51 Hutchinson, “Inclusive museum audio guides: 'guided looking' through audio description enhances memorability of artworks for sighted audiences,” 442.
Chapter 3: Computerized Connections

“Along the way we are also moving beyond the conventional, one-sided communications of the traditional museum and learning how to interact with our digital user community. All of our digital activity points to the promise of a new and a more democratized Smithsonian Institution, a Smithsonian for one and for all.”

Gerald Wayne Clough

Museums benefit greatly from the use of interactive technologies, which can offer tremendous opportunities for altering and enhancing how visitors experience and remember the wealth of information and culture they offer. Although museums play an extremely important role in the preservation and dissemination of this heritage and knowledge of humanity, many are weak in regards to their static, inaccessible nature. This is where interactive displays – in particular those utilizing new and trending technologies – come into play. These technological, interactive elements can be QR codes, augmented or virtual reality, audio descriptions, mobile phone apps, and more which aim to meet the needs of contemporary communication, increased accessibility, and positive, enriching experiences for the visitor. In this paper I aim to detail several common technological interactive tools, some of the complications museums can encounter in their utilization, and explain how museums can best utilize these tools to the benefit of the institution and its visitors.

In recent years, the utilization of virtual reality, augmented reality, and other forms of digital integration in many areas of life has grown significantly. These technological advances, particularly as they pertain to museums and interactive displays and exhibitions, have an enormous potential to compliment, enhance, and extend the cultural experience of and access to information within museums in new ways; as well as share said information with new

---

52 Clough, Best of Both Worlds: Museums, Libraries, and Archives in a Digital Age, 60.
audiences.\textsuperscript{54} Indeed, sharing has become (and arguably always was) more important to museums than possessing, and this realization has led many to make their digital collections available with as few restrictions as possible.\textsuperscript{55}

Display and exhibit development is incredibly complex and cannot be completely simplified or automated through the integration of technology in their design. Instead, the experience and intuition of museum professionals and staff is necessary to determine the precise degree to which any of these technological advancements is necessary or beneficial to each exhibition and display. No two visitors, exhibits, or museums are the same, and so the approach should be tailored and customized accordingly. This part of the creative process does not change with the integration of technology. It requires well-conceived objects, creative thinking, understanding of human factors, competent engineering, visitor survey evaluation, and a healthy dose of common sense to design an effective story-telling, technological interaction in a museum.\textsuperscript{56} Without all of them together, not only would each individual element be useless, but any interactive device – no matter how technologically advanced – would fail to communicate the exhibitions' message.

Although different attempts have been made by various authors in a variety of fields to pin down a precise definition of “interactivity” in regards to museum displays, this is not easily done.\textsuperscript{57} In this context, I discuss interactive, technological displays as those utilizing mediums which connect and interact with the human body in some way through the use of electronics. Although this is still a rather broad definition, throughout this paper, this term primarily refers to the use of virtual reality, augmented reality, audio description, QR Codes, and other digital

\textsuperscript{54} Economou, “A World of Interactive Exhibits,” 154.
\textsuperscript{55} Sturabotti, “Museum of the Future,” 5.
technologies which require human interaction to derive different information from the related exhibits.

Digital Details

While a brief description of digitization itself was shared in the “What exactly is Digitization?” section, this section will cover more specific technological terminology used throughout this paper and within the museum field. In this spirit of defining things, we will begin with a brief outline of what precisely virtual reality, augmented reality, QR codes, and audio descriptions are.

Virtual reality (VR) is defined by the Oxford Dictionary as a computer-generated simulation of a three-dimensional image or environment which, through the use of specialized electronic equipment (such as a helmet with a screen inside and gloves fitted with sensors) can be interacted with in a way which seems “real” or physical to the user. Virtual reality has been used for such projects as reconstructing historical environments, interpretation and experience enhancement, increasing visitor engagement and education, “creating interactive, engaging, and immersive experiences in museum environments”, and more.58

Regarding virtual reality, here I want to describe Matterport, the system utilized in both case studies I refer to later in this paper. “With over 15 billion square feet of data and growing,” Matterport boasts their building of “the largest digital library of spatial data and information in the world”, noting that it gets “[even] better” as they're “open for innovation and available to your business.” Matterport is designed to be easy-to-use for clients, advertising that a business or institution can use a variety of capture methods ranging from their very own Pro2 3D Camera, to personal iPhones and iPads for “single room scans, ad-hoc captures, and easy sharing”, to “expert technicians” and their “Capture Services.” Recently, through my work with the Burchfield Penney Art Center, I was fortunate enough to work with the back-end of Matterport, which granted me personal experience in the process of capturing, uploading, and customizing such virtual tours. With this personal experience, I can better explain the strengths and weaknesses of such digitization tools through their execution and customization in the case

---

Somewhat similar, augmented reality (AR) is a step between virtual reality and physical reality in that it combines computer-generated images on a screen with the real object or scene that the user is observing. Put simply, augmented reality crafts an augmented environment by introducing virtual objects into a real environment. The resulting experience is the direct superimposition of physical objects as well as computer-produced objects which have been seen to positively benefit mobility, handle, wearability, environment-awareness, multi-modal, flexible usage, visual alerts, etc. This overlay of information and positive benefits has led to AR being utilized in a wide range of domains from museums and tourism to education and healthcare.\textsuperscript{60}

Quick Response Codes (QR Codes) are a two-dimensional symbol, which were introduced in 1994 and registered by Denso Wave Incorporated. Initially, they were intended for use in production of automobile components, but the patent was released into the public domain and has since been approved as an ISO international standard. QR Codes are now utilized in many diverse fields all over the world, ranging from object tracking in museums and archives, to hospitals for patient identification, blood testing laboratories, bill payment management, unitary identification in agriculture, and more. What differentiates QR Codes from barcodes is the increased amount of data which can be stored within them – this data can include photographs, text, links to websites, and geographical coordinates.

---

Audio description (AD) is a tool used for improving accessibility for people with visual impairment through verbal description. These verbal descriptions explain through speech the visual details of an object or artwork which would otherwise be less accessible or completely inaccessible. AD has demonstrated an enormous potential, not only for those with visual impairments, but also their sighted peers, as the tool may be designed and utilized to “guide people around a painting or object in a way which can enhance the 'seeing' ability of all people, whether or not they have sight.” Furthermore, such multisensory experiences, when combined with semantic or factual information have demonstrated the capacity to enhance memorability.

---

An examination of these cognitive psychological studies, as well as further detail regarding ADs are discussed further in the “Accessibility for People with Disabilities” section.

Figure 6: NPS Accessibility Live Audio Description icon.

Source: NPS Graphics on Wikimedia Commons.

**Complications – Because There are Always Some**

“… There are always complications and there is always a reason for doing nothing. But what is the cost of not doing anything? It is always better to do something, even if little, because in a changing world the worst mistake is to stand still and digitalization is the only way to go.”

Javier Pantoja from Prado

Digitization initiatives, regardless of their depth or breadth, require an investment from museums by way of funding, staff time, or both. This investment frequently ends up becoming hotly debated as museum staff attempt to determine whether or not these investments are worth it in the face of the potential complications. When discussing these possible challenges, however, it is important to attempt to frame it as one would other, more traditional methodologies, since

---

many of the complications digitization can face are similar to those that can be found inherent in more established museum practices.

For example, a museum utilizing digital interactive devices in their exhibitions will face some of the same struggles as when integrating traditional interactive devices. The limitations, cost, and substitution factors are all valid concerns and complications. The approach one must take when determining whether or not to employ these tools is to decide whether the promising benefits outweigh these potential difficulties. And while cost can end up being the ultimate determining factor (as understandably seems to be the case in most areas of museum decision-making), the issues regarding digitization's limitations and the “substitution” fears can be tackled through the easier and more cost-efficient means of integrating digitization thoughtfully.

To combat the fear that digitization tools will only serve to “substitute”, distract, or undermine museums, their use must be standardized through the use of policies and be focused on learning and education, “some of which should be structured and purpose-driven, and some of which should be open-ended and curiosity-driven.” An example of this can be seen in the possible complications of dealing with digitized collections, especially pertaining to those which are to be placed online, which may be handled with the creation of standardized methods and practices. These procedural manuals will ensure that the digitized collections are cared for and utilized properly and, as with concerns a museum might have regarding any new or changing procedure, there should be a comprehensive procedural manual or policy which aims to “establish a consistent set of standards and methods”.

---

There are, of course, limitations to what digitization can do – which is simultaneously a challenge and a relief. No digitally-crafted experience can replace the reality of walking through the doors of a museum. No high-resolution rendering of a statue can perfectly capture the slowly-shifting sunlight moving across its surface. No thoughtful recording of a pre-recorded audio tour can replicate the back-and-forth dialogue of a personable docent and their tour group. Digitization cannot replace reality, so where does the fear it may do so (and thus ultimately damage a museum or similar institution) come from?

While this fear might be seen by the more technologically-adept as old-fashioned or simply techno-phobic, it's important to remember that for many museum staff, their love of history and their collections may feel attacked by the very presence or appreciation of such emerging technologies. In these cases, as noted in the article “Museum of the Future: Insights and reflections from 10 international museums,” it is important for museums to instill a greater confidence in all museum staff about their participation in the digital world. Every individual has unique, invaluable subsets of knowledge which are truly irreplaceable, and engaging with digitization in no way lessens or negates this. With training and open-mindedness from museum leadership, digitization can be integrated into museum procedures as a tool through which this knowledge and expertise can more thoroughly be engaged with and employed.

The suspicion that digitization and technological exhibits will somehow replace traditional, physical museum experiences or will somehow render them inert or unvaluable is, fortunately, truly impossible. The limitations of current technology (and even those of the projected near-future) do not lend themselves to the ability to recreate the complete human sensory experience. The precise weight and texture of holding an object in your hands, the unique scent of old paper or fresh paint, the sensation of rushing air as you move about from
room to room, the distant hum of other visitors' conversations and footsteps. None of that can be replicated or replaced.

This is one of the limitations digital tools face in their incorporation at museums – the overall perception of the ideal use and role of said technologies. Those utilizing and tailoring these tools need to understand that they are not there to (nor are they capable of) completely replacing the current museum experience. They exist to enhance and alter the pre-existing displays and exhibitions in a meaningful way. They aren't there to substitute the current museum experience, but rather to combine with traditional methods and bring the absolute best of the museum forward, to make it accessible and engaging for as many people as possible.

It's when these technologies are used in an effort to replace their more traditional, physical counterparts that they – and their effectiveness – hit a wall. As an anonymous interviewee from a 2020 study published by Applied Sciences noted:

“I think where it gets challenging is when you try to use VR to replace the gallery experience or to provide a gallery experience in a virtual environment. That’s not what it’s good for. It’s good for offering a different kind of experience. So, use VR to create experiences that people can’t get anywhere else. People can walk into museums and galleries all over the world. So, don’t try and make a virtual museum or a gallery, make something else, a studio, a scene, a location, or send them to the moon. But don’t try and create a gallery in there”.

Instead of attempting to completely substitute or replicate the museum experience, museum professionals should seek to utilize these technologies to ensure a more multifaceted experience is made available and accessible to as many visitors as possible. Integration between traditional and new interactive elements is the key to success, particularly as (even before the incorporation of more recent, technological tools) interactive elements in exhibitions and displays have always been important to museums. When utilizing a more interactive method,

---

museums have reported visitors more frequently reporting a heightened level of engagement with the museum and its exhibits. Ultimately, the inclusion of such tools as virtual reality, augmented reality, audio description, and QR Codes shouldn't change the logical and empathetic process by which these exhibits are designed, tested, created, and executed.

Science museums and centers, for example, have become rather ubiquitous with interactive exhibits over the years, utilizing technologies and techniques that history, cultural, and art museums might have been hesitant to embrace. Examining their history of using these interactive tools, several common pitfalls can be identified. These include features allowing multiple users to interfere with one another, options which encourage users to disrupt the phenomenon being displayed, and secondary features which obscure the primary feature of the technology. In general, many traditional interactive exhibits in science museums with such problems can be solved through relatively minor changes to the physical affordances or labels of the exhibit. Museums can limit or segment functionality or create a hierarchy of importance in order to help each exhibit find their “sweet spot” and set their optimal degree of technological interactivity.

Another factor which must be considered in regards to digitization tools is their cost and upkeep. The cost of creating and maintaining these technological, interactive exhibits in particular cannot be overlooked. Even the most traditional interactive devices will inevitably be subjected to a variety of abuse by visitors – from kicking, hitting, and intentional destruction to potential liquid spillage. For this reason, like all museum installations, it is important that the materials used be as durable and easily repaired as possible. The more elements there are to an

---

69 Hashim, “The Integration of Interactive Display Method and Heritage Exhibition at Museum,” 314.
interactive exhibition, the more costly it will be to create and maintain; and while this is true regardless of the level of technology involved, the specialized nature of some of these digitization tools cannot be dismissed.

3D model creation is a prime example of this, as in recent years 3D model creation has become so fast and easy to use that there are several models of high-quality 3D scanners and printers available even for personal, at-home use. Despite this development, museums still require simple, efficient, cost-effective methods of creating the digital exhibitions themselves.\textsuperscript{72} In particular, smaller museums and institutions without the funding for museum staff dedicated to and with expertise in IT would struggle with setting up and maintaining these exhibitions. This would then necessitate hiring or contracting specialists who can take on this work, either creating the devices so that they are more easily repaired and maintained, or fixing the devices themselves.

Certainly, there are technical limitations to all of the technologies I've defined, such as the limited depth perception, tracking and calibration, outdoor use, user experience, overload, over-reliance, and portability with augmented reality technologies.\textsuperscript{73} However, overcoming these limitations and reaching the potential they offer museums comes from combining our more traditional knowledge with a thorough understanding of and interest in these new technologies.\textsuperscript{74} Doing this will ensure that visitors are able to interact with these technologies as easily and naturally as they do real-world objects, further enriching their museum experiences.\textsuperscript{75}

Thoughtful digital integration boils down to understanding both the true utility of digitization tools and their limitations. Rather than fearing these new technologies will replace


\textsuperscript{73} Baker, “Mobile Augmented Reality Elements for Museum Hearing Impaired Visitors' Engagement,” 171.

\textsuperscript{74} Sturabotti, “Museum of the Future,” 17.

\textsuperscript{75} Walczak, “Virtual Museum Exhibitions,” 93.
the physical museum, staff, or the collections themselves, digitization should be viewed like any other tool. Only, this tool uniquely allows visitors through a museum's doors to glimpse the collection within, awaiting a possible future visit, even if the buildings themselves are shuttered. These virtual interactions further benefit the museum by reaffirming to the public that the institution doesn't simply exist, but operates with attention to their community both locally and globally. Such digital engagement has been proven “to drive audiences to seek out the “real deal”, and “[validate] the existence of such cultural institutions when in-person visits are not possible”; a truly invaluable benefit for museums.\(^7^6\)

**Benefits of Digitization**

“Digital is useful to create immersive environments that involve the audience. But a museum is not Disneyland: the user does not only look for an escape, but also for a cognitive development. … Hermitage visitors are like researchers that prefer the museum to outer space as a place of exploration.”

Daria Hooke from Hermitage\(^7^7\)

The potential benefits of these technologies are as numerous and varied as their possible utilities, particularly when considering the issues surrounding accessibility. This can easily be seen as new technologies in museums enable access to those individuals with disabilities who are most often neglected in museum and exhibition design.\(^7^8\) The potentiality of digitization, cliched as it may be to say, is truly only limited by the imagination.

The enhancement digitization can offer even just to museum management is generally considered undeniable, from filing systems (of collections documents as well as financial and administrative documents), to indicators and evaluations on a museum's social standing, to


\(^7^8\) Lisney, “Museums and Technology: Being Inclusive Helps Accessibility for All,” 3.
revisions of strategies based on tracked goals and results, and much more.\textsuperscript{79} Improvements to arguably all management and administrative processes can be clearly made with efficient, thoroughly standardized digital innovations.

As Trilce Navarrete explains in “Digitization in Museums,” even though the use of technology was initially perceived as contradictory for those cultural institutions which revolved around their physical collections, digitization is capable of supporting and enhancing all aspects of the work museums pursue.

“Though we mostly think of digitisation in relation to online exhibitions, digital technology has become essential in the overall management of collections. Museums increasingly connect all the information related to the objects in a digital repository, including images, history of the object, conservation reports, exhibition texts, related publications, and physical location of the objects using a form of barcode. Creating such a repository of information increases efficiency in the work-flow; in effect it substitutes ‘capital’, that is data processes, for labour.”\textsuperscript{80}

Through the use of these digital aids, museums can shift specific information about their collections into a position of availability online, allowing for remote access. This possibility represents the “new working form” offered by digitization, allowing museums to participate in the information economy that is the internet.

With the enormous wealth of potential strictly for museum management acknowledged, I want to specifically touch on a handful of other digitization benefits which are readily identifiable. The four benefits discussed below include supporting collections care, prolonging the life of an object, expanding access to collection storage, and increasing accessibility.

Firstly, digitization supports collections care by strengthening inventory control through electronic record keeping and by providing visual documentation of collection items. Collections are important to museums as, without them, many museums might find themselves unable to

\textsuperscript{79} Horan, “Digital Heritage: Digitization of Museum and Archival Collections,” 11.

perform the basic functions found in their mission statements regarding exhibition, preservation, conservation, research, and interpretation.\(^8^1\) Digitization tools like digital documentation, filing and management systems, and standardized organization all improve the efficiency and accuracy of tracking and inventory control, ensuring curators, researchers, and educators alike are able to find and access what they're looking for, be it the objects themselves, similar items, or associated documents.

Second, digitization prolongs the life of an object in a museum's collection by minimizing handling. The protection of collections involves “both specific and generalized knowledge of varied practices and methodologies to best care for each individual piece to ensure its safekeeping for the future.”\(^8^2\) Objects in museum collections can endure a significant amount of handling, particularly when the institution is research oriented, and handling always comes with the risk of damage. Regardless of the degree of damage, this can be detrimental, particularly in collections whose value, in part, comes from their ability to be viewed and studied closely. 3D scans and models, detailed photographs and scans, video documentation, recorded measurements and weights, etc. can all offer a truly significant amount of information, some of which may ease the necessity of a researcher handling and viewing the object in person.

Third, digitization extends access to collections items in storage. Digitization can offer worldwide access to the entirety of a museum's collection, large parts of which are typically not often on display.\(^8^3\) Most museum professionals are familiar with the degree to which storerooms are frequently packed to the point of being over-crowded, which not only means many of those objects are never seen in exhibitions, but can also create a less-than-ideal or even dangerous environment for proper storage. Digitization of collections has also proven to help institutions

\(^{8^1}\) Horan, “Digital Heritage: Digitization of Museum and Archival Collections,” 11.

\(^{8^2}\) Horan, “Digital Heritage: Digitization of Museum and Archival Collections,” 16.

\(^{8^3}\) Economou, “A World of Interactive Exhibits,” 150.
expand on-site visitation as well as capture virtual audiences through the use of websites, online collections and archives, and various other methods of digitization.84

Museums often find that a large part of their collections do not or can not receive their own time in the limelight. Through a combination of the sheer size of some (often ever-increasing through purchases and donations) collections and the limited display space for exhibitions, many objects and artifacts struggle simply to see, and be seen by, visitors. For example, the National Palace Museum (NPM) of Taiwan contained more than 650,000 domestic and foreign antiquities in 2018.85 If each exhibition they ran lasted only three months at a time, it would still take them over 30 years to exhibit each and every piece in their current collection – a collection which has only been increasing through acquisitions.86 NPM is hardly alone in their predicament, as this particular struggle is one museums around the world face when considering their collections, exhibit spaces, and applications for acquisitions and donations. Extrapolating their statistic with the over 155 million objects, specimens, volumes, and archives distributed across the Smithsonian campus, for example, is staggering.87 Digitization can be utilized as a tool in this regard, to bring museums out of their out-dated role as warehouses of antiquities and further into their modern, moral role as sources of free information.

And fourth, digitization increases accessibility to collections and research for those unable to visit and access museums and collections in person. There are several obstacles which may prevent an individual, either physically or otherwise, from experiencing a museum's collections. These walls can include financial walls which reinforce classist structures and restrict fair and equal access to quality information; situational circumstances such as the

87 Smithsonian Digitization Program Office, “Welcome.”
COVID-19 pandemic and repeated, subsequent global lockdowns; lack of physical disability access in the building itself; and lack of less physical disability accessibility to those of differing needs, learning abilities and styles, etc. Museums can overcome these walls, or at least begin dismantling them, through the use of digitization tools.

For example, with virtual reality, a visitor immerses themselves in the environment in order to gain the information offered by the object or display – a process which gives visitors the feeling that they are actually in the recreated space.\footnote{Hashim, “The Integration of Interactive Display Method and Heritage Exhibition at Museum,” 315.} This can have an immensely powerful emotional and sensory impact, proving virtual reality a useful tool for offering new dynamics in storytelling, content creation, and accessibility. Likewise, an augmented reality display can offer a visitor a chance to experience an historic or archaeological object within their own, modern reality, something which inherently encourages empathy and interaction.

\begin{figure}[h]
\centering
\includegraphics[width=0.4\textwidth]{figure7.jpg}
\caption{Photograph titled “Seated Statue of Hatshepsut...by my couch”.
\textit{Source}: Ben Davis}
\end{figure}
Virtual reality, augmented reality, and other technologies are able to offer ideal presentation options for museum exhibitions. These virtual, interactive exhibitions can “enable different audiences, including the disabled and students of all ages, as well as the general public to access and interact with vast numbers of objects scattered among various localities in an engaging and informative way.” The utilization of such technologies for the improved accessibility of museums for individuals with disabilities is of the utmost importance in ensuring museums remain the relevant, impactful service to their communities that their mission statements claim they desire to be.

For example, individuals with hearing-impairments face massive difficulties with accessibility as well as engagement in their museum experiences. Individuals with hearing-impairments account for over 5% of the world's populace – about 360 million people – about 124 million of which are affected with moderate to severe hearing impairment. Despite their prevalence, little attention is paid to their needs in regards to actively developing or including interactive technologies to increase accessibility and improve the engagement experience in museums for these individuals. This is not a circumstance born of malice or intent, but ignorance. Unfortunately, many of the access barriers that people with disabilities encounter are unwittingly created and maintained by a sheer lack of awareness of disability issues by museum staff.

Perhaps due to a reticence to admit the advantages these advancing technologies could have in disability accessibility over more traditional exhibitions, there is a severe lack of research regarding their impact on museums and visitors alike. More research is certainly needed, particularly in regards to the specific perceived challenges and how to overcome those

---

limitations with technologies such as interactive and social virtual and augmented reality applications. However, there are many effective ways museums could utilize digitization technologies – particularly alternative, interactive ones – to better serve individuals with disabilities. As has been emphasized in related studies, “accessibility, inclusion, and democratization” are some of the most important advantages gained from the use of augmented reality, virtual reality, and other emerging, interactive technologies in museums.

QR Codes have also proven to not only assist in collections management, but also to increase accessibility in museums. Research on QR codes on movable, symbolized object labels in museum displays has demonstrated an enthusiastic response and increased accessibility, which encourages further investigation into its use. This kind of layered information system might also help modestly-funded museums as visitors arrive with their own smartphones and tablets, particularly as those devices will most likely already be set up with the visitor's preferred accessibility options. Additionally, QR Codes have proven themselves to be a useful method for labeling in museum collection management, allowing for more information to be recorded on labels (even as small as 1.5cm!) than any other method. Moreover, these labels can be read on any mobile smartphone, making that information more accessible to staff, researchers, and visitors alike.

More specific examples of successful digitization efforts can be seen in museums such as the Cleveland Museum of Art (CMA), the Louvre, and the American Museum of Natural History. These museums, as well as the Beyond Van Gogh: The Immersive Experience

---

exhibition have all achieved phenomenal accomplishments with their efforts toward thoughtful
digitization integration.

For example, the CMA saw unparalleled success with their ArtLens Wall, “a 40-foot
interactive, multi-touch, MicroTile wall, [which] displays in real time all works of art from the
permanent collection currently on view in the galleries,” totalling between 4,200 and 4,500
artworks at any given time. As noted in their explanation of the ArtLens Wall on their website,
this digital tool serves visitors as an orientation experience which allows them to download
visitor-created tours (and create their own), facilitating discovery and dialogue. Beyond visitor
engagement, the ArtLens Wall also offers the museum important feedback through its
“favoriting” feature, which uses docking stations to connect visitors wirelessly to the Wall. This
feature provides the museum with important metadata, allowing them to understand which
artworks visitors are engaging with.

Additionally, the CMA’s Open Access initiative has “transformed not only access to the
CMA’s collection but also its usability inside and outside the walls of our museum.” William
Griswold, Director and President of the CMA, explains in an article entitled “Introducing Open
Access at the CMA: For the Benefit of All the People Forever” that the Open Access program is
a logical and exciting outgrowth of the CMA’s inclusive mission “to create transformative
experiences through art, for the benefit of all people forever.” Griswold states clearly that the
time is right to bring their mission into the 21st century, and that such an initiative is the perfect
manner in which to do so.

---

96 The Cleveland Museum of Art, “ArtLens Wall,” The Cleveland Museum of Art, accessed 17 November 2021,
https://www.clevelandart.org/open-access.
98 Griswold, “Introducing Open Access at the CMA: For the Benefit of All the People Forever.”
The Louvre has seen particular success in their first virtual reality experience, working in partnership with HTC VIVE Arts to create *Mona Lisa: Beyond the Glass* as part of the landmark exhibition *Leonardo da Vinci*. Though the exhibition was from October 24th, 2019 to February 24, 2020, the VR experience is still available for free through VIVEPORT, an “app store for virtual reality content and experiences.” The VR experience allows visitors to interact with the famous painting in a virtual space, presenting a truly intimate look at the painting and incorporating new scientific research regarding the techniques used by the artist as well as the identity of the sitter. The virtual reality experience was a new way for the Louvre to expand their

---

99 Louvre, ““Mona Lisa Beyond the Glass”: the Louvre's first Virtual Reality experience.”
100 Vive, “What is VIVEPORT?”
existing practices and devices, moving from traditional wall labels to audio and video guides, which has greatly increased the accessibility of their collection. As Dominique de Font-Réaulx, the director of the Louvre’s interpretation and cultural programming department said “We have many different publics and we have to accommodate all of them and the different types of questions they have, so offering different types of education is a crucial thing for us.”

*Mona Lisa: Beyond the Glass* was part of a broader plan to make culture accessible to a wider public, as efforts have been undertaken in France to redistribute some of its cultural resources around the country. A number of small-scale museums, planned by French culture minister Franck Riester, will be introduced around France showcasing high-resolution digital copies of works from the country’s 12 national public collections. This greatly increases the accessibility of these collections with those who otherwise may not be able to access them.

Despite these many, demonstrable benefits, there are still those who doubt digitization's utility and viability. While realistic concerns over the challenges inherent in utilizing digitization tools can be valid, the trivialization of these technological tools is a sincere obstacle and must be approached as one does any reticence to change and evolution – with the reminder that museums, like their staff, visitors, and community, are living, breathing entities, subject to growth. Successfully addressing these challenges could promote not only the growth and relevance of museums in an increasingly high-tech era, but also increase the societal value of the knowledge and cultural heritage museums contain. The aim and application of digitizing museums should be the same as any other innovative technique – to engage visitors and broaden both accessibility and representation.

---

A unique, immersive digital exhibition which has seen tremendous success as it traveled to dozens of cities across the United States and Canada is *Beyond Van Gogh: The Immersive Experience*. Describing itself as “a truly immersive experience,” *Beyond Van Gogh* breaks barriers by incorporating both still and moving art, projecting the show onto every surface around the visitor.103 Created by French-Canadian creative director Mathieu St-Arnaud and his team at Montreal’s Normal Studio, the exhibit’s aim is to make the visitor feel as though they have stepped directly into one of the artist’s masterpieces. The 300+ artworks are “now freed from frames, come alive, appear, and disappear, flow across multi-surfaces, the minutia of details titillating our heightened senses.”104

One visitor, who attended *Beyond Van Gogh* in Buffalo, NY responded to a question about the uniqueness of the immersive exhibition by saying:

“Experiencing Van Gogh’s artwork this way made me realize truly how much of his soul that he puts into each one of his pieces. You can almost feel it. Even in a simple still life you can sense [the] emotion in the piece. I have seen a few pieces by Van Gogh in person and you can tell he truly puts himself into his work, but at the immersive experience you can understand this at a whole new level.”

Another visitor, who attended the exhibition in Honolulu, HI expressed their opinion on the success of the educational aspects of the exhibit, explaining:

“I learned a lot about Vincent's relationship to the people in his life, in particular his brother who provided most of the letters and context for the biography section. It acts as humanizing to these historical figures that we learn about and know the names of. It's not a full picture, but it's certainly more than any standard text book would provide. He was a brother, a son, a friend, and those people aren't famous. They aren't historical monoliths that will survive generations as Vincent has become, but to him, they were important.”

Though by no means extensive, *Beyond Van Gogh* made considerations such as making limited seating available for those with mobility issues and ensuring the entire show is accessible to wheelchairs, mobile scooters, canes, etc. Additionally, their website has a section dedicated to accessibility, answering questions regarding accessibility for service animals, those with hearing impairments, and children with “autism, spd, or adhd”, as well as warnings for flashing lights and sounds, possible motion sickness, etc. These efforts are not comprehensive, but certainly worthy of note and appreciation.

The American Museum of Natural History (AMNH) similarly aims to provide a wide range of virtual visitors with the ability to access their collections. Beginning in 2006 in the hopes of digitizing their research library’s collection of about one million images, the AMNH’s online collection is now home to 32 million specimens and cultural artifacts. Their wide range of collections includes the Ambrose Monell Cryo Collection (an accessible repository or frozen tissue specimens), Anthropology Collections, Invertebrate Zoology Collections, Paleontology Collections, Physical Sciences Collections, Vertebrate Zoology Collections, and more. In a wonderful display of integrating traditional and contemporary techniques and practices, AMNH maintains the historical integrity of their online collections by retaining legacy information such as “*original caption,*” but also includes modern terms and newly generated titles. This combination ensures a preservation of historical integrity, while simultaneously encouraging discovery. The AMNH recognizes that “collecting in the natural sciences is a different enterprise than it was 100 years ago,” and has enhanced its online collection with

---

105 Roberts, “By Digitizing Images, Museum Opens a Window Into the Past.”
annotations and explanations, offering a wealth of information and documentation ranging from
handwritten correspondence to histological and chromosome preparation slides.

In discussing the Smithsonian Institution's Digitization Program Office, Clough states
plainly that their program's aim to “document and increase the quantity and quality of digital
inventory records and digital images” has not only been successful, but has also advanced “each
of the four major goals of our Strategic Plan, as well as broadening access, revitalizing
education, and strengthening collections.” 108 Clough defines the priorities and primary drivers of
their digitization program as including inventory control, compelling research interest, education,
and preservation. Their goal is to explore creative and efficient ways in which they can integrate
digitization into the core functions of the museum; a goal which demonstrates itself to be the
founding of all successful digitization efforts in museums. The keyword here is not substitution,
but integration.

---

Chapter 4: Increasing Public Accessibility

“Museums need to change their behaviour a bit. They should be able to share their collections more and with less restrictions. Of course we are custodians of our collections, but we need to bring them to the audience. If we look at the development of some very successful applications that changed our lives, like Airbnb or Uber, it is clear that today the key word is not possession anymore, but sharing. The main challenge for museums is not to attract audiences only, but to find the easiest way to share their collections and to connect with other groups of society.”

Linda Volkers from Rijksmuseum

In recent decades, museums have realized and truly embraced the fact that sharing and accessibility, rather than possessing, is more important. This focus on their communities has helped bolster initiatives towards ensuring as much of their collections are available to as many audiences as possible, in many cases with the help of technology and digitization. Despite this somewhat recent shift in focus, digitization efforts are by no means new to the museum field. Institutions all over the world have been adapting to the digital landscape and utilizing these technologies for decades. In fact, museums have been increasingly inclined to use these new tools as more research and evidence becomes available, proving the success of their utilization.

As mentioned in the “Benefits of Digitization” section, the COVID-19 pandemic, beginning in 2020, resulted in a surprising but clear demonstration of the value of the digitization efforts in museums. Summarizing the exact impact of COVID-19 on museums is difficult, but in a recent survey ICOM found that almost all museums around the world (94.7%) were temporarily closed due to COVID-19 and reports by both UNESCO and ICOM predicted that 1 in 8 museums could permanently close due to the COVID-19. The American Alliance of

---

Museums (AAM) also reported that about 30% of institutions may not be able to reopen without the government’s financial support and it has been estimated that ticket sales in museums have dropped by 80% due to appropriately maintaining social distance.\textsuperscript{113} Many in the museum sector expected to temporarily or permanently lose job contracts or employment as well, sometimes with varying degrees of warning and available financial assistance.

As the definition and identity of museums evolve and change with time, particularly in the face of such seismic, global crises and shifts, accessibility has become a matter of ethics in the museum field.\textsuperscript{114} Controversial though its entirety is considered by some, ICOM's current definition of museums clearly expresses that public accessibility is undoubtedly necessary to museums, as they cannot be “open to the public” or operate “for the purposes of education, study, and enjoyment” behind locked doors and with limited accessibility. Many museums have shifted their focus towards ensuring that the knowledge, heritage, and objects they safeguard remain readily accessible to the public, reflecting a prioritization of people rather than objects.\textsuperscript{115}

Integrating digitization into museum procedures and policies is key to this focus of increasing accessibility to the public. The contemporary cultures and tools reflected in digitization define a new kind of global community, one characterized by sharing and a dedication to the future, ensuring this reasonable public access creates connections with new audiences, even those physically distant. It also creates an opportunity for growth of museums as it can be utilized as a tool of “indirect marketing”, making it demonstrably useful in broadening a museum's audience.\textsuperscript{116}

A demonstration of this is the efforts put forth by museums throughout the global COVID-19 pandemic. COVID-19 saw museums struggling – some overcoming and some failing – to adapt to the new landscape a global pandemic and unpredictable lock-downs brought. Concentrating on increasing accessibility to collections, exhibitions, and resources online was one of the ways museums succeeded in meeting the changing needs of visitors in recent years. Those museums which were already integrating digitization tools and technologies fared better with public engagement and support throughout the pandemic and repeated lock-downs.

The effect of having greater accessibility to collections through digital tools and media is becoming steadily more apparent. In recent years research has demonstrated not only an increase in digital traffic to the museum, but also in-person visitation peaking as online visitors seek to follow up their research in person – even at museums like the Smithsonian.\textsuperscript{117} The availability of quality information, like that provided through museum digitization efforts, stimulates innovation, and limited evidence suggests that entrepreneurs in creative industries may find inspiration for new works through access to such vast digital collections.\textsuperscript{118} This spillover of positive effects, further demonstrates the massive potentiality of accessibility digitization efforts.

**Accessibility for People with Disabilities**

“People talk about all the things you can find on museum websites: interactive tours, documents to read, precious objects to look at. None of these are accessible to someone who cannot see the screen. It is not as if the technology does not exist. What would happen if there was a button to click on to get a description of an image, in the same way that you can enlarge an image? What would happen if you could take an audio tour? Think of the creative capital that could be made out of producing audio descriptions of visuals.”

Kirsten Hearn\textsuperscript{119}

\textsuperscript{117} *Smithsonian Institution Fiscal Year 2021 Budget Justification to Congress.* Submitted to the Committees on Appropriations Congress of the United States, (2021): 1-291. 
\textsuperscript{118} Navarrete, “Digitization in Museums,” 6. 
\textsuperscript{119} Lisney, “Museums and Technology: Being Inclusive Helps Accessibility for All,” 5.
There are major areas wherein museums are undeniably currently lacking in their accessibility, however. One of these is accessibility for individuals with disabilities, both physical and otherwise. For example, individuals with a visual-impairment accounted for over 4.24 million people in the United States alone in 2015, including 1.02 million who were blind.\textsuperscript{120} Despite their prevalence, when is the last time you saw any form of readily accessible aid or consideration for an individual with a visual-impairment at a museum? How are they meant to access and engage with a collection they cannot see? What experience can smooth screens and buttons offer to the blind? What experience can ambient music and audio cues offer to the deaf? What possibility is there for appreciation or connection to something on display if you cannot perceive it? What was once a well thought-out display or exhibition becomes nothing more than a wall, reminding the visitor that they are not considered – and thus not welcome.

The goal of accessibility is often a struggle for museums in regards to those with disabilities. While legislation in both the United States and the United Kingdom should ensure that individuals with disabilities should be able to access museums and galleries, this is not always the case.\textsuperscript{121} As Dr. Walters expresses in “Approaches in museums towards disability in the United Kingdom and the United States,” “Physical and sensory access should be addressed and, where possible, adjustments made to reduce or remove existing barriers.”\textsuperscript{122} While these adjustments can range from large physical improvements (such as installing elevators which access all floors) to exhibitions integrating multi-sensory experiences, often times the barriers to access for people with disabilities within museums are less obvious.

\textsuperscript{121} Walters, “Approaches in museums towards disability in the United Kingdom and the United States,” 29.
\textsuperscript{122} Walters, “Approaches in museums towards disability in the United Kingdom and the United States,” 29.
However, this institutional insensitivity is being challenged by awareness groups, activists, and researchers such as VocalEyes, the Sisters of Frida, and the Research Centre for Museums and Galleries (RCMG). The RCMG’s current research project, for example, Rethinking Disability Representation (RDR) is a large-scale, experimental, social advocacy mission which focuses on “developing new approaches to the interpretation of disability and the representation of disabled people's lives within museums and galleries.”

More specifically, RDR aims to “challenge commonly held perceptions of impairment as limitation and to interrogate disablist attitudes, experiences and barriers, both historically and within contemporary society” Collaborating with nine museums and galleries across the UK and experts in the disability field, RDR initiates and manages exhibitions and educational programs intending to offer “alternative and non-prejudicial ways to think about disability” whilst enhancing the visitor's understanding of the histories and experiences of disabled people.

While each project is unique, they all share a philosophy and approach created and guided by disabled activists, artists, and cultural practitioners. RDR draws on this broader community of non-museum experts with the understanding that museums themselves do not have the fundamental expertise necessary for the intellectual and social pursuit of this project. RDR is an excellent example of what can be achieved when museums combine their research expertise and know-how with the social relevance and community-mindedness of disability activism. As Janes notes in *Museums in a Troubled World: Renewal, Irrelevance or Collapse?*, the RCMG is a role model “for unlocking the synergy between museum practitioners and

---

124 Disablism refers to discriminatory, oppressive, or abusive behavior arising from the belief that disabled people are inferior to others.
museum academics” and such practices exercised by RDR are “an undeniably powerful recipe for the collective good”.

Seamless, perfect accessibility for all is rarely achieved, and may even be arguably impossible given the vast and occasionally polar opposite needs of different individuals – however that is no excuse for the gross lack of considerations many museums and individual exhibitions demonstrate for those with disabilities. Combating this involves far more than ramps, elevators, automatic doors, braille, and the occasional, optional sign-language interpreter for docent led tours. As the RCMG’s work exemplifies – it’s a matter of considering physicality, interactive tools, sensory overload, differing sensory capabilities, and even various learning styles and inherent intelligences.

Combining this philosophy and diligence with efforts in digitization could be the key to ensuring a great degree of accessibility for people with disabilities within museums. As noted in the “Literature Review” section, “Museums and Technology: Being Inclusive Helps Accessibility for All” examines this cross-section of issues in the museum sector quite candidly. While many cultural institutions take pride in their degree of physical accessibility, the same level of attention has not been paid to information access. As a blind individual herself, Kirsten Hearn reflects,

“The last time I went (to the Science Museum), I was faced by a mass of smooth screens and buttons. Yes there were noises, but I could not see the screens, so they made no sense to me. … Nearly thirty years on, where are we now? As museum design has leaned on technology, exhibitions have become even more visually oriented, and there is now nothing to touch rather than not being allowed to touch.”

---

129 Lisney, “Museums and Technology: Being Inclusive Helps Accessibility for All,” 4-5.
Speech screen readers on museum websites are a tool which has become increasingly common and serve as a very basic start in regards to digitization intended to increase accessibility for those with visual-impairments. But what else can be done? Organizations like VocalEyes are an excellent example, as they aim to increase the possible opportunities that people who are blind and partially sighted have to experience and enjoy art and heritage.\textsuperscript{130} They do this, in part, by supporting museums, galleries, historic sites, and natural heritage locations in their efforts through digital means such as live and recorded audio descriptions, creative workshops, consultancy, and training courses in audio description and visual awareness. The training courses VocalEyes offers are truly invaluable, as many of the obstacles which make museums inaccessible to those with disabilities are not malicious or intentional. Instead, many of these barriers are born and maintained unwittingly by museum staff through a sheer lack of awareness of disability issues.\textsuperscript{131} Thus, awareness training and utilization of digital tools can be just the lesson a museum may need in order to drastically improve their conditions and better serve their visitors with disabilities.

Hearn expresses her personal experiences using VocalEyes:

“Vocaleyes … has brought theater to life for visually impaired theater-goers, creates audio describing some exhibitions. Their work brings something to life that is incomprehensible otherwise. It is possible to go to the theater without having to take a sighted guide who irritates those sitting around by whispering to the blind companion. It is possible to go to a mere handful of exhibitions, but I cannot just arrive at the National Gallery and get audio descriptions of the paintings in the latest blockbuster exhibition of some famous painter.”

As Hearn explains, the visuo-centric bias many museums exhibit can impede the possibly engaging and memorable experiences of visitors, particularly those with visual impairments and

\textsuperscript{130} VocalEyes, “About,” VocalEyes, accessed 21 Apr. 2021, https://vocaleyes.co.uk/about/.
\textsuperscript{131} Lisney, “Museums and Technology: Being Inclusive Helps Accessibility for All,” 6.
blindness. In light of this, researchers like Dr. Eardley explore the design and implementation of ADs as well as their many positive benefits in papers like “Enriched Audio Description: Working Towards an Inclusive Museum Experience.” Additionally, she analyzes cognitive psychological studies which suggest that the proper execution of ADs in museums may benefit not just those with visual impairments, but also those without.

As explained in the “Digital Details” section, audio descriptions (AD) are defined as a verbal commentary which provides visual information for those unable to perceive it themselves – however, the last part of this definition limits the utilization of the technology. AD can offer assistance not only to visitors with visual impairments but also those without, particularly in regards to guiding them where to look and how to look. The museum environment can present such an array of visual stimuli that it can overwhelm sighted visitors, triggering what is characterized as “browsing behavior”. Browsing behavior is where individuals spend “only a very short time in front of any one exhibit or artwork”, glancing only briefly at objects rather than contemplating them for extended periods of time. In fact, research in art museums suggests that even when people physically stop to look at a piece of work, they only spend about 17 seconds on average on each piece, calling into question just how meaningful and engaging their experience could be.

This is where museum interpretation steps in, offering guidance and communicating as much significant, relevant information as possible to visitors in their exploration and experience of an exhibit or collection. Audio interpretation, particularly in the form of AD is one form of this guidance. While conventional audio tours offer only short bursts of information (typically 180 seconds per “stop”), they have demonstrated a positive impact on visitor behavior, drawing

---

attention to aspects of a display or setting which otherwise may go unnoticed and encouraging a more inquisitive mindset.\textsuperscript{134} Employing multisensory techniques such as AD guides visitors into deeper processing and is associated with increased memorability of the stimulus (in this case the exhibit or object) and helps build a narrative around the image.\textsuperscript{135} AD can describe the visual appearance of objects and works of art (such as color, contrast, shape, and form) as well as factual, contextual, narrative, and historical information which can enrich the description of visual features. As Dr. Eardley explains:

“The key difference between audio description and a standard audio guide is that the audio description systematically describes visual elements and the spatial relationships between them in order that a blind user may create mental images of the object. In contrast, while audio guides may refer to prominent visual aspects of the work they are addressing, they do not systematically guide the user’s eyes from one detail to the next.”

Functioning as a kind of “guided looking”, these positioning and focusing words which differentiate AD from standard audio guides may help museum visitors to “direct, and importantly, prolong their visual attention”.\textsuperscript{136} ADs may reduce cognitive load and enhance the memorability of the experience, as they lead sighted visitors to focus on visual features, rather than their attention becoming divided by the ample competing information in museums. The increased engagement and memorability found with the use of AD demonstrates an additional utility to an already widely-utilized digitization tool. The use of more descriptive, directive AD techniques in all audio resources would help create a more inclusive, impactful museum environment for all visitors.

Linguistic accessibility can be addressed through the use of such digital tools as well. If the end goal for an exhibition is information in a format which can be written or spoken, as with

\textsuperscript{134} Eardley, “Enriched Audio Description: Working Towards an Inclusive Museum Experience,” 429.
\textsuperscript{135} Eardley, “Enriched Audio Description: Working Towards an Inclusive Museum Experience,” 429-431.
\textsuperscript{136} Eardley, “Enriched Audio Description: Working Towards an Inclusive Museum Experience,” 430.
ADs, it can also be re-written and stylized for multiple audiences, as well as translated into theoretically any language. This way the information being presented to one target audience isn’t inherently inaccessible to others due to their individual backgrounds, learning styles, or native languages. A 10-year old exploring a 3D virtual reality tour like that of ‘Iolani Palace as they play on their virtual reality headset can learn the same things as an elderly woman who might only speak Japanese and is being shown virtual reality for the first time.
Chapter 5: Integration Success!

“The worth and importance of the Institution are not to be estimated by what it accumulates within the walls of its building, but by what it sends forth to the world.”

Joseph Henry\(^\text{137}\)

It is important to remember that the current and historic tendency for a lack of consideration towards disability accessibility need not be a deterrent to the possibilities provided by digitization! As Lisney writes:

“The possibilities afforded by digital accessibility excite me. Many disabled people are not able to visit museums physically. But virtual visits, although not exactly the same experience, can give an alternative. This is universal design in practice—everybody profits…”

The strengths of digitization lie in the adaptability of its various tools, which offer endless possibilities to museums. It is when digitization and digital accessibility are not executed with all potential users and visitors in mind that their potential is tragically cut short. This lack of inclusivity not only drastically limits the audience of a museum, collection, or particular object, but conveys to those excluded that they are not thought of and thus not welcome – an outcome which surely goes against the missions of all museums and like institutions.

The trivialization of both digitization tools and the responsibility museums have to develop and utilize them should be avoided, as this not only maintains the stilted accessibility issues museums face, but could undermine any future attempts at other fundamental improvements as well. If these tools are dismissed as frivolous or unimportant, they will not be integrated into the wider strategies and goals of a museum, and become something of a self-fulfilling prophecy.\(^\text{138}\) This prophecy being one wherein digital methods become trivial,


stagnating and falling to the wayside as just another useless gadget which adds nothing to the museum experience or degree of accessibility. For the integration of digitization to be successful, this pessimistic mindset must be combated by centering the goal of accessibility and sharing within museums.

The point here is that with properly executed integration, and when used with consideration and communication, technological tools can make museums more accessible than ever. Approaching digitization with accessibility at the forefront of the mind – rather than relegated to an afterthought of legislative necessity – museums could ensure a more universal access for the benefit of all their visitors – disabled and non-disabled alike!

Such conscientious digitization efforts are hardly new, and many notable, renowned museums around the world have prioritized such efforts for nearly a decade pre-COVID-19. Such institutions as Museo Nacional del Prado, Hermitage, Kiasma Museum of Contemporary Art, MAAT Museum of Art, Architecture and Technology, MUSE Museo delle Scienze di Tronto, Musee du Louvre, National Museum Wales Amgueddfa Cymru, POLIN Museum of the History of Polish Jews, Rijksmuseum, Victoria and Albert Museum, and many more. Many of these institutions did not cease their digitization efforts under the influence of COVID-19, but rather expanded their initiatives. In fact, ICOM reported that around 15% of museums globally increased their digital communication activities during the COVID-19 lockdown, and even now, as the world is slowly opening back up, these museums are focusing on online museum resources, e-learning, and online collections.

For example, the Museum of Modern Art (MoMA) in New York took advantage of the lockdown in 2020 to work on their digitization efforts, and by December 2020 had increased

---
their digitized works from seventy-nine thousand to more than eighty-nine thousand.\textsuperscript{141} In Madrid, the Prado Museum has grown their digital archive to now offer over twelve thousand works online.\textsuperscript{142} Likewise, the British Museum in London drastically increased their catalog of digitized images by over two-hundred-eighty thousand to an impressive total of nearly 4.5 million.\textsuperscript{143} In all of these cases, the remarkable additional step was taken to ensure these digitized objects were made available for all, by sharing them online through catalogs which are accessible for online research and consultation by anyone. This removes some of the tremendous obstacles many individuals face in accessing these massive collections, reaching wider audiences and inherently facilitating a new creation of long-term involvement between the museum and the public.\textsuperscript{144}

Digitization and virtual interactions are vital to the future of museums, not only in allowing visitors through their metaphorical doors when the buildings and collections themselves are inaccessible, but also in validating such cultural institutions in the eyes of the public. Regardless of whether or not museums may be visited in-person, promoting the knowledge and heritage of humanity is worthy of attention, and something which that same humanity genuinely craves. The digital engagement museums participated in pre-lockdown has proven to drive visitors to seek out the “real deal”, and those museums that invested in the movement early saw their efforts confirmed.\textsuperscript{145}

To ensure these efforts are and remain successful, the degree to which museums integrate digital tools can and should be customized and individualized. Traditional, physical museums and displays have an irreplaceable value, and to effectively incorporate digitization, museums

\textsuperscript{141} Corona, “Museums and Communication: The Case of the Louvre Museum at the Covid-19 Age,” 19.
\textsuperscript{142} Corona, “Museums and Communication: The Case of the Louvre Museum at the Covid-19 Age,” 19.
\textsuperscript{143} Corona, “Museums and Communication: The Case of the Louvre Museum at the Covid-19 Age,” 19.
\textsuperscript{144} Sturabotti, “Museum of the Future,” 8.
\textsuperscript{145} Burke, “Museums at Home: Digital Initiatives in Response to COVID-19,” 123.
can survey their own visitors and communities to determine their preferences. Based on the results of these surveys, institutions can determine a plan to provide as best they can for their visitors in whatever way is suitable to their mission, their collection, and most importantly, their community.

For example, in “Augmented Reality Interaction Design and User Experience of Hand Puppet Historical Museum in Taiwan,” Chan-Li Lin of the National Taipei University of Education discussed the integration of sensor technology and virtual reality technology to create “a new experience of the hand puppetry culture” at the Li Tien-Lu Hand Puppet Historical Museum. Throughout this experiment, Lin sought a balance between the “traditional display of artifacts and use of digital instruments”, ultimately determining that they are profoundly complementary. “[T]he core advantages of the two models can be emphasized in the application of mixed reality in museum exhibition” to result in a design which was “an optimal combination of virtual and reality elements”. This integration, rather than a complete replacement, is what made this application of augmented reality so successful.

**Tweaking the Tools**

To successfully use digitization practices or create a successful, digital exhibit, museums must utilize the technology as though it were any other tool. This focus on parallels with preexisting practices is far more successful than that of looking at these new technologies as an unnecessary, additional complication, or fearing them as intimidating or cumbersome.

Exhibitions designed in this way take advantage of the versatility of technology to healthily harmonize the new and preexisting methods. For example, this joint interface of digitization

---

devices and the objects on display grant visitors a direct manipulation of and interaction with the exhibit, which goes a long way towards helping the museum achieve their communicative goals of such an exhibit.¹⁴⁸

When determining this degree of balance between technological interactivity and physical, traditional methods, the efforts of the museum staff and volunteers, as well as visitor input can be of great help. Visitor input and evaluations are critically important in the development, preparation, and performance of any museum exhibition; doubly so for digitization and interactive exhibits. Evaluating visitor input throughout the planning, preparation, and post-installation stages can provide information about their depth of knowledge, misconceptions, general attitudes and interests, what does and doesn't work, and a basis for final adjustments and improvements.¹⁴⁹

There are many sources which could prove invaluable to a museum or institution looking to design such technological, interactive exhibits with their collections, such as Creating a Winning Online Exhibition: A Guide for Libraries, Archives, and Museums written by Martin R. Kalfatovic and published by the American Library Association. This book discusses the roles of museums, libraries, and archives in an ever-advancing technological landscape, and ends by offering samples for Online Exhibition Proposals, Exhibition Scripts, Guidelines for Reproducing Works from Exhibition Websites, Suggested Database Structures for Online Exhibitions, and more. Although targeted more directly at online exhibitions rather than generalized digitization efforts, many of the lessons and topics are still applicable, particularly to combining physical exhibitions and digital tools. For example, Kalfatovic opens the book with the statement:

“It is very important to remember that a collection of objects does not make an exhibition. It is only when objects are carefully chosen to illustrate a theme and tied together by a narrative or other relational threads that they become an exhibition.”

When planning an integration of something like augmented reality into an exhibition, a museum needs to plan as they would a traditional interactive exhibit, by focusing on the elements of purpose, content, standard, authority, and responsibility. Plan and prepare clear and explicit goals and objectives, define your audience, conduct front-end evaluations of the audience, consider how the interactive technologies will relate to other exhibits, consider the quantity of stations/access points etc. Additionally, these initial stages of development and evaluation would be ideal for ensuring those tools such as AD are best conceptualized and designed with disability accessibility in mind. Integrating them early on would assist in the aim of elements such as AD, as they strive not to intrude or draw attention to itself, rather aiming to blend in or remain background to the focus.

With these same elements, a display or exhibition utilizing augmented reality or QR Codes can reach the same goals. Is your aim for your exhibit to be aesthetic and emotive? Or perhaps evocative and entertaining? How about purely didactic? Whatever a museum's goals, if approached with clear intent and comprehensive planning, the integration of technology and interactivity can prove itself to be an invaluable tool.

---

Chapter 6: Ensuring Integration: Case Studies

“In a contemporary museum, digital technology is essential but should not prevent the perception around the find and the unique empathy that only its materiality can generate. The availability of a tablet or augmented reality use should not prevent the public fully reaping from the potential of the objects. What we need, [is a technology that] does not create gaps between digital natives and those who are outside it: a “responsive” technology, able to respond differently depending on who uses it … ”

Samuela Caliari from MUSE

As marvelous as their possibilities might be, digitization tools are by no means a simple, fix-all solution. Like any other tool utilized by museums and like institutions, it must be applied with consideration and creative thinking, or museum's efforts will fall flat and fail to communicate the desired message. In this section, I will discuss two 3D virtual reality tours of significant historical locations – The Theodore Roosevelt Inaugural National Historic Site in Buffalo, New York and the ‘Iolani Palace on Oahu, Hawai‘i. Sharing my personal experiences with these tours (as a visitor and as a creator), I will demonstrate the great capabilities and successes of such virtual reality systems, as well as how their improper application can undermine the efforts and great importance of these locations.

In this chapter, I explore and narrate my experiences with the Matterport 3D virtual reality tours offered by both The Theodore Roosevelt Inaugural National Historic Site and ‘Iolani Palace. These examples demonstrate the strengths of such digitization tools, as well as how their under-utilization can be a weakness. In particular, I will address how the conscientious efforts seen in The Theodore Roosevelt Inaugural National Historic Site virtual tour stand at odds with the seemingly incomplete nature of ‘Iolani Palace's tour. This impression of underdevelopment leaves much to be desired in order to communicate the monumental cultural value of the

---

palace, and so I offer suggestions throughout the narration of how to make better use of the digitization tools on display.

The Theodore Roosevelt Inaugural National Historic Site

The first example discussed here is the Matterport 3D virtual tour of The Theodore Roosevelt Inaugural National Historic Site, which proves itself to be extremely thoughtful and deliberate. The Theodore Roosevelt Inaugural National Historic Site is a “unit of the National Park Service, the only NPS location in Western New York” and “Since its inception, the Site has been managed by a local board of trustees, the Theodore Roosevelt Inaugural Site Foundation, through a cooperative agreement with NPS.” The museum boasts that visitors can “step back in time and into the world that TR [Theodore Roosevelt] knew” by walking where he walked, and seeing and hearing about the challenges he faced, thus gaining a sense of what it was like to lead the United States during such a pivotal time in its history.

The Theodore Roosevelt Inaugural National Historic Site website has a wealth of information in its own right, offering pages about the collection, special exhibits such as the current “Votes for Women! / TR & The Women's Suffrage Movement”, social issues of Roosevelt's day such as environmental conservation, race and social inequalities, big business and labor, the role of the United States in global affairs, etc. There is also a section of the site aimed at educators, offering tours, classroom resources, off-site presentations for adult audiences, and further external resources such as links to relevant websites and recommended reading for adults and students.

Upon starting the virtual tour, there are no views of the grounds or the outside of the building itself. Instead, the virtual visitor sees a quick perspective of a dollhouse view of The

\[\text{Figure 19 portrait of Theodore Roosevelt available in Appendix 3.}\]

Theodore Roosevelt Inaugural National Historic Site, before being dropped immediately into the entryway of the museum. Stepping forward to the welcome desk, immediately to the right is an open gift shop, and to the left is a display including a large print of a greyscale photograph of the building, as well as some of the notable individuals who lived there, and a life-sized cardboard cutout of Theodore Roosevelt himself.

Figure 9. Screenshot of TR Site entrance from Matterport VR tour.

*Source:* Shayna Diamond.

Standing in the entryway, virtual visitors will immediately note the small, semi-opaque white circles on the ground as well as circles of various colors which either hover on thin lines from the floor or seem attached to certain objects and locations. The white circles on the ground are travel points, or locations where visitors can “stand” as they move freely throughout this virtual tour. (From a creation standpoint, these are the locations where the 3D camera is positioned when it scans the space around it. This makes it ideal as a virtual viewpoint since it will have the clearest perspective of the space.) The colored circles are called Mattertags[^1],
which Matterport describes as a “way to add context to specific locations, objects, and features within your Spaces”. Clicking on one of these Mattertags™ will navigate you automatically to it, positioning your perspective in front of it, and immediately triggering a pop-up. These pop-ups offer additional information and function excellently as an effective storytelling tool, letting the visitor decide which content they want to interact with, how much, and when.

Selecting the “Play” option (indicated by an arrow pointing to the right inside a circle) on the bottom left next to the viewing tools (labeled “Dollhouse View”, “Floorplan View” etc.) begins an automatic walk-through. When this automatic walk-through plays, it starts with a slowly rotating dollhouse view before sliding through the entryway and gift shop. It moves smoothly through the halls, stopping just inside the corner of each room for a slow pan of the space. After completing the first floor, the camera zooms out to the dollhouse view again, before zooming into President Roosevelt's office and continuing to the walk through the halls, stopping to view each room. Once this walk-through is complete, you are taken through the dollhouse view one more time before the perspective returns you to the entryway you started in.

158 Figures 30-33 demonstrating Floorplan Views of both TR Site and ‘Iolani Palace available in Appendix 5.
When navigating on your own, a drop-down menu appears on the top left corner of the screen, offering categories such as “RECEPTION AREA”, “PAN-AMERICAN EXPOSITION ROOM”, “THEATER FOR THE ISSUES OF 1901”, “TR'S WHITE HOUSE OFFICE”, “ISSUES OF THE DAY VS. TODAY”, etc. which in turn have lists of Mattertags™ with varying colors. Although they are not labeled as such throughout the tour, visitors can discover by reading the “Virtual Tour Guide” pdf that the variety of colors each signify something different – red indicating the virtual tour guide, blue and gold indicating “lots of great facts and stories about TR's time here!”, grey are quizzes about the museum's contents, purple mark event space information, and green link to The Theodore Roosevelt Inaugural National Historic Site gift shop. Selecting any of these Mattertags™ navigates the virtual visitor automatically to the
space or object they are attached to, traveling efficiently through the halls or zooming out into dollhouse view and back into the designated room, making the transition as smooth as possible.

One of the categories of these colored stags are labeled as “VIRTUAL TOUR GUIDE STOPs” or STOP points. These STOP points are titled “Welcome to the Theodore Roosevelt Inaugural Site!”, “Welcome to our Visitor Center!”, “Welcome to the Pan-American Exposition!”, “The Dining Room!”, “This room was Mr. Wilcox's office!”, “Welcome to the Theater for the Issues of 1901 America!”. “The Library!”, and “This room represents TR’s White House Office!”. Each of these STOP points offers a pop-up with embedded audio or the option to open the audio outside of the tour. An excellent example of accessibility is the inclusion in each of these STOP points of an external link to “view & print a written transcript of the “Virtual Tour Guide” to help you navigate through this tour.” This link opens to a pdf which offers a transcript of what the “Virtual Tour Guide” is saying at each of the STOP points. This transcript is not precise, but none of the information offered either auditorily or through text seems to be lost in the alternative format.

Figure 11. Screenshot of TR Site audio STOP from Matterport VR tour.

Source: Shayna Diamond.
The Virtual Tour Guide audio offers concise information regarding the room the visitor is entering, as I imagine an in-person docent might offer in a real world tour. However, there is certainly a lack of descriptive information for those with visual impairments. For example, while the Theater for the Issues of 1901 room offers additional video content regarding the individual topics of conversation depicted in the large mural, there is no description of the mural or independent images themselves. In a similar vein, videos are available throughout the entirety of the virtual tour, both as pop-ups which open a new tab or window or which can be played without leaving the tour. These videos throughout the virtual tour provide spoken context and additional visuals to the exhibit or display they are tagged to, explaining everything from “Immigration & Urban Poverty” to a demonstration of the “Interactive Exploration Desk” touch screen in the Exploration Room. However, though this supplementary audio and visual content is wonderful in its own right, the entire tour lacks any of the information which would make these effective additions ADs. They offer neither a description of the objects on display – either two-dimensional or three-dimensional – or information on orientation to guide one through the physical space itself. This oversight makes them far less beneficial to the visitors with visual impairments or blindness.

The presidential desk in “TR's White House Office” serves as an excellent example of digitization and interactivity, and its digitized form effectively demonstrates to the virtual visitor what they would see in person. Embedded in the surface of the desk is a touch screen which in-person visitors can interact with to “Decide what legislation to sign into law or take part in other presidential activities.” Though the touch screen itself is static in the 3D tour, the interactive element remains to some degree in this digitized format, as the virtual visitor can choose to play the attached video under the Mattertag™ pop-up titled “Be President at This

159 Figure 21 of Interactive Exploration Desk available in Appendix 3.
Interactive Desk”. The video is only 13 seconds long, but shows someone demonstrating how the interactive screen works, with the anonymous hand opening files, signing the Isthmain Canal Act of 1902, and vetoing the Antiquities Act of 1906.

Figure 12. Screenshot of TR Site presidential desk from Matterport VR tour.
*Source:* Shayna Diamond.

While I cannot personally report on the budget, time, or resources spent on the creation of this virtual tour, it is clear that diligent efforts were made by those at The Theodore Roosevelt Inaugural National Historic Site to utilize Matterport to the best of their abilities. The result makes the tour easy to navigate and surprisingly intuitive, which is deeply commendable. While this careful planning speaks to a resourcefulness, it also demonstrates their wealth of resources – as it takes a tremendous amount of time and/or money to create such a virtual tour in the first place, much less one so customized and detailed. However, linking pre-existing sources both of their own productions as well as those of other reputable experts rather than creating new,
customized content specifically for the purposes of this virtual tour doubtlessly cut down on the
necessity for additional costs.

Unfortunately, it does not appear as though accessibility for people with disabilities was
considered a key factor from the digitization's inception. The complete lack of AD for example,
makes the majority of this experience inaccessible to those with hearing impairments or
disabilities. Additionally, as with anything, this virtual tour is not without flaws. Occasional
typos, graphical glitches, and other minor imperfections can be found throughout The Theodore
Roosevelt Inaugural National Historic Site tour. However, with the clearly thoughtful efforts
made in creating this virtual tour, these spots are insignificant in the face of what the rest of the
tour achieves.

The Kingdom of Hawaiʻi

“Koʻu noho mihi ʻana
A paʻahao ʻia
ʻO ʻoe kuʻu lama
Kou nani koʻu koʻo
Mai nānā ʻinoʻino
Nā hewa o kānaka
Akā e huikala
A maʻemaʻe no”

“I live in sorrow
Imprisoned
You are my light
Your glory, my support
Behold not with malevolence
The sins of man
But forgive
And cleanse”

Queen Liliʻuokalani

The next 3D virtual reality tour I will be discussing is ʻIolani Palace which stands at the
center of Honolulu on the island of Oʻahu, Hawaiʻi and is “the only royal palace in America”. In
order to best emphasize the importance of ʻIolani Palace as a cultural and historical site, I will
first go over a brief history of the Kingdom of Hawaiʻi, as well as its occupation, overthrow, and

160 Huapala.org, “Queen’s Prayer (Ke Aloha O Ka Haku) - by Queen Liliʻuokalani,” Huapala.org, accessed 5
161 Tom Coffman, Nation Within: The History of the American Occupation of Hawaiʻi, (United States: Duke
University Press, 2016), 7.
illegal annexation by the United States of America. Explaining this history serves to highlight the prominence of ‘Iolani Palace as a museum and historic site within the United States. This importance, in turn, underscores the necessity to utilize tools like Matterport as completely and conscientiously as possible to ensure the Palace and its substantial history is respectfully digitized.

In brief, in 1893 foreign insurgents in the form of a small group of haole plantation owners and missionary descendants, backed by the United States government and U.S. Marines, organized a coup d'état and overthrew the Kingdom of Hawai‘i. After King David La‘amea Kamananakapu Mahinulani Naloiaehuokalani Lumialani Kalākaua's (more commonly referred to as King Kalākaua\textsuperscript{162}) death, U.S. Marines stepped off their ship in 1893, setting up across the street from ‘Iolani Palace and Ali‘iolani Hale, the two structures which “symbolized the sovereignty of the Kingdom of Hawai‘i”.\textsuperscript{163} Rather than use her royal guard or the gun battery on Pūowaina (now, Punchbowl) to fight and spill blood, King Kalākaua's sister, Queen Lydia Liliʻu Loloku Walania Kamakaʻeha (more commonly referred to as Queen Liliʻuokalani\textsuperscript{164}) stood down, cautioning “the leaders of [her] people to avoid riot or resistance, and to await tranquilly” the decision of the United States government, whom she still trusted.\textsuperscript{165}

Queen Liliʻuokalani was held prisoner within ‘Iolani Palace as it changed around her – abruptly being referred to by its occupiers as the “Executive Building”. Despite being in the very same building, merely one floor away, the “Republic” bickered away downstairs over who was allowed the highest honor of seating. In her writings, Queen Liliʻuokalani notes that “While I was a prisoner in ‘Iolani Palace, now called Executive Building, it seems that the little comedy of

\textsuperscript{162} Figure 23 portrait of King Kalākaua available in Appendix 4.
\textsuperscript{163} Coffman, \textit{Nation Within: The History of the American Occupation of Hawai‘i}, 39.
\textsuperscript{164} Figure 24 portrait of Queen Liliʻuokalani available in Appendix 4.
\textsuperscript{165} Liliuokalani (Liliʻu Loloku Walania Kamakaʻeha or Lydia Kamakaʻeha), \textit{Hawaii's Story by Hawaii's Queen}, (United States: CreateSpace Independent Publishing Platform, 2016): 109.
precedence was re-enacted under the “Republic” in the rooms beneath mine … The disputants did not on this occasion send to me for an opinion on this perplexing question. Had they done so I should have decided without a moment’s hesitation”. All but ignoring the rightful Queen of Hawai‘i upstairs, the insurgents argued and fought amongst themselves, establishing a government modeled on that of America's Jim Crow South.

The history of the overthrow of Hawai‘i has historically been held in the dark, the details glossed over in favor of a much brighter picture – a falsehood that Hawaiians were willing and grateful to join the United States. Even with public, legal acknowledgment of the illegalities of the overthrow, nothing substantial has been done in regards to restitution. The Joint Resolution (Public Law 103-150), adopted in 1993 by the U.S. Congress, acknowledges the “100th anniversary of the January 17, 1893 overthrow of the Kingdom of Hawaii.” While this law “[offers] an apology to Native Hawaiians on behalf of the United States for the overthrow of the Kingdom of Hawaii,” its overtly empty words and lack of concrete restorative action served to give “an infusion of energy and inspiration” to the Hawaiian sovereignty movement. There are a number of disparate groups in the Hawaiian sovereignty movement, which each offer widely varying solutions to their goals of establishing an autonomous or independent nation or kingdom. However, they all agree steadfastly on the acknowledged illegality and injustice of the overthrow and serve a general desire for self-governance and sovereignty.

---

166 Liliuokalani (Lili‘u Loloku Walania Kamaka‘e ha or Lydia Kamaka‘e ha), *Hawaii's Story by Hawaii's Queen*, 47.
170 Further history and context available in Appendix 2.
Figure 13. Image of flag of Hawaiian Sovereignty; the inverted Hawaiian flag has come to symbolize a nation in distress and is the main symbol of the Hawaiian Sovereignty Movement. 

Source: Dbenbenn on Wikimedia Commons.

‘Iolani Palace

An example of an unfortunately under-utilized digitization tool is the Matterport 3D virtual reality tour of ‘Iolani Palace (also known as Hale Ali‘i) on the island of Oahu in Hawai‘i. While visually gorgeous and clearly captured with truly exceptional skill and care, there is a considerable issue with what is available in the virtual reality tour – namely the complete absence of contextual information. Given the tools readily available through Matterport, as seen in The Theodore Roosevelt Inaugural National Historic Site tour, as well as the wealth of information on the ‘Iolani Palace website, the tour is left feeling incomplete and

unfinished. To those of Hawaiian ancestry and others personally aware of the historic injustices committed here, the lack of context creates and experience more akin to walking through an extremely luxurious hotel or restaurant with an historic theme, rather than the sacred Palace of a beloved monarchy which was violently betrayed and overthrown by the United States merely 127 years ago.

Starting up the virtual tour is easy and straightforward, whether the visitor is utilizing a virtual reality headset, a computer monitor, personal tablet, or smartphone. After panning quickly over a dollhouse view of the Palace, the visitor is dropped right into the entrance of the Grand Hall. Turning about in the virtual space grants the visitor a glimpse of the outside with spots to navigate to. These spots, in turn, offer a view of the outside of the Palace entrance, the open grounds, tall iron gates, and Mililani Street, leading out to Honolulu. As virtual visitors move from the entrance of the Grand Hall to the right, they step into a room lavishly decorated in crimson and gold. From the presence of two masterfully carved thrones, elevated on a short platform, visitors could assume that this is the Throne Room\(^{172}\). However, what precisely are the crowns and swords in the glass case to the left of the room?\(^{173}\) What are the strange, barrel-shaped feathered constructions standing tall behind those thrones? While it's truly impressive that you can lean closer in this 3D virtual environment and approach the case and thrones from multiple angles, noting details missed in static photographs, this doesn't tell the visitor what these things are or why they're significant.

\(^{172}\) Figure 25 of ‘Iolani Palace Throne Room available in Appendix 4.
\(^{173}\) Figure 26 ‘Iolani Palace Crowns available in Appendix 4.
This is where one immediately feels the need for a docent, a voice-over, a pop-up – something to offer substance and explain what's being presented. As seen in The Theodore Roosevelt Inaugural National Historic Site, a Mattertag™ could rest beside the case of crowns for example, and when clicked on by the visitor, the pop-up of information could explain that this was the crown of the late King Kalākaua – known affectionately as Our Merrie Monarch. The visitor could scroll down for further information, like glancing down at the perhaps more detailed didactic label beneath the standard one in traditional museums. There, they could learn that three months after Queen Liliʻuokalani was imprisoned and overthrown by the United States, this very crown was found – twisted and broken, the kalo leaves along the band bent, with every jewel pried out, and even the velvet lining torn away by suspected haole anti-royalists.174

Similarly, a Mattertag™ could be present with the tall feathered structures behind the throne, perhaps this time offering a link to further information on ‘Iolani Palace's own website. This link could direct visitors to learn that those objects are kāhili, symbols of the aliʻi and their

---

174 Figure 27 of King Kalākaua's coronation crown available in Appendix 4.
families, used to indicate their lineage. Instead of being left wondering what those objects might have been, as one must do in the current state of the virtual tour, visitors can learn that their fine craftsmanship came from the use of feathers of small birds which are held in high regard for their spiritual significance in Hawai‘i.

Navigating upstairs, the visitor moves to the second floor and to the left is another room which serves a similar example – a large room, bare and empty, save a single flat, waist-high glass case which displays a large quilt.¹⁷⁵ There is no title at the entrance to the room, no STOP or offer of auditory instruction, no label or interactive element to offer information. Just large, open windows, bright sunlight, and a colorful, complex-looking quilt. Was this just a storage room, now utilized to display this unknown object? Was this room left unfinished when the virtual reality tour was created and they plan on finishing the display within it later?

Figure 16. Screenshot of ʻIolani Palace Imprisonment Room from Matterport VR tour. 

Source: Shayna Diamond.

¹⁷⁵ Figure 28 of Queen Lili‘uokalani’s quilt available in Appendix 4.
On the ʻIolani Palace website in their section on the Palace Interior, this room is referred to as The Imprisonment Room. Navigating further into the website, visitors can learn that this very room was where Queen Liliʻuokalani was imprisoned as United States forces threatened her and the lives of her people. After nearly eight months of imprisonment in this room with only one lady companion allowed to visit, no news of or communication with the outside world, and constant threat to her beloved people, Queen Liliʻuokalani was forced to abdicate the throne and allow the United States to annex the Kingdom of Hawaiʻi. While imprisoned here, Queen Liliʻuokalani was allowed very few activities, including prayer, crochet-work, quilting, and music composition. This very quilt on display was a powerful statement of Queen Liliʻuokalani's rebellion, its creation used to communicate to her cherished people that all through her long imprisonment she never forgot them, never stopped suffering with them, never stopped loving them. Instead of necessitating navigating the website – something many visitors simply looking to walk through a virtual reality experience may not think to do – this information could be offered via a Mattertag™. If the desired effect of the room is a respectful silence for visitors to contemplate the grim reality of it, this link or voice-over could be left at the entrance of the room, much like an introductory sign to an otherwise label-less exhibition.

In another room, known as the Music Room or the Gold Room, three musical compositions are displayed prominently on a lush seat in the center of the room. As one leans closer in the virtual reality environment, the aged texture of the pages is impressively clear, as are the titles: Hawaiʻi Ponoʻi, Aloha ʻOe, and Ke Aloha O Ka Haku. While Hawaiʻi Ponoʻi was written by King Kalākaua, Aloha ʻOe and Ke Aloha O Ka Haku were both written by Queen Liliʻuokalani.

---


Liliʻuokalani. *Ke Aloha O Ka Haku* was actually written and composed while Queen Liliʻuokalani was locked in the Imprisonment Room, as a prayer for Princess Victoria Kawēkiu Kaʻiulani Lunalilo Kalaninuiahilapalapa Cleghorn (more commonly referred to as Princess Kaʻiulani\(^\text{178}\)), who was heir apparent to the throne. A lovely possibility here would be creating an option for visitors to select one of these compositions and listen to it. As seen in the audio clips of STOPS along the The Theodore Roosevelt Inaugural National Historic Site tour, an audio clip of the song could play, or the visitor could be taken to a video on an external site. These clips of the song could be performed by any number of the local Hawaiian orchestras or choirs which perform these songs regularly, respectfully, and passionately. Not only would this add an emotional depth to the visit and innately involve the local community, but would also offer an audible experience for those who might have visual impairments, learning disabilities, or simply prefer learning auditorily.

![Figure 17. Photograph of musical compositions in Gold Room in ʻIolani Palace.](image)

*Source:* Jeff Kern on Wikimedia Commons.

Another contrast between ʻIolani Palace and The Theodore Roosevelt Inaugural National Historic Site can be seen upstairs in their respective offices – the desks. Where The Theodore

\(^{178}\) Figure 29 of Princess Kaʻiulani in available in Appendix 4.
Roosevelt Inaugural National Historic Site tour offers an interactive experience both in person and virtually, there is no proffered information about King Kalakaua's desk in ʻIolani Palace. If you have never been in person to experience the docent-led tour or searched for information on the room intentionally on the website, you might not even be able to infer that this was King Kalākaua's desk, much less the depth of important governance which took place there. Again, the significance of ʻIolani Palace is undermined by what feels like an unpolished, digitization tool, particularly when contrasted with the available customizable options seen executed elsewhere.

The remaining explorations through the Palace feel much the same – aesthetically beautiful, awe-inspiring, and mysterious, but uniformed and thus somewhat disassociated. While an esoteric setting can certainly pique a visitor's interest, taking that secretive effect too far turns the experience into something incomprehensible or even off-putting. Without context or directions to valid, relevant information, this virtual reality tour might not gain the desired result of encouraging virtual visitors to learn more about the singular, complex history of ʻIolani Palace. After all, without so much as a hint of additional information through these digital tools, virtual visitors are in danger of believing that there is little more to this Palace than its...
appearance, even if they were to visit in person. This is repairable without necessitating the creation of new, complexly coded virtual material. Although using the built-in Matterport tools would be an obvious solution, even this could be avoided if the museum was so inclined to use as few of the digitization techniques as possible. Something so simple as a statement before the beginning of the tour itself, recommending visitors read some of the room descriptions or watch some of the available lectures, would add a tremendous amount of invaluable context to this unique experience.

This would be feasible as the ‘Iolani Palace website has a truly tremendous wealth of knowledge and experts behind it, all of which is available to online visitors for free. This includes several particularly informative video lectures series which would greatly amplify and inform the virtual reality tour experience.\(^{179}\) The first series discusses fourteen of the portraits currently hanging within the Palace – an explanation which would aid in humanizing and demystifying the faces of the monarchs and their consorts that digital visitors find themselves staring up at as they walk through the Palace. The second lecture series is called \textit{Nā Moʻolelo} and features “presentations by Hawaiian cultural experts, historians, and museum professionals that prompt discussion of Hawaiʻi history and culture as well as museum practices.”\(^{180}\) This lecture series would contextualize the seemingly random blending of cultural items on display in the Palace such as elephant tusks, statues of dragons and Buddhas, American-made electronics, and traditional Hawaiian masterworks like the \textit{kāhili}.

The final lecture series is called “A King’s Noble Vision”, and explains the history of the Palace from its building in 1882 by King Kalākaua, to its service as residence to Queen Liliʻuokalani, up through her imprisonment, and finally her deposition and the overthrow of the

\(^{179}\) ‘Iolani Palace, “Virtual Experiences and Resources.”

Hawaiian monarchy. All of these lectures would be wonderful additions to the 3D virtual tour as Mattertags™ like those seen in The Theodore Roosevelt Inaugural National Historic Site tour. With a little editing, even the longest parts of the Nā Moʻolelo lectures (some of which are several hours long) could be crafted into shorter sections and distributed throughout the tour. Furthermore, a link leading the visitor to the already-existing video and audio could be provided as a Mattertag™ pop-up alongside relevant rooms or objects, driving further traffic to the ‘Iolani Palace website and content.

**General Suggestions**

My key suggestion with digitization in such cases as these 3D virtual reality tours, would be to make it customizable. An example of this would be what we saw with the use of Mattertags™ in The Theodore Roosevelt Inaugural National Historic Site virtual tour. Encourage visitors to check out the already-present information on their website, add the contextual pop-up labels and information throughout the tour, offer a pre-recorded AD or audio guide, but allow guests to turn these integrated features off if they wish. Much like a visitor in a museum can coast past all of the didactic labels, introductory posters, and signage, or even ignore the docent as they speak – a digital visitor could choose to experience the museum in a way that is unique and best suited to them, individually.

Even when leaving these virtual additions on, they can be altered and adjusted to varying degrees. One of the most attractive characteristics of digitization tools is their ability to personalize and adapt the information they're fed.\textsuperscript{181} This means the educational, interpretative, or emotive material they're given can be presented in a wide variety of ways which can make it more accessible to individual visitors and their learning styles. When designed appropriately,

\textsuperscript{181} Economou, “A World of Interactive Exhibits,” 149-150.
these tools can offer different types of learning – degrees of active participation, specificity, vocabulary, etc. which allow for even greater accessibility for those who might have difficulty navigating the digital landscape and its tools. If designed with clear intent and empathetic comprehension, then the age, familiarity, and potential disability of the user will be irrelevant.

Unfortunately, the particular programming which creates an intuitive nature in these technologies may not be something that museums themselves have control of or influence over unless they have the generous funding for specialists in content creation and editing. For example, think of the ease with which you’ve navigated some websites where it felt almost instinctive. You don't really need to think or hunt around for information, but instead navigate almost naturally towards what you're looking for. Now compare that experience to those websites which have been a struggle, where you may have had to fight to find whatever features you’re looking for. It’s this programmed interface which is built into all user-based technology that helps determine its ease of use and accessibility. In these cases, museums need to be cognizant of the companies and technologies they are choosing to employ and allow within their collections and among their visitors. Choosing a touch screen which is appropriately or even impressively responsive is pointless if the programming behind the screen makes the information within difficult for all visitors to access.

The customizable options inherently available to digitization are something which, in order for those tools to be incorporated most effectively and efficiently, cannot be ignored. As Samuela Caliari from MUSE stated in the quote used to open this chapter, digitization and its tools should not be an obstacle to the perception of the unique collections and presentation of museums. Instead, it should be “responsive”, something which can adjust and adapt to the user, regardless of their individual familiarity with the technology. The only way digitization can be of
any use to visitors is if it is accessible. But once that criteria of approachability is checked, once that hurdle of customized efficiency is overcome, there is no more versatile tool.
Chapter 7: Conclusion

“In the process, museums, archives, and libraries will become a resource that is infinitely more valuable than a passive set of digital images and will play a larger role in helping our nation meet some of its most pressing educational challenges. The possibilities for museums, libraries, and archives to serve the public through digital technology are immense, but none of them will become reality without commitment, resources, effort, and innovation.”

Gerald Wayne Clough 182

Throughout this paper, I have addressed the changing role of museums as institutions and why this evolution is beneficial to both the museums and the public they serve. I defined digitization in the museum context, introduced the inherent challenges of digitization, as well as outlined some of the many benefits of digitization to collections, the visitor, and the museum itself. In sharing studies and examples of successful digitization efforts, I demonstrated how digitization can increase public accessibility and highlighted the benefits digitization offers to increasing accessibility, particularly for people with disabilities. Finally, I illustrated how one of the many tools of digitization could be more successfully integrated into traditional museum methods to offer the most to virtual visitors.

Digitization in museums allows for fast, easy access to the vast wealth of knowledge and heritage therein, breaking down the walls – both physical and metaphorical – which historically have prevented much of the public from accessing and experiencing them. While there is still much we don't know about the development and long-term effects of specific digitization tools, the benefits to visitors, collections, and the museum itself are undeniable. Investing and integrating digitization into the core functions of a museum provides numerous positive contributions to those looking to center their efforts around their communities and ensure their

182 Clough, Best of Both Worlds: Museums, Libraries, and Archives in a Digital Age, 68.
collections and knowledge do not decay, locked away from the very people they are there to represent and inspire.

A further consideration which must be made from the perspective of museum leadership is whether or not these digitization efforts affect the roles of staff. The answer is, quite frankly, yes they do. Whether one works in collections, communication, education, development, or curation, the introduction of digitization efforts will (and should) affect them. This might immediately cause concern in some as their own digital literacy may concern them – Will their jobs be in jeopardy? What about the projects they have passionately labored over for years? Will everything be overwritten by these new digitization efforts? This time, thankfully, the answer is no.

Digitization can certainly impact every single aspect of museum operations, but this is nothing to fear, as with proper leadership, these effects will only yield positive results. When introducing digitization and new technological tools, competent museum leadership should take an integrated approach, ensuring that all the highest levels of leadership understand the potential and challenges. This first step will guarantee that leadership are equipped to make wise decisions, such as how to approach any variance in existing staff's digital literacy and how to incorporate new digital strategies and teams into the museum's pre-existing organizational structure.

Digital literacy is certainly a skill which is being more and more frequently expected in the workplace – both in the museum field and outside of it. However, this by no means cuts pre-existing staff out of these new processes. To combat this, museum leadership should provide training for all staff involved, particularly regarding what the technologies being introduced are capable of. This will ensure that everyone participating has a similar, general understanding as
they work together to create their digital strategy. Additionally, for those technologies and processes which are outside the realm of expertise of any current staff, it is important to recognize when to bring in the right people, whether this means hiring specialists or selecting external contractors to become long-term partners on the project.

One of the greatest flaws from leadership comes from viewing digitization as something which can be “silked into an existing department” or segregated from the museum's strategic plan. This is ineffective because digitization affects the entire museum. Thus, keeping departments isolated will only inhibit and belabor these new, evolving processes. Where the digitization team lives will have a tremendous impact on their goals and work, as those which exist merely as subsets of pre-existing departments will generally align their work to those goals. Instead, digitization teams should be elevated to their own, co-equal place within a museum's organizational structure and report directly to the CEO or director. This structure for incorporating digitization has been observed to “[result] in innovative, boundary-pushing work.”

These new digitization divisions should not, however, be left adrift and leaderless as this has several risks of its own. Considering additions such as creating a cross-departmental team is an extra step towards a successful initiative, as it would ensure all those involved are able to bring their diverse perspectives forward. This way, staff can identify and prioritize complications and solutions accordingly. As with the introduction of any new practice to a museum, regardless of the size, success will only be found in considerate and conscientious execution from leadership.

---

New technologies can be intimidating or off-putting to some, particularly when they may feel as though its very presence negates the traditional or historic aspects of institutions like museums. However, there is a tremendous incentive for museums to modernize in order to take advantage of the immense opportunities such digital devices can offer. Be it virtual reality, augmented reality, QR Codes, or audio descriptions – new, emerging technologies are here to stay. And to help, if museums let them. These technological, interactive tools, despite their inherent challenges, can be utilized to increase accessibility and aid both museums and their visitors. The immense wealth of information and heritage within storage and on display in museums hold no value if it cannot be shared with humanity. Thus, museums cannot rest on the laurels of their previous methods and successes, but must ensure they are evolving – just as their communities are – to ensure that as many visitors as possible are able to access and experience their incredible collections and research.
Image Citations


Bibliography


Appendices

Appendix 1

Hawaiian Pronunciation Guide\(^\text{185}\)

Hawaiian consonants are said the same as they are in English, except for w, which is usually pronounced like v after i and e.

Vowel sounds:
- \(a, ā\) like a in was: (olonā)
- \(e\) like e in red: (heʻe)
- \(ē\) like a in baby: (nēnē)
- \(i, ī\) like e in me: (imu, kī)
- \(o, ō\) like o in go: (kalo, kō)
- \(u, ū\) like oo in moon: (hula, pāʻū)

Hawaiian words are usually stressed on the next-to-last syllable, unless there is a single line over a vowel. This line is called a macron or kahakō. It shows that the vowel should be said with stress, or longer and stronger.

Sometimes two vowels go together: ai, ao, au, ei, eu, oi, ou. The vowel sounds are rolled together as you say them, with the first one being stronger.

The mark like an upside-down apostrophe (ʻ) is called an ʻokina. It marks a glottal stop. It shows that there is a break in the word, as when you say the English oh-oh.

Appendix 2

Leading up to the occupation and overthrow of the Hawaiian Kingdom, Queen Liliʻuokalani resisted years of attempts made by these insurgents to sway her into deposing her brother, King Kalākaua. According to Queen Liliʻuokalani’s own writings, in 1888 Mr. James I. Dowsett Jr., a young man only 18 years old, was sent to her home at Muulaulani, Palama by members of the missionary party “to inquire if I would accept the throne in case my brother should be dethroned.” About a week later, Mr. W. R. Castle called for a private meeting with Queen Liliʻuokalani, insisting they speak where they could not be interrupted or overheard. Queen Liliʻuokalani took him to a side room where she typically attended to her correspondence and literary work, but in the adjoining room were “a party of girls who had met” regarding other matters, and hushed at hearing her approach “[remaining] still as mice; and so listened to every word which passed” between Queen Liliʻuokalani and Mr. Castle. Mr. Castle proposed that Queen Liliʻuokalani should immediately ascend the throne and “receive the support of the missionary party”. Again, Queen Liliʻuokalani immediately refused and demanded to know what the missionaries plans were with her brother - were they plotting to harm or murder him? Mr. Castle denied that there was a plot to murder the king, saying only that King Kalākaua must “must retire” and that she “should assume his position as reigning sovereign.”

Even prior to the 19th century, Hawaiians faced the issue of fighting off the armed forces of Western nations several times before, including when Captain Cook kidnapped their aliʻi in 1779. As Hawaiians stood against “the exploding guns and defended their chief” in the 1779 kidnapping, they took heavy losses, and their villages at Kealakekua were burned. Despite these great losses of life and land, they were able to rescue their chief after killing Cook and several of his men. Later, off the coast of the island of Maui, an American trader “heinously slaughtered over a hundred Hawaiians who had come out to trade” and “whipped a high chief”. The retaliation resulted in the deaths of several sailors, including the son of the murderous trader. Though the aliʻi “pursued a strategy of avoiding armed conflict with foreigners.”

The overthrow and illegal annexation of the Kingdom of Hawaiʻi is still an incredibly painful and raw wound, something which is all but impossible to convey in such a short section of this thesis. There are several books listed within this bibliography which I would highly recommend to those seeking to further educate themselves on the matter – Hawaii’s Story by Hawaii’s Queen by Queen Liliʻuokalani, Aloha Betrayed: Native Hawaiian Resistance to

---

186 Liliʻuʻokalani (Liliʻu Loloku Walania Kamakaʻeha or Lydia Kamakaʻeha), Hawaii’s Story by Hawaii’s Queen, 82.
187 Liliʻuʻokalani (Liliʻu Loloku Walania Kamakaʻeha or Lydia Kamakaʻeha), Hawaii’s Story by Hawaii’s Queen, 83.
188 Coffman, Nation Within: The History of the American Occupation of Hawaiʻi, 40.
189 Coffman, Nation Within: The History of the American Occupation of Hawaiʻi, 40.
American Colonialism by Noenoe Silva, and Nation Within: The History of the American Occupation of Hawai‘i by Tom Coffman. Brief though it was, I found it essential to demonstrate the significance of ‘Iolani Palace and explain just why the incomplete utilization of their digital tools (while understandable and doubtlessly due to particular circumstances) is a tremendous shame.

Additionally, it is here that I would like to acknowledge the awkwardness of using The Theodore Roosevelt Inaugural National Historic Site as the balancing example with ‘Iolani Palace, given Theodore Roosevelt's participation in the illegal annexation of the Kingdom of Hawai‘i. Though he was Assistant Secretary of the U.S. Navy at the time, Roosevelt was “one of the major proponents for the acquisition of the Hawaiian islands, and the imperialist philosophy in general.”190 This is not the appropriate paper to discuss his influence on the overthrow, but Nation Within: The History of the American Occupation of Hawai‘i discusses his involvement at length if you would like to learn more. My choice of using these historic sites was based purely on the criteria of their utilization of Matterport for their virtual 3D tours, and while this uncomfortable connection was not recognized until much later, I still find them appropriate case studies from a digitization and disabilities accessibility perspective.

Appendix 3

Figure 19. Portrait painting of Theodore Roosevelt.
Source: John Singer Sargent.

Figure 20. Screenshot of TR Site Donations Box from Matterport VR tour.
Source: Shayna Diamond.
Figure 21. Screenshot of TR Site Interactive Exploration Desk from Matterport VR tour.

Source: Shayna Diamond.

Figure 22. Screenshot of TR Site Immigration and Poverty mural from Matterport VR tour.

Source: Shayna Diamond.
Appendix 4

Figure 23. Portrait painting of King Kalākaua by William F. Cogswell.

*Source*: ‘Iolani Palace.

Figure 24. Portrait painting of Queen Lili‘uokalani by William F. Cogswell.

*Source*: ‘Iolani Palace.
Figure 25. Screenshot of ‘Iolani Palace Throne Room from Matterport VR tour.

Source: Shayna Diamond.

Figure 26. Screenshot of ‘Iolani Palace Crowns from Matterport VR tour.

Source: Shayna Diamond.

Figure 27. Photograph of King Kalākaua's coronation crown composed of diamonds, opals, emeralds, rubies, and kukui nut jewels with velvet cap and taro leaves.

Source: ‘Iolani Palace.
Figure 28: Photograph of Queen Liliʻuokalani’s quilt in ‘Iolani Palace.

Source: Queen Liliʻuokalani.

Figure 29. Photograph of Princess Kaʻiulani in 1897 wearing a pearl necklace.

Source: Hawaii State Archives.
Appendix 5

Figure 30. Screenshot of TR Site Floor 1 from Matterport VR tour.
Source: Shayna Diamond.

Figure 31. Screenshot of TR Site Floor 2 from Matterport VR tour.
Source: Shayna Diamond.

Figure 32. Screenshot of ʻIolani Palace Floor 1 from Matterport VR tour.
Source: Shayna Diamond.

Figure 33. Screenshot of ʻIolani Palace Floor 2 from Matterport VR tour.
Source: Shayna Diamond.
Glossary

aliʻi – chief, ruler, royal, noble
aloha – love, greetings
Aloha ‘Oe – Farewell to Thee
hale – any building, house
Hale Aliʻi – House of the Chiefs or Palace
hale aliʻi ‘o ʻIolani – ‘Iolani Palace
hale hōʻikeʻike – museum
haole – one who is not descended from the aboriginal Polynesian inhabitants of Hawaiʻi
Hawaiʻi Ponoʻi – Hawaii’s Own
he’e – octopus
hula - Hawaiian dance, dancer, or chant used in dance
imu – underground oven
ka – the, used before most Hawaiian words
kāhili – a feather royal standard, a symbol of the aliʻi, used by the Hawaiian Royal Families to indicate their lineage
kalō – the Hawaiian name for Colocasia esculenta or taro, main food of ancient Hawaiʻi and a symbol of the Hawaiian's family connection to nature and the earth, considered by some to be the world's oldest cultivated crop
ke – the, used before words that being with k, e, a, and o
Ke Aloha O Ka Haku – The Lord's Mercy or The Queen's Prayer in Hawaiian
kī – tī plant, key, tea
kō – sugarcane
moʻolelo – story, history, or tradition
na – for, by, belong to
Nā Moʻolelo – The Story or The History in Hawaiian
nēnē – Hawaiian goose
o – of, belonging to
‘o – particle marking subject, identification sentence pattern
‘oe – you
olonā – shrub from which strong cordage was made
pāʻū – woman’s skirt, made of tapa cloth in ancient days; these days often refers to a hula skirt
pono ‘i – self, own