

The State of Museum Digital Practice | 2021

A collection of graduate
essays and responses

Museums and Technology | George
Washington University

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Teaching Museum Digital Practice in 2021

The *Master of Arts in Museum Studies* program at The George Washington University responds to the evolving museum profession by combining hands-on training with future-focused theoretical engagement. Students who enrol in the program gain foundational knowledge about the state of museum work today, practical skills and the ability to critically engage with developments in the field.

In *Museums and Digital Technology*, these goals are met in the form of a syllabus that concurrently gives a broad overview into the issues related to technology in museums today; a deep engagement with a topic of personal or professional interest through a research project; experience in a collaborative creative environment through the peer review process; and practical skills in Markdown language. At the end of the semester, each student has a published piece to share with peers, colleagues and friends.

Each student is responsible for defining and researching their topic and writing their paper. Dr Suse Anderson, Assistant Professor in Museum Studies, working closely with Greg Albers, Digital Publication Manager at the Getty, was responsible for compiling the final book. Because the project is produced quickly, the editorial hand is only lightly felt, so there may be inconsistencies in style, formatting and approach.

This is the second iteration of this publication project. The first, produced in 2019, was designed by Dr Anderson, informed by her experience co-editing several digitally-informed publishing projects, including *CODE|WORDS Technology and Theory in the Museum*, which brought together leading museum thinkers and practitioners to explore the impact of digital technology on the nature of museums, and *Humanizing the Digital: Unproceedings from the 2018 MCN Conference*, which responded to the *MCN annual conference*. Produced in less than four months, *Humanizing the Digital*

contained 17 reflections, case studies, conversations, essays, and an experimental in-book zine, from 34 different contributors. It also marked a specific moment in time. Likewise, it is intended that each book in the *The State of Museum Digital Practice* series will stand as a marker of each cohort of students and their concerns and interests in a specific timeframe. While the 2019 publication for this class touches on some similar and overlapping topics to this one, it is framed quite differently. Indeed, the COVID-19 pandemic has shaped the ways in which the current class has interacted with museums online and in-person for two years by this stage, and the themes that are found in this year's project – such as the many references to Google Art and Culture – reflect that.

The project did not run in 2020.

We hope you enjoy this publication, produced by the fall class of 2021.

Socially Distanced, Virtually Connected: Digital Collecting During COVID-19

Devon Valera, The George Washington University

In March 2020, the World Health Organization (WHO) declared COVID-19, the disease caused by the SARS-CoV-2 virus, a global pandemic.¹ SARS-CoV-2, a coronavirus similar to SARS, was first identified in Wuhan, China in December 2019. China was the first country to undergo a strict lockdown to minimize the spread of the virus and its resulting respiratory disease.² In March 2020, California became the first U.S. state to declare a lockdown.³ This triggered a wave of quarantines and restrictions, with only necessary businesses still operating in person, such as grocery stores, laundromats, banks, and pharmacies.³ Within a matter of months, companies collapsed, borders were sealed, schools went remote, and over a billion people worldwide lost their jobs.⁴ Museums were caught in the middle of this sudden upheaval, as the sector was faced with closures, job losses, and virtual transitions. What were museums to do? Eighteen months later, we're still trying to figure it out.

With physical spaces rendered useless overnight, museums were forced to find methods to stay relevant in a new, virtual world. Suddenly, institutions had to reimagine the very definition of a museum. What were they? What could they do? In a field traditionally reliant on physical exhibitions and in-person interpretation, many struggled to transition their work online.⁵ Institutions had to get creative and soon virtual initiatives were flooding the internet, from #museumsfromhome on Twitter to virtual gallery tours and Zoom programming. Former Director of the Smithsonian Arts at the Smithsonian Institution, Susan Lubowsky Talbott, stated it clearly: "Virtual programmes are now essential for maintaining audiences confined to their homes.

They are quickly developed and inexpensive to launch on already existing platforms.⁶ The question of cost was key, as a lack of visitors meant many institutions faced dire budget shortages. In a national survey on the impact of COVID-19, the American Alliance of Museums (AAM) found that 33% of institutions were worried that they would have to close their doors forever if they were left without some form of financial assistance.⁷

Despite strict restrictions and financial burdens, memory institutions like museums, libraries, and archives were needed more than ever to collect and commemorate the unprecedented events of the COVID-19 pandemic. But how can you collect and connect during a time of social distancing and physical isolation? Museums around the world turned to their communities to address this problem, starting digital outreach campaigns that encouraged the donation and submission of objects. Museums specifically relied on born-digital materials, such as photos, typed reflections, videos, and audio, which were easy to submit online and didn't rely on in-person interaction. In this article, I will look at how institutions enacted COVID-19 collecting initiatives that melded community collecting, rapid collecting, and participatory practices into a new, virtual format. In particular, I will examine submission portals to evaluate how institutions formatted their requests for content and identify the key components of a collecting project. When the need arises again, what can museums learn from COVID-19 collecting in order to quickly roll out clear, effective, and thoughtful programs?

Even before COVID-19, museums have been preoccupied with the problem of falling visitor rates. In 2008, the National Endowment of the Arts Survey of the Public Participation in the Arts identified a crisis of culture. They found that "audiences for museums, galleries, and performing arts have decreased, and the audiences that remain are older and whiter than the overall population."⁸ In her book, *The Participatory Museum*, Nina Simon offers a solution to this problem: engage with the public, invite them in, and allow them to actively participate in learning and meaning-making. With COVID-19 rendering in-person visitation non-existent, many museums have adopted Simon's participatory approach, endeavoring to make their institutions more engaging by reaching out to digital audiences and inviting them to interact on social media or join collecting projects. What sets participatory museums apart is that "information flows between institutions and users" and community members are respected as sources of information and inspiration.⁹ Participatory projects, like digital collecting initiatives, can "make relationships among staff members, visitors, community participants, and stakeholders more fluid and equitable," and this relationship building is especially valuable during a time of social isolation.¹⁰ Collecting initiatives are what Simon labels "me-to-we initiatives" which empower visitors to create content that will enhance the experience of others. This is done by "[coordinating] individuals' actions and preferences to create a useful and interesting collective result."¹¹ By encouraging visitors to share their stories of the pandemic,

museums are not only preserving objects for the historical record but also fostering a sense of community among their audience.

While COVID-19 collecting projects rely on audience participation, they are also informed by the practices of community collecting and rapid response collecting. These two collecting strategies existed long before 2020, but the COVID-19 pandemic created the perfect environment for common adoption. Focusing on contemporary events, community collecting and rapid response collecting methods deny the museum's traditional passive donation strategy and instead take an active role in shaping collections. In community collecting, community members are empowered to identify and collect objects that they find valuable and representative. Museums around the world have expressed their intent to become more accessible and more representative, and community collecting has revealed itself to be a radically democratic solution that privileges the knowledge and experience of the many over the "expertise" of the few. The time frame of this collective effort is sped up when combined with rapid response collecting. As the name suggests, rapid response collecting focuses on short bursts of collecting, usually in reaction to sudden, dramatic, and historically valent moments. This collecting methodology arose in response to the September 11th terrorist attacks in New York City,¹² where the New-York Historical Society created the "History Responds" initiative to quickly collect and preserve objects from the event.¹³ These two methods are not commonly combined, as building relationships with communities requires a large time investment that rapid collecting can't afford. For this reason, most time-sensitive rapid collecting efforts are led by curators and topic experts. Considering the course of the COVID-19 pandemic, community collecting and rapid response collecting become more powerful in combination, as they utilize broad community knowledge to build an image of the present moment.

With the emergence of COVID-19, museums needed to quickly reach out and make connections with their communities to identify meaningful stories and solicit donations. To do this, museums of all sizes and budgets took advantage of social media. In an article for the American Alliance of Museums, Anne Raymond, Board Member for the Unionville Museum in Connecticut, explains how her small institution utilized social media to begin a rapid response collecting project that directly involved the local community. Of the program, Raymond says "Living through this historic event now gives us and others working in local history an opportunity to start collecting relevant primary sources immediately."¹⁴ Working with the resources they had, the Museum posted a request for "photographs and stories about the effects of the virus" on their website and Facebook page.¹⁴ The posts directed community members to submit their content in an email. Needing only a Facebook and Gmail account, the museum was able to kickstart their community collecting project one day after the governor's shutdown order.¹⁴ In reflecting on the impacts of this project, Raymond noted that they were not only able to grow their collection, but also

stay connected to their community during a time of isolation, increase awareness of the museum, engage a younger audience, and increase the institution's use of social media.¹⁴

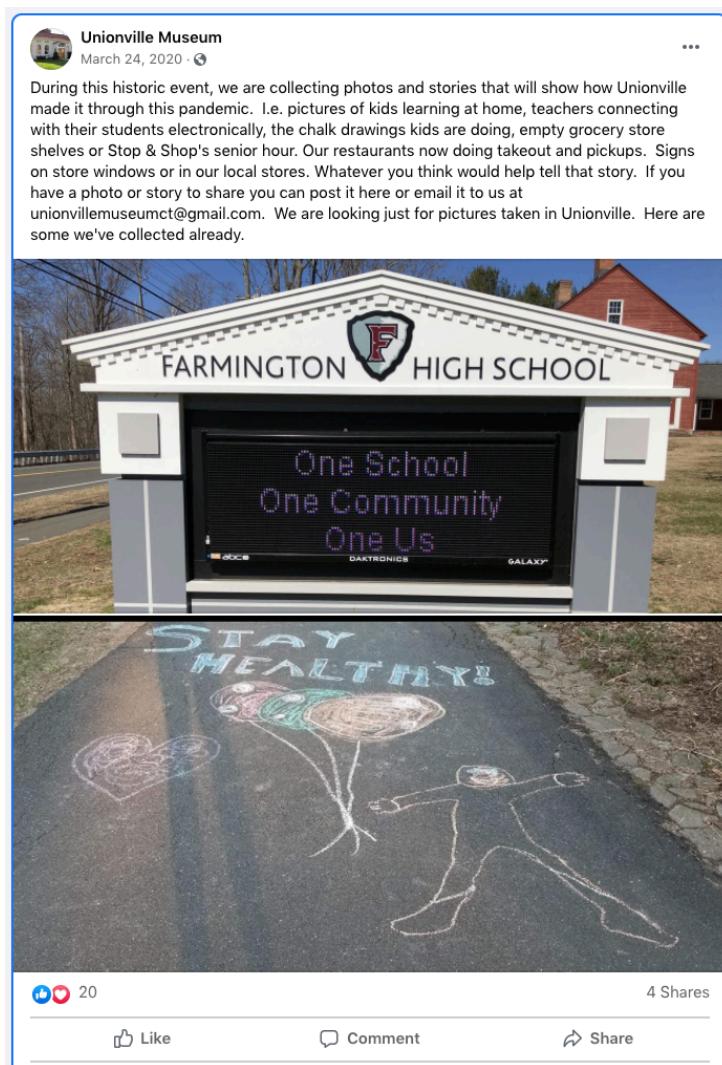


Figure 1: Facebook post by Unionville Museum requesting photos and stories about COVID-19's impact on residents and the local community. They include photos of the local Farmington High School's LED sign and a sidewalk chalk drawing. Accessed on Unionville Museum's Facebook page, October 15, 2021.

Despite a difference in resources and scale, all the museums I evaluated for this article utilized their Facebook pages in order to kickstart COVID-19 collecting projects. The similarities in these cases reveal that museums need only two things to create these virtual initiatives: a way to reach people, and a place for them to submit their content.

While social media was the main format used by museums to reach out to their audiences, submission methods varied widely between institutions. With little precedence, differences in approach and technique emerged as museums tried to identify the best approach to digital collecting in their communities. In this section, I will compare and contrast the submission pages of three mid-sized museums: the Chicago History Museum, the Museum of Ventura County in California, and the Museum of the Home in London. While museums can make do with directing submissions to an email account, as in the case of the Unionville Museum, a website allows museums to situate the project within the context of their institution. Submission portals also allow museums to structure the information they are receiving, enabling them to request specific data to enrich the submission. These three museums have similar missions and scopes that support such reflective, contemporary collecting programs. Despite this, they all have distinct focuses, perspectives, and serve different communities, from metropolitan cities to large counties and international communities.

As these submissions will be preserved in perpetuity as archival materials, museums must not only have a close relationship with their audience but also explain and describe how the project will provide long-term benefits to the community. To this point, the first adjective the Chicago History Museum uses to define its collecting project, *In This Together*, is “community-based.”¹⁵ They note that the historical benefit of collecting personal reflections is that they “provide depth and context for what an event or era was like for the everyday people experiencing it.”¹⁵ The Museum of Ventura County’s COVID-19: Rapid Response Collecting program takes a similar approach, first emphasizing the historic nature of the current moment before stating “Capturing these stories today will help future generations understand what life in Ventura County has been like during a global pandemic.”¹⁶ These two museums focus on preserving a sense of place and time, as their museums focus on the history of their geographic regions. The Museum of the Home, on the other hand, has a more symbolic focus, which is represented in the language they use to define this project. With the refrain “our homes have never been more important,” the Museum of the Home does not spend a lot of time explaining its Stay Home collecting project, rather immediately directing visitors to explore their archive and collected stories.¹⁷ Perhaps there is no need to convince the audience of the truth of this statement; many have been stuck at home due to the pandemic and the importance of “Home” may be self-evident. But this experience was not universal and

essential workers who provided indispensable in-person services may interpret this sentiment differently.



https://youtu.be/2_akQ2xYs5c

Figure 2: Screen recording of the Chicago History Museum's *In This Together* webpage. Includes information about the Museum's collecting project, requirements, and the submission portal. Recorded by author October 27, 2021.

When it comes to content, all three museums specifically request digital photographs alongside written reflections such as journal entries. The Chicago History Museum and Museum of Ventura County also add oral histories and video recordings to their list. While digital materials are the focus of these collecting projects, the Chicago History Museum also links to their donation inquiry form for physical material and the Museum of Ventura County has a section detailing the physical objects they intend to collect “when it is safe,” including masks, takeout menus, home lesson plans, grocery lists, and signs.¹⁶ All three museums post selected reflections online for the public to browse and include links to these pages in their submission portal. By posting submissions online, museums give donors a sense that they are having a direct impact, adding to the historical record, and participating in a collective program.

Provide details about where this image was created	The spatial or temporal topic of the resource, the spatial applicability of the resource, or the jurisdiction under which the resource is relevant
<input type="button" value="Select Below"/>	
Provide details about what --or who-- it depicts.	The topic of the resource <input type="text"/>
What was used to create this image?	The file format, physical medium, or dimensions of the resource <input type="text"/>
What kind of camera or what kind of art materials?	<input type="text"/>
Do you have a title you would like to assign to this image?	A name given to the resource <input type="text"/>

Figure 3: Screen capture of the Museum of Ventura County's COVID-19: Rapid Response Collecting webpage.
Recorded by author October 27, 2021.

So how do you go about actually submitting your content? All three take a similar approach, although executed differently. The Chicago History Museum is the simplest, first requesting that donors upload materials to Box, a cloud-based file-sharing system, or enter content into a text box. They then request information about when and where the content was created and how the donor would like to be identified publicly. After that, it's a quick read through the terms and conditions before clicking submit. The Museum of Ventura County is a little more circuitous in design. The donor is directed to the research library website where they must choose from a dropdown menu whether they would like to submit a story, photograph, video, "sign, poster, pamphlet or other object", or oral history.¹⁶ Each option brings up a different list of questions, specific to the item format, and a way to upload media. While it is an exhaustive way to collect metadata about the submission, the information they are requesting is not always clear. In many cases, each prompt is phrased two separate ways. For example, when submitting a photograph, one text box is labeled both "provide details about what --or who-- it depicts" and "The topic of the resource," figure 4. The donor is left to guess at the meaning, which at best would create a variety of interpretations in data and at worst would disincentivize donors from completing their submission.

COVID-19: Rapid Response Collecting

The Museum of Ventura County is collecting materials documenting the response of our community to the coronavirus that causes COVID-19.



COLLECTING HISTORY TODAY

Translate » Ventura County residents continue to live through historic events, the

CONTRIBUTING YOUR DIGITAL CONTENT

Your images, stories, videos, art projects, and more tell the story of life today



<https://youtu.be/cdHoIizxBBg>

Figure 4: Photo of questions from the Museum of Ventura County's COVID-19 collecting portal. An example of a confusing question is bracketed in red. Accessed October 23, 2021.

The Museum of the Home has a slightly different structure, although it mirrors the fundamental ideas of the other museums. The page first prompts donors to respond to 7 questions about their home, like “How does staying at home affect your relationships?” and “Has lockdown changed your habits or routines at home?.”¹⁷ The next page asks for five photos of the donor’s home and a description of the photos. Finally, the last page requests demographic information about gender, age, and location, before asking that the donor agrees to the Archive Agreement. With little introduction, these intimate questions come off as personal inquiries into the donor’s life, especially as it is unclear whether a donor can choose to skip a question or keep certain information private. While these prompts may help the donor stay on topic, the Museum of the Home chooses not to address how personal they seem, only acknowledging that the demographic questions might be “a little personal, but it is really useful to us.”¹⁷

COVID-19: Rapid Response Collecting

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COLLECTING HISTORY TODAY

[Translate »](#)

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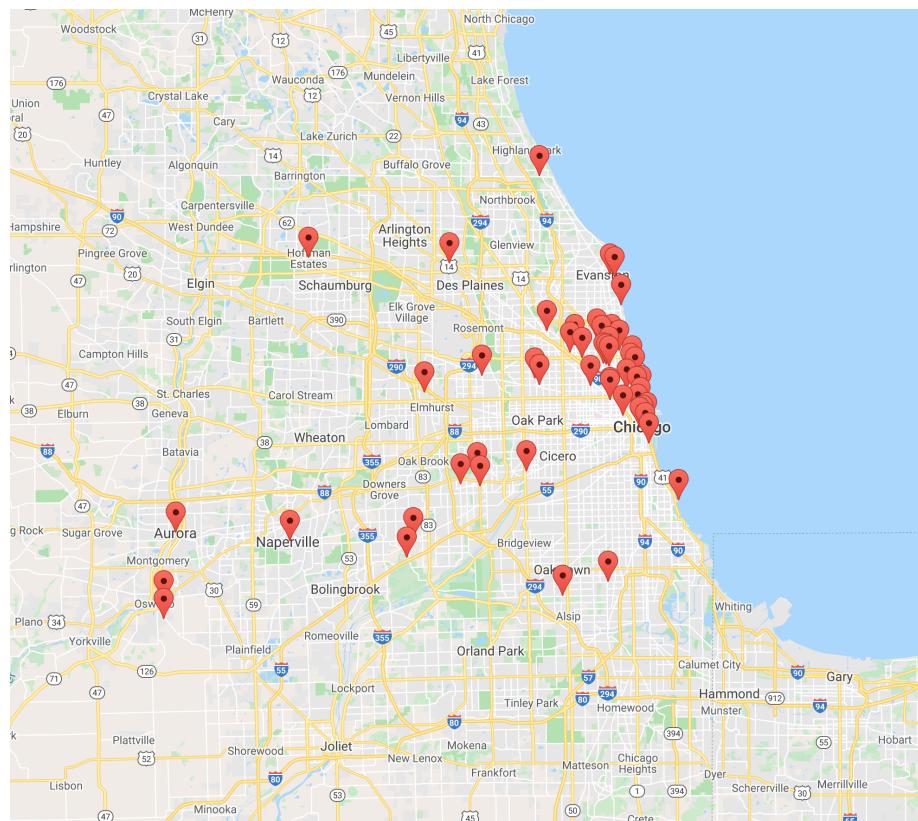


Figure 5: Screen recording of the Museum of the Home's *Stay Home* collecting webpage. Recorded by author October 27, 2021.

While I do not have access to data about the number of submissions each institution received, their posted submissions can be used as a rough measure. While this is not perfect, it is useful in imagining the overall volume of submissions to each project. The Chicago History Museum features 58 collected stories, the Museum of Ventura County 5, and the Museum of the Home 85. Despite its county-wide scale, the Museum of Ventura County has significantly fewer posted submissions and one reason for this may be their portal. By asking unclear questions, the museum puts many steps between the donor and the submit button. If a donor has to stop and puzzle over the meaning of a prompt then they may lose motivation or quit in frustration. In comparison, the Chicago History Museums only asks a few, clear, and key questions to enrich the donated material and the Museum of the Home guides donors through three pages of simple questions and submission portals.

While these numbers are certainly interesting, it's also valuable to evaluate the trends within this data. All three museums collected geographic area information, but the Chicago History Museum used this data to make a map of their donors' locations. In July of 2020, Chicago Magazine observed that, in the map of submissions, "nearly every entry is from the North Side or the suburbs. The one South Side submission is from Hyde Park, and there are none from the West Side".¹⁸ This omission of historically neglected Black and Latino communities reveals that this project is not reaching a diverse audience. Using the data to its advantage, the museum notes that it intends to conduct outreach to these underrepresented zip codes.¹⁸

This is a good time to mention that, when it comes to community projects, one museum does not have to do it all. In her piece for Chicago Magazine, Moore turns to highlight the work of The Blackivists, a collective of archivists in Chicago who are responding to the systemic underrepresentation of Black communities in the historical record by prioritizing Black cultural heritage preservation and memory work.¹⁹ This highlights a key element of community collecting - for the community to respond to you, you must put in the work to earn trust and respond to historical patterns of exclusion. The individuals who will submit reflections are those who feel comfortable and familiar with the institution. This trust will not appear, fully formed, in the moment of a crisis. The work has to be done beforehand.



Map of submissions for *In This Together*, the Chicago History Museum's collecting initiative. Submissions are clustered to the North Side of the city, with the only submissions from the South Side coming from Oak Lawn and Hyde Park. Accessed October 26, 2021.

In creating a participatory museum project, Nina Simon identifies three necessary elements, "The institution must promise an appealing participant experience. The

institution must provide access to tools for participation that are easy to understand and use. And the bargain between institution and participants—regarding management of intellectual property, outcomes of the project, and feedback to the participants—should accommodate participants' needs.²⁰ And while we've seen the importance of the tool, the submission portal, it's also important to consider the bargain made by these collecting initiatives. Museums offer donors the opportunity to have their stories posted on the museum's website and this bargain is functionally fulfilled. But, once posted, these submissions seem to sit unused. This is not a satisfying or sustainable outcome for a participatory community project. There is only one real dimension to this work, the creation of the object, and this is the fundamental flaw of submission portals. Beyond the single submission, there is no further life for the project, no continuing opportunity to engage. Imagining participation only as content creation is narrow and limits not only the project but also the portion of the community engaged. Only 24% of people engage with social media as creators, while others act as critics, collectors, joiners, and spectators.²¹ How will museums access these sections of their audience? A straightforward way would be to enable likes, reactions, and tags on the community submission page. Museums can also experiment with having a submission portal always open, which allows them to be constantly available. If necessary, the museum can craft questions to capture experiences of current events. This transforms the project into a living time capsule that can have usefulness beyond the present moment.

While rarely acknowledged, the COVID-19 pandemic was a traumatic event that impacted everyone's lives. While these collecting projects are important, institutions need to think about how they will handle personal topics and, as stated in the Contemporary Collecting Toolkit, museums should have "procedures in place so that staff and public participants know what to expect and what kind of support might be available to them."²² While "museums can play a role in healing processes" with collections work, "it is important to remember that museums can be exploitative institutions and that the act of collecting can, even today, be experienced as extractive."²³

In reviewing these COVID-19 collecting portals, it becomes clear that participatory community collecting initiatives are built on trust. Museums have to be constantly engaging with their local communities, encouraging and fostering closer relationships all the time. In this way, when rapid collecting or community collecting initiatives are necessary, they can be linked to preexisting networks of communication and outreach. Collecting projects from institutions like the Unionville Museum, the Chicago History Museum, the Museum of Ventura County, and the Museum of the Home all provide important lessons on building submission standards, but to make these experiences truly participatory, truly relational, we must go beyond the submission portal and imagine a museum built on ever-evolving community knowledge. By doing this, we can not only create a more equitable

museum for communities of the present but also build a representative historical record for the future.

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Capturing Complexity: Activating Musical Instruments in Online Museum Collections

Norman Storer Corrada, The George Washington University

It's hard to go through a day without musicking in some way. Musicologist Christopher Small proposes music as a verb rather than a noun, and musicking—to music—"is to take part in any capacity in a musical performance".¹ Viewed even more broadly, musicking can be anything from performing a concert in front of thousands of people, to dancing at a party, to listening to the radio, to making a playlist, and beyond. Music is all around us and it is deeply connected to countless dimensions of our lives and cultures. Music also leaves behind countless material traces, including (but by no means limited to) musical instruments. Like all other objects, musical instruments are part of the infinitely complex web of social interactions between humans and things. They contain complex dimensions which include sound, touch, craft, performance, heritage, racism, nationalism, spirituality, and more.

In recent decades, the awareness of these social and material connections has informed the study of musical instruments in organology and ethnomusicology.² While some museums have applied this approach to curating and displaying musical instrument collections in exhibitions,³ institutions can also embrace these connections within their online information management systems. When used to their full potential, online collections can allow museums to capture the true complexity of objects as social actors by incorporating diverse resources and

perspectives and “reconnecting museum objects and knowledge to global flows of culture and information.”⁴ Building on this idea, this paper explores how museums can use the content included in information management systems and online collection object pages to contextualize musical instruments within the wider social and material networks that they are a part of. By incorporating visual resources, sound and video, and interconnecting multiple types of objects, museums can embrace the inherent complexity of musical instruments within their collections pages and bring those objects to life.

CURATING MUSICAL INSTRUMENTS AND CREATING ONLINE MUSEUM COLLECTIONS

Under Western frameworks of knowledge, the study of musical instruments usually falls under the field of organology.⁵ In the 20th century, organologists were mainly concerned with classifying musical instruments, developing systems such as the commonly used Hornbostel-Sachs classification which divides instruments into families based on how they produce sound. Organologists also explored construction techniques and the historical evolutionary trajectories of instruments. Though much of this work focused on European instruments, organologists also studied instruments from around the world in a process paralleling the systematic study of material culture in museum anthropology, often ignoring Indigenous and non-Western histories, worldviews, and classificatory schemes.⁶

In recent decades, organologists and, especially, ethnomusicologists⁷ have pushed for the study of musical instruments to expand beyond classification and lineages and to delve more deeply into the “social life” of musical instruments.⁸ As Dawe explains,

musical instruments are embodiments of culturally based belief and value systems, an artistic and scientific legacy, a part of the political economy attuned by, or the outcome of, a range of associated ideas, concepts and practical skills: they are one way in which cultural and social identity (a sense of self in relation to others, making sense of one's place in the order of things) is constructed and maintained.⁹

This approach is informed by the exploration of active relationships between people and things in anthropology and material culture studies. Although specific theories and terms vary, multiple scholars have sought to highlight that objects are entangled or enmeshed in complex webs of socio-cultural interactions with humans. Within these networks, objects may play multiple roles and attain varying degrees of agency throughout their lives.¹⁰ Just like other objects, musical instruments are inextricable from human cultures and their multiple dimensions deserve to be explored.

Some museums with musical instrument collections embrace this perspective when curating physical exhibitions, albeit inconsistently. For centuries, the role of museums was (and too often continues to be) to impose order on the natural and cultural world through white-supremacist, and imperialist hierarchies, disciplinary segmentation, and decontextualization.¹¹ It should be no surprise, then, that many museums have traditionally opted for displaying instruments by following the organological classifications born out of the same Euro-centric frameworks. The permanent displays at more traditional musical instrument museums such as the Musée de la musique in Paris and the Museo degli strumenti musicali in Milan, for example, group instruments based on instrument families and provide relatively little social contextualization. This is often true of museums dealing with Western classical music and instruments, though it is an order also imposed on displays of instruments from musical traditions around the world.

Museums that host collections or exhibitions about popular music tend to explore the social dimensions of musical instruments more extensively by connecting them to artists and wider cultural and historical contexts (see, for example, the *Musical Crossroads* permanent exhibition at the National Museum of African American History and Culture and the *David Bowie is* temporary exhibit at the Victoria and Albert Museum¹²). Curators and designers use various techniques to make popular music exhibitions more engaging and immersive. First and foremost, they draw on multiple kinds of objects (musical instruments, clothing, ephemera, etc.) and connect them to tell a story. Second, many exhibitions use sound and music extensively, either through headphones or out loud. In these cases, sound is afforded the status of object, displayed and working alongside what may be viewed as more obviously material objects.¹³ Indeed, preserving and sharing sound is an integral part of curating the complex and intriguing totality (“the magic”) of musical instruments.¹⁴ Exhibitions also rely on dramatic contrasts and enveloping strategies to capture the viewer’s attention and create an immersive experience, much like music is an experience in itself.¹⁵

All these techniques come together in physical exhibitions to show that musical instruments are one component of an incredibly complex network of objects, sounds, people, and relationships tied to all other cultural dimensions. At the same time, the immersive experiences include the visitors and make them part of the story. By embracing complexity and interdisciplinarity, these kinds of exhibitions begin to push (even if too gently) against the traditionally Euro-centric knowledge structures that lie at the core of Western museums. While exhibitions are a powerful and highly visible site in which to challenge these structures and ways of thinking, they are not the only place where museums can highlight the inherent complexity of musical instruments as part of efforts to break disciplinary walls and reconnect objects with their social networks. These connections can also come to life in the collection documentation itself, especially as it appears in museum websites.

Museums are sites of power, and this extends to how they manage their objects and information and make that information accessible online. Erin Canning, writing on the ICOM International Committee for Documentation blog, stated this idea clearly: “[...] information systems – such as collections management systems – are artifacts of systems of power, and like any other system or infrastructure, they enact the power relations of those who originally designed and created the systems to the detriment of those upon whom power is enacted.”¹⁶ Information management systems tend to force objects into static hierarchies and classifications that do not reflect their dynamic existence in the world. Additionally, they prioritize only certain forms of knowledge (Euro-centric, colonialist, exclusively text-based, physical, visual, etc.) over others (Indigenous, traditional, oral, multi-sensory, trans-disciplinary, etc.).¹⁷ Like all other objects, musical instruments in these collections suffer under the limitations of such a framework, perhaps even exacerbated by their inherent multi-sensory and social function.

To challenge these frameworks, Fiona Cameron highlights the importance of embracing the complexity of networked objects. Cameron and Mengler define complexity as “the holistic, global or non-linear form of intelligibility needed to comprehend a phenomenon” and “a dense, entangled dimension that appears rebellious to the normal order of knowledge.”¹⁸ By understanding online collections through this lens of complexity, we can more effectively envision objects connected to one another, to people, and to global flows of materials, information, relationships, and more. Cameron takes this idea further by calling for an ecological view of collections that embraces objects as part of fluid, infinitely complex, and inseparable systems.¹⁹ Connecting this view to Tim Ingold’s idea of the meshwork,²⁰ we can imagine each musical instrument object page as a collection of knots tying together all kinds of resources—images, sound, video, etc.—from which we should be able to follow the strings leading to other objects, people, relationships, traditions, cultures, and lives.

INCORPORATING VISUAL RESOURCES

Museums tend to prioritize the visual aesthetic component of musical instruments in both displays and online collections pages, often to the detriment of other resources and ways of appreciating and understanding the instruments.²¹ Nevertheless, incorporating visual resources such as high-quality images, diagrams or schematics of objects, 3D models, and visualizations of entire collections in online information management systems remains a key strategy for institutions to increase access to and better contextualize musical instruments. These resources highlight components of the musical instruments that reflect wider cultural connections, facilitate recreations and artistic reappropriations, and allow users to visualize connections and interactions between instruments (and people). Though rarely, if ever, done,

images can also show the instrument in use, interacting with people as it was designed to do. High-quality images of the instruments themselves can even allow users to see detail that may not even be visible in person. Thus, while they should not be prioritized to the detriment of others, these resources are a key component in embracing the complexity of these objects.

Even when the information about a musical instrument on an object page is extremely limited, a good image can allow craftspeople to recreate an instrument. For example, the National Museum of Natural History page is a simple and seemingly outdated, hardly more than a digital card catalog (fig 1). However, thanks to high-quality images and measurements of a rare 19th century Puerto Rican *tiple requinto costero* in the collection,²² the luthier William Cumpiano was recently able to create a construction plan and build reproductions of the instrument.²³ The object record could do a much better job contextualizing the instrument, but at least the images helped bring them (or a copy) to life.

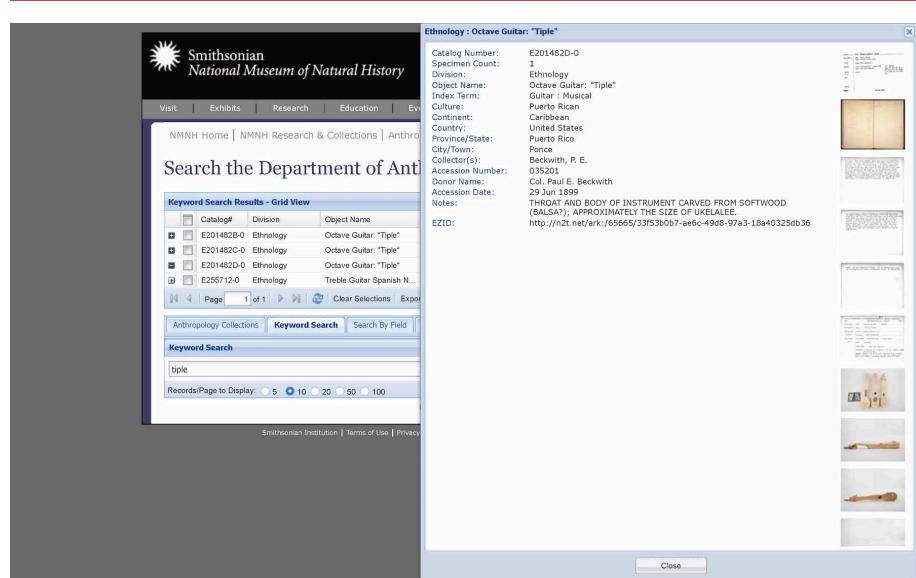


Figure 1: Screenshot of the object page for a 19th century *tiple* in the NMNH online collections. Although the page only provides the same minimal information available on the card catalog, the images of the object are of high quality.

Visual resources can also go beyond the visible surfaces of instruments, providing a glimpse into more subtle details, construction processes, and even suggesting possible tactile interactions. For example, technical drawing and schematics such as those offered by the Musikmuseet of the National Museum of Denmark and the

Museum of Fine Arts (MFA) Boston can further aid instrument builders in creating reconstructions. Although in these two examples the drawings exist separately from the object pages, they are a resource that could be integrated to add an additional visual dimension.

As another example, the Smithsonian Institution Digitization Program Office's 3D Program has digitized two musical instruments associated with well-known artists: Charlie Parker's alto saxophone in the National Museum of African American History and Culture²⁴ and José Feliciano's guitar in the National Museum of American History.²⁵ The 3D scans of the objects allow viewers to see colors and textures in a context that more closely resembles a physical object. Furthermore, users can explore angles that aren't necessarily visible in photographs. The resolution of the scans can make viewing certain details difficult, and users cannot currently view inside the instruments. However, projects such as the Musical Instrument Computed Tomography Examination Standard (MUSICES) at the Germanisches National Museum which are developing technology and standards to produce more detailed 3D models could make such features available in the future.²⁶

Museums can also use data visualization to help us see the complex networks that instruments in their collections are enmeshed in.²⁷ The Musical Instrument Museum of the University of Leipzig (MIMUL) musiXplora app allows users to visualize connecting lines between objects in their collections.²⁸ The website features visual maps of places, time, people, objects, and more. Although still in its infancy and limited to European instruments (and especially keyboards), the resource is an example of embracing complexity and highlighting instruments as part of an entire ecosystem. Another innovative example of data visualization in a music exhibit is the Library of Congress Southern Mosaic online exhibit. The exhibition includes a visual map that gracefully and effectively represents the humans, geographies, genres, and interconnections of the LOC collection of Lomax field recordings of Southern music.²⁹ Similar mapping could be used to re-incorporate musical instrument collections into the flows of music and culture.

INCORPORATING SOUND AND VIDEO

Musical instruments are made to interact with humans to produce sound, and this unique purpose highlights the need of preserving and sharing that sonic component. The sound of the instrument can be treated as its own object worthy of preservation.³⁰ As Eric De Visscher explains, "the sound object is not just a quality or an attribute of the object—it's not like the color of the object, if you want, because it exists independently also—but both A, the object, and B, the sonic object, are part of a whole of this kind of hidden real object."³¹ By incorporating sound as part of

information management systems, museums can also move beyond exclusively visual sources of analysis.³²

When an instrument is in playable condition, its object page can include recordings of the actual instrument. For example, the Musical Instrument Museums Online (MIMO) page for an eighteenth-century guitar in the Musée de la musique, Paris,³³ features several audio clips of music played on that same guitar. If instruments cannot be played, a recording of a similar instrument can be featured instead. On the object page of a nineteenth-century Peruvian charango in the MFA Boston collection,³⁴ the museum included an audio recording of Bolivian musician Hector Martínez-Morales playing a piece on a different charango in the 1990s. Although a different instrument, the recording nonetheless highlights the sonic dimensions of the collection instrument. Additionally, in both collections, searches can also be filtered based on the availability of audio (and video) resources.

Audio recordings don't have to be limited to music. The Metropolitan Museum of Art (The Met) includes recorded curatorial commentary on a handful of instruments on display, in addition to recordings of the instruments themselves (see the page for the Cristofori piano).³⁵ Audio resources can also capture oral histories, conversations about traditions and uses of the instruments, discussions with artists about what their instruments mean to them, rich descriptions of the physical features of instruments for those who are blind or visually impaired, and so on.

Streaming services can also allow museums to incorporate audio resources, especially commercial music recordings. The Met has produced several Spotify playlists associated with their musical instrument exhibitions (such as a playlist accompanying the *Play it Loud: Instruments of Rock and Roll* temporary exhibit) or which contain tracks that use instruments in the collection (like "Archtop guitar at The Metropolitan Museum of Art"). Unfortunately, while the museum does feature the playlists elsewhere on their website (for example, on the *Play it Loud* page), individual instrument object pages do not link to them. Furthermore, because the playlists are published on Spotify by Met curator Jayson Kerr Dobney rather than by The Met itself, they are harder to locate for anyone interested in them, ultimately hindering their purpose.

Museums can also include video resources as an integral part of their object pages to show not only sound but also the instruments in action. When made available by the contributing institutions, the Musical Instruments Interface for Museums and Collections (MINIM) UK, for example, includes videos as part of the information that accompanies many musical instruments (like this pair of kettledrums).³⁶ These often feature musicians playing the instruments and allow us to see and hear the instruments as working objects designed to interact with people.³⁷ We can see instruments in their proper positions relative to the human body and get a sense of

their tactile interfaces. Additionally, like with audio resources, videos are an opportunity to include resources about instrument construction, artists, performances, traditions that may otherwise be missing in text-based information on object pages.

Even if it is not immediately feasible for some museums to embed videos in their information systems, institutions could take advantage of their existing resources on video hosting sites by using hyperlinks. The Met's YouTube channel features a playlist called MetMusic dedicated to their musical instrument collection. In it, they post videos of musicians playing instruments in the collection or similar to examples in the collection. Additionally, some of the videos feature interviews with curators and/or performers in which they discuss the history and social contexts of some of the instruments. For example, a video featuring Puerto Rican *cuatro* player Fabiola Méndez shows several Puerto Rican string instruments in The Met's collection in action. Méndez also adds historical context and her perspective as a musician and educator.³⁸ These videos are a good example of content that can bring instruments to life by showing them in use and highlighting their complexity and relationships. Although it is not the case with the Fabiola Méndez video, many of the other videos on the channel link back to relevant objects in the descriptions. However, the pages of instruments featured in the videos do not link to them, missing the opportunity to enrich the available information with existing content.³⁹

CONNECTING OBJECTS

In addition to an extensive musical instrument collection, The Met, like other so-called encyclopedic museums, also holds a vast repository of other kinds of objects: visual art, textiles, historical objects, archaeological artifacts, ethnographic collections, etc. Because of this, encyclopedic museums are well-equipped to explore the complex social dimensions of their musical instruments by drawing connections between these and other kinds of related (though not necessarily musical) objects. Curators of The Met's updated Musical Instruments gallery were aware of this and made an effort to incorporate objects from other departments to better contextualize instruments.⁴⁰

However, when it comes to online content, despite hinting at these connections at the collections search level, The Met and other museums often miss the chance to highlight these relationships within specific object pages. For example, the page for a woodblock print by Japanese artist Ryūryūkyō Shinsai titled "Musical Instruments for the Noh Dance,"⁴¹ which depicts two drums in addition to a fan, a textile, and a scroll, displays prints by the same artist in the related objects section but no musical instruments (fig 2). When searching "Noh drum" on the website,⁴² one can find at least five drums and seven other related objects. Unsurprisingly, the object page for

one set of three drums⁴³ did not display any relationship to the print or other artworks depicting similar instruments (fig 3).

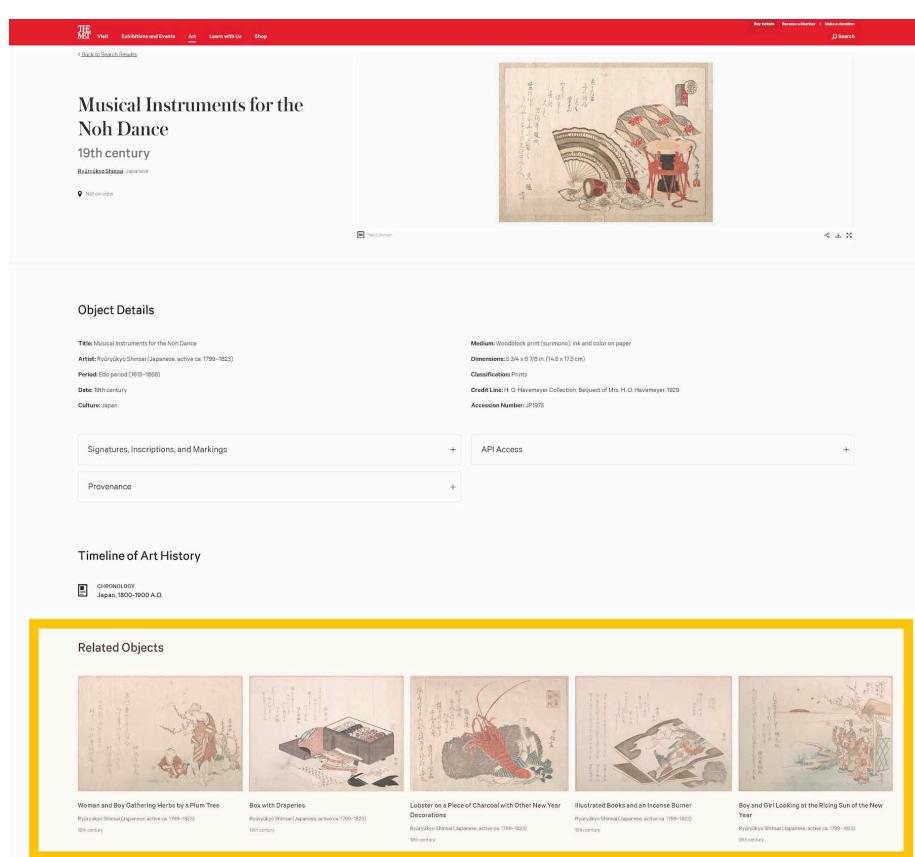


Figure 2: Screenshot of the "Musical Instruments for the Noh Dance" object page on The Met's website. The "Related Objects" section, highlighted in a yellow rectangle, displays prints by the same artists but no related musical instruments.

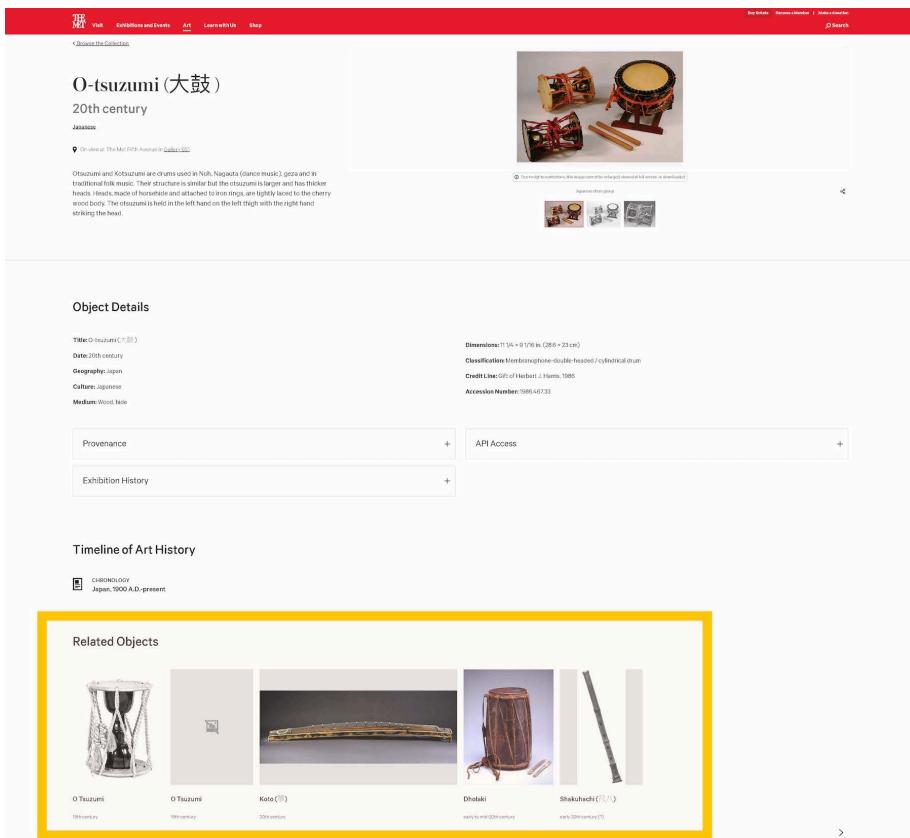


Figure 3: Screenshot of the “O-tsuzumi (大鼓)” drum object page on The Met’s website. The “Related Objects” section, highlighted in a yellow rectangle, displays other musical instruments but not the print mentioned above nor other related artworks.

By not highlighting the relationship between these objects, The Met is missing a valuable opportunity to enrich the information available for each one while inviting visitors to explore other parts of the collection. I am not saying object pages should identify or link to every single related item in the museum’s collection. Indeed, the question of how to best display these relationships is a constantly evolving issue for The Met as well as countless institutions and museum technologists.⁴⁴ Nevertheless, these missed opportunities highlight the limitations of hierarchical and disciplinarily disconnected methods of organizing information management systems. Because the drums are in the Musical Instruments department and the print is in the Asian Art department, the objects exist separate from each other in the museum and online. Ideally, the physical obstacles that make such crossovers difficult in the real world should not be as pressing virtually.

To tackle this challenge, the Brooklyn Museum allows users to create tags on different objects to connect them and generate what is known as folksonomies (folk taxonomies). This non-hierarchical, responsive, dynamic strategy can draw on the knowledge, insights, and experiences of users to highlight complexity within collections. To mirror the previous example from The Met, on the page for the 1803 woodblock print “The Actors Matsumoto Yonesaburo and Segawa Kikunojo” by Japanese artist Utagawa Toyokuni I,⁴⁵ which features a *tsuzumi* drum used in *Noh* and *Kabuki* performances, we can see a series of related objects ranging from prints by the same artists, to Japanese furniture, to various drums, all connected through both user- and curator-generated tags (fig 4). Unfortunately, the Brooklyn Museum collection does not include a *tsuzumi*, but it is likely that if such a drum were in the collection, it would appear in the related objects list.

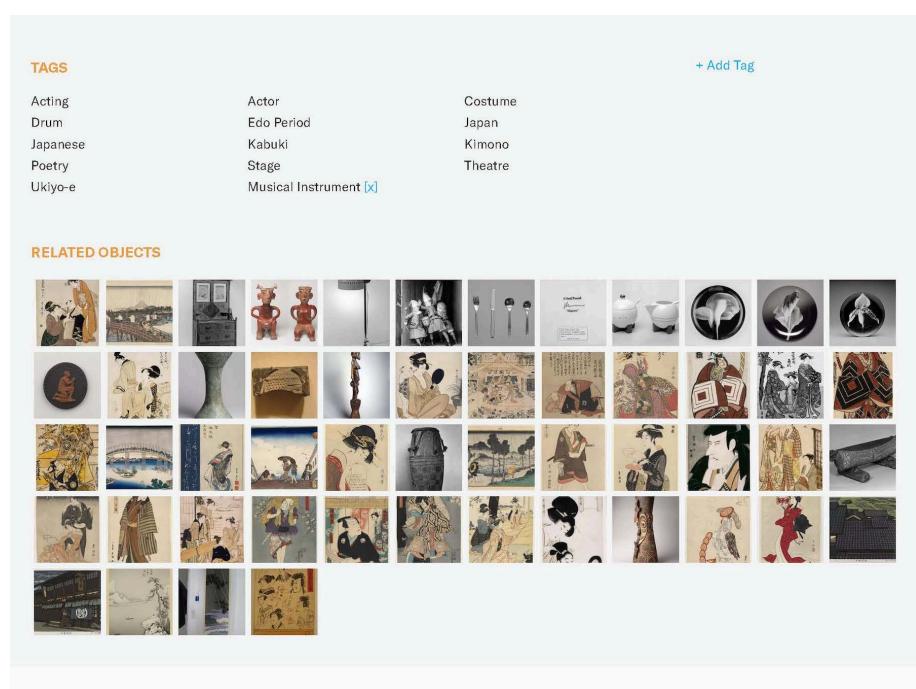


Figure 4: Screenshot of the Tags and Related Objects section on the “The Actors Matsumoto Yonesaburo and Segawa Kikunojo” object page on the Brooklyn Museum website. The Related Objects, generated by user- and curator-submitted tags include musical instruments, artworks, furniture, and utensils.

While still requiring some curator involvement, drawing on user-submitted tags can make it somewhat easier for the website to connect related objects without requiring more hours of labor from museum staff. Though not without their own set of limitations, challenges, and concerns, folksonomies contribute to a more dynamic use

of the collection and the online musical instruments by users.⁴⁶ Moreover, their decentralized and democratic approach challenges the authority of hegemonic systems of knowledge, redistributing authority to various publics, embracing different ways of knowing, and capturing more complex perspectives and relationships.⁴⁷

CONCLUSION

Images, models, diagrams, visualizations, audio recordings, videos, and interconnected objects can work together to capture the events, ecosystems, relationships, and complex human-object interactions that should be evident in online collections. These resources and strategies must be understood as part of a whole. They are pieces in a complex and ever-changing dynamic bundle of connections that form musical instruments, and they must work together with other types of resources to activate multiple senses and ways of understanding, feeling, experiencing, thinking.

Funding and logistical barriers often keep institutions from providing all these resources at once, but we can imagine these strategies working together to contextualize musical instruments as richly and completely as possible. Changing how online collections are presented to the public requires time, effort, and funding. As institutions improve online collections to make full use of often existing resources, they will continue to move their information management systems beyond the narrow structures that limit them today. In doing so, they will come closer to capturing the complexity and the magic of musical instruments.

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III

Turning a Blind Eye to Design: Technology and Visual Impairment In Modern Museums

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The modern museum, ideally, is a bastion of accessible design and planning. Through it, guests are encouraged to explore their interests without limitation – though some find this more difficult than others. Those with visual impairments often find museums unwelcoming and even hostile environments. It requires no great stretch of the imagination to discover why: filled with inscrutably small label text, inadequate (or nonexistent) audio tours, obtuse floor plans, and objects displayed with only the needs of the sighted in mind, some museums seem almost purpose-built to turn away visually impaired visitors. Despite how it may seem, this does not have to be the case. Clever implementation of long-existing techniques and the new technological advances alike are providing museums around the world with exciting opportunities to engage those with visual impairments through more nuanced approaches to wayfinding, audio description, and tactile feedback. Though individual exhibits and museums often demonstrate an extraordinary attention to the needs of visually impaired visitors, broader adoption of both high- and low-tech solutions is necessary to bridge the gap between museum collections and visually impaired persons who want to explore them. This paper will explore some of the exciting advancements, like haptic feedback systems, enriched audio descriptions, and self-directed audio tours, that are currently being employed at institutions in our field.

DEFINING VISUAL IMPAIRMENT

Though they are often conflated, not all persons with visual impairments are blind. “Visual impairment”, “low vision”, “partial sight”, and other terms have historically been used to describe a condition “in which visual acuity is 20/70 or poorer in the better-seeing eye and cannot be corrected or improved with regular eyeglasses”.¹ Though neither “visual impairment” nor “legal blindness” are functional definitions of any condition – and a range of severity exists within the classification of “visual impairment” – for the purposes of this work, “Persons with Vision Impairment” (PVI) will be used to denote any persons for whom visual perceptual difficulties hinder their ability to interact with a museum environment.² According to the American Association of Museum’s *Annual Survey of Museum-Goers*, approximately 12% of visitors to museums self-identify as “blind or low vision”.³ During their museum visits, over half of PVI surveyed in Fogle-Hatch and Winiacki’s *Assessing Attitudes of Blind Adults About Museums* reported that museum staff and volunteers did not seem comfortable interacting with them.⁴ Many also cited further barriers to accessing museums that ranged from difficulties navigating the space to frustrating experiences with the visual nature of many major exhibits at almost all museums.⁵ In the face of such unmet needs, it is incumbent upon any museum that desires to “give equitable access to everyone across the continuum of human ability and experience” (per the AAM’s definition of accessibility) to recognize and resolve the barriers to entry they present to PVI.⁶

Before going any further, it should be noted that my review of museum technology and its intersections with accessibility efforts for the visually impaired will by no means be exhaustive. As a sighted individual, such an endeavor would be both irresponsible and unnecessary, given the current state of literature on this topic. For excellent examples of firsthand accounts of blind or visually impaired museum experts, see Braham’s *The Inclusive Museum*, Kudlick’s *The Local Museum, So Near and Yet So Far*, or Kleege’s *More than Meets the Eye: What Blindness Brings to Art*.⁷ The perspective of the blind and visually impaired is comprehensive, constant, and impossible to replicate by sighted individuals. No attempt will be made here to do so. It is my hope, rather, that a review of the current uses of technology to make the museum a welcoming, intuitive space for the visually impaired can spur institutions who have not made such efforts into action – for, as this work will demonstrate, such efforts are essential in fulfilling the promise of museums everywhere.

NAVIGATING AND WAYFINDING

Before PVI can interact with an exhibit, listen to the latest advances in audio description technology and methodology, or take part in new experiences afforded by haptics and tactile feedback-focused research, they must navigate their way

through the museum environment. This issue is illustrated concisely in Handa et al.'s 2010 *Investigation of Priority Needs In Terms of Museum Service Accessibility for Visually Impaired Visitors*: "even if objects are available for touching, there is no way to know where the objects are".⁸ Essentially, it does not matter if the presentation of an exhibit's content empowers the visually impaired if they cannot find that content independently in the first place. To overcome this most basic of barriers to entry, a number of innovative technological solutions can be employed. A relatively low-tech option may involve using tactile markers set into the ground in combination with textured materials on the walls (like embossed leather, for instance) that both guide the experience of PVI and invite the use of touch to navigate rather than sight, as practiced in the Quai Branly Museum.⁹ The Quai Branly Museum is also amongst a growing contingent of museums that offer a 3D model of the museum itself that can help PVI orient themselves and guide their experiences throughout the museum, as well as a "tactile exploration guide" that can be printed out on raised paper prior to a visitor entering the museum.¹⁰

More technologically-intensive solutions have been implemented in multiple locations in Greece, where visitors can utilize the *Blind MuseumTourer* app to assist in navigating the Tactual Museum of the Lighthouse for the Blind of Greece, the National Archeological Museum and the Acropolis Museum.¹¹ While using the app, a series of low-power Bluetooth sensors placed around points of interest are used in combination with a phone's preexisting suite of sensors to provide directions uniquely tailored to the individual stride length of the visitor.¹² With their position triangulated by sensors and the length of their stride accounted for, the accuracy of directions provided ("take 14 steps forward and 3 to the left", e.g.) and the integration of audio recordings explaining points of interest allow users of *Blind MuseumTourer* to engage in a truly self-guided experience. Similarly, Athens' Museum of Cycladic Art uses sensors and their own app to provide guided thematic tours that direct PVI towards tactile elements of their exhibitions designed to be handled.¹³ Pilot studies at New Delhi's National Science Center have combined similar smartphone-based technology with a small wearable device that vibrates in certain situations to provide visitors with the ability to pick and choose the elements in an exhibit that appeal most to them.¹⁴ The interface of such systems with the crowd-sensing Bluetooth devices focused on in Germak and Khan's *Interaction Design Application for Museum Spaces* may further increase their utility by enabling technologists to integrate real-time positions of other members of the public in the navigation instructions given to PVI.¹⁵

Through application of these innovative solutions, museums can augment their existing efforts towards making the layout of their space more intelligible. Large-print, braille labels, and well-trained docents equipped to handle the request and needs of PVI will always be an essential part of the puzzle of wayfinding. As the list of new technological solutions grows ever-longer, however, museums everywhere must

ask themselves if the bare minimum of navigation assistance is too low of a standard to hold themselves to.

ENHANCED AUDIO DESCRIPTION

While traditional audio tours are certainly helpful, the opportunities presented by “enhanced” or “enriched” audio description – which focuses not merely on the translation of visual content into an audio format but the creation of a unique auditory landscape – can enhance the experience of PVI and sighted individuals alike.¹⁶ Indeed, when museums devote focus to exploring what their audio tours can offer, the results are often surprising. “Enriched” audio descriptions are not strictly defined, but usually are recognized as audio descriptions that incorporate “semantic or factual details as well as highlights of a piece, which help the listener create a story about that piece” as well as “a rich range of multisensory imagery and metaphor”.¹⁷ The shift to an audio-focused method of information intake “can enhance later memorability of an experience, for both blind and sighted people”.¹⁸ Enriched audio experiences that incorporate narration and soundscapes have been noted to positively correlate with the amount of time that guests spend taking in the information presented to them.¹⁹

In her PhD thesis on audio descriptions in museums, Rachel Hutchinson expounds not only the potential benefits of enriched audio in the museum but also the wide range of theory and practice that dictates how audio descriptions are currently used.²⁰ Audio description, as traditionally defined and used in the museum field, is an attempt at the “translation of visual information... [seemingly] designed above all else to address the category of ‘object experiences’ – enabling visitors to ‘see’ rare or valuable objects”.²¹ Most museum professionals would probably argue, however, that merely seeing an object constitutes only a small part of the experience of visiting a museum. When attempting to emulate the cognitive, introspective, and social experiences that make up the rest of the museum experience, those working with audio descriptions must contend with the complexity of translation ethics.²² Where, for instance, should a museum draw the line between explaining the history of a work of art and interpreting that art *for* the visitor? At what point does so-called “enriched” audio description become a cultural text unto itself? Should those working on audio descriptions be wary of making statements about non-visual aspects of the art, or encouraged to use language that evokes a multisensory experience? Though the answers to these questions will vary from museum to museum (surveys show that European describers are more open to creating descriptions that “explore meaning” and “create emotional experiences”) they underscore the truth of the vast opportunities provided by smartphones and other technologies when it comes to audio description: it can only ever be as impactful as an institution allows it to be.²³

Features From Qatar, a 2015 Mathaf exhibit of an original 1973 painting by Jassim Zaini, is a prime example of how responding to these ethical questions can provide novel solutions that make the most of current technology. After a long period of analyzing the work itself, carefully editing the script of the audio description, and creating a soundscape that would accompany the audio guide (composed of music and audio cues that evoked the location and ambience of the painting), the exhibit went live.²⁴ PVI could access the enriched audio as a .mp4 file through any device they had on hand.²⁵ The response—overwhelmingly positive, but with a wealth of constructive critiques—led project lead Joselia Neves to conclude that “there is an enormous potential for Enriched Descriptive Guides as a specific museum text type that can contribute to visitor engagement”.²⁶

In taking these measures towards inclusive and accessible design for PVI, museum workers engage in a far more involved process of meaning-making. Though the ethical questions that enriched description poses are daunting, the ease of access that such efforts enable are important steps in developing a museum that is open to all.

HAPTICS AND TACTILE RESPONSE

Some of the most exciting work being done in the museum field to cater to the needs of PVI involves the use of *haptics*, or technology that makes use of one's sense of touch, in transforming visual information into a more accessible format. Haptic technology can take many forms: it can be used to enhance color recognition, create tactile-focused versions of paintings and other printed art, provide facsimiles of 3D art that are available for visually impaired visitors to touch and handle, develop wholly virtual recreations of famous works of art (accessible through specialized machinery that mimics the 3D rendering of the piece in VR), and more. The uses of tactile sensation in the museum setting presented below are just a sampling of what the technologies that drive them have to offer.

Investigations of the uses of such technologies can be difficult to grasp: some instances of haptic feedback systems within the museum are positioned as novel, while other efforts at making visual information tactile are well-established. Take, for instance, the case of the Louvre's Tactile Gallery: since its inception in 1995, the Tactile Gallery has provided visually impaired visitors to the world's most-visited museum with reproductions of famous works that they can touch and feel (fig 4).²⁷ On the other hand, an interactive computer-based exhibition at the Mm Gerdau Museum Of Mines And Metal that merges tactile exploration with intelligent audio descriptions matching the objects being touched (if, for instance, the visitor picks up two of the five objects on display, the exhibitor machine will begin to explain the similarities and differences between those objects) was recently tested to great

effect.²⁸ Neither of these uses of technology are particularly resource-intensive nor radically different from what museums around the world already offer visitors on a day-to-day basis (especially with the advent of low-cost 3D printing technology), but each can fundamentally alter and greatly enhance the experience of PVI in the museum setting.

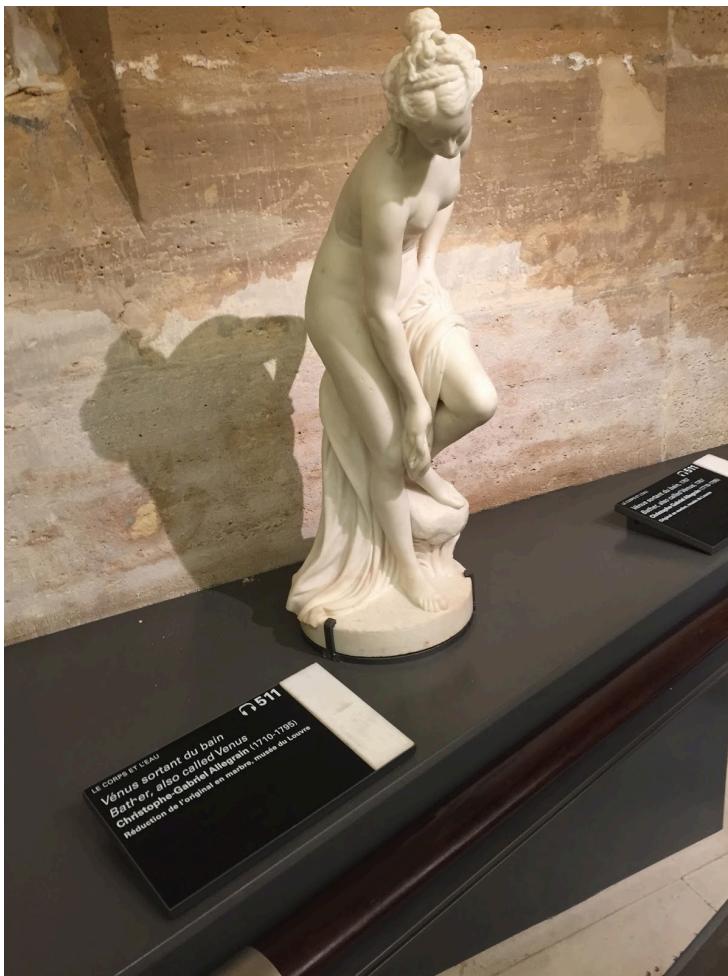


Figure 4: A reproduction of Allegrain's Venus After the Bath, available for visitors to touch in the Louvre's Tactile Gallery

Though it may seem to be on the cutting edge of technological advancement, haptic displays that replicate the feeling of touching an object (achieved through force feedback on the hands and vibratory stimuli) has been in development since the turn

of the 21st century.²⁹ Jansson et. al.'s development of a system that mimics the feeling of touching a sculpture for the E.U.'s PURE-FORM project in 2001 was the precursor of modern advances in museum haptic technology that are radically changing what experiences are open to PVI.³⁰ The National Museum of Transylvanian History has used a relatively simple haptic device—the Geomagic Touch System, which consists of a stylus on a mechanical arm that can provide force feedback (fig 5)—to provide visitors with an intuitive yet novel experience in which they can “touch” a range of 3D-scanned artifacts from the museum's collection.³¹



Figure 5: Proposed usage of haptic feedback device at the National Museum of Transylvanian History.

Cost is rightfully a concern whenever the adoption of new technologies is attempted by museums. Fortunately, the distance between what a museum can spare and the costs of implementing haptic technologies may be substantially smaller than some would imagine. Prototype devices custom-built for educators have been produced for less than \$300.³² The aforementioned Geomagic Touch, if purchased with the associated Sculpt software that allows museum workers to design and scan the objects in their collections, can cost anywhere from \$900 to \$3300 (depending on the condition of the device).³³ More advanced systems, like the Museo Archeologico Nazionale delle Marche's haptic application that uses an Omega-6 machine produced by haptic-tech company Force Dimension, trade a higher price for a higher level of detail in the digital reproduction of artifacts.³⁴ The Museo Archeologico's system was found to greatly influence the level of visitor engagement with the museum's

collection and the overall visitor experience and showcases how efforts at PVI accessibility can often result in a more enriching experience for all.³⁵ At the Prague National Gallery, the exhibition *Touching Masterpieces* showcased some of the most advanced haptic technologies currently available and outfitted visitors with a set of haptic gloves that could reproduce the feeling of touching the Venus de Milo and other pieces in real space.³⁶

Perhaps the most exciting implications of the use of haptic technology comes from studies like Park et. al.'s *Telerobotic Haptic Exploration in Art Galleries and Museums for Individuals with Visual Impairments*, in which PVI can remotely explore a museum's collection through haptics.³⁷ The act of making a museum's collection available virtually is nothing new, but the upload of 3D renders of a museum's objects can allow PVI to bring the experience of touching that collection into the comfort of their own homes. This is by no means a replacement for the full experience of visiting a museum space, but can serve as a means to virtually explore the collections of a museum in the same manner that sighted individuals have been able to for decades.

CONCLUSION

What the vast differences between the many effective methodologies above imply is sure to be familiar to many museum professionals: the solutions that work for one institution may not be applicable to another, and the unique nature of a particular museum's collection should drive the efforts in implementing accessible technologies. While for some the more technology-heavy solutions (like *Touching Masterpieces*) may be within their institutional reach, others may only be able to lay down simple tactile tape for wayfinding or provide brief audio descriptions. Yet another well-worn precept of museum work comes in to play here: museum workers should not allow the perfect to be the enemy of the good. Any effort to provide an inclusive experience for PVI, no matter how inadequate it may seem when ranked against industry-leading solutions at major institutions, has the potential to completely change the museum experience for a subset of guests that have for too long been left without adequate attention.

The needs of the visually impaired pale in comparison to the number of solutions that empathetic museum professionals can design into their exhibits and institutions that can make our industry accessible to them. Technology and careful planning provide us with near-limitless potential when it comes to making wayfinding easier, audio descriptions more effective, and art, quite literally, within our visitors' grasp. These efforts need not all be wheel-redesigning, boundary-breaking technological marvels. The single unifying factor between each of the successful iterations of PVI-inclusive museum technology detailed above was not the budget of the team or the novelty of the gadgets used -- far from it. The most PVI-accessible implementations of technology are those that represent the truth that true accessibility is not an item on

a checklist, but rather that it is an evolving process that demands inclusion of visually impaired perspectives throughout.

Technological advances will continue to provide potential engagement opportunities for PVI. Until their input and feedback is recognized by the museums that claim to represent them, however, no true progress can be made. Including PVI perspectives throughout the design process of any new exhibit -- through meaningful and empathetic dialogue, to start -- is the only way to provide accessibility that is anything more than performative. Conducting "outreach" misses the point -- visually impaired visitors do not need to be reached out to. They are already in attendance and they have been expressing their dissatisfaction with our museums for as long as we have existed. Once those perspectives have been incorporated into a design process, the usage of technology to address their concerns can begin. Put simply, technology can be an excellent tool, but not while museums remain willfully blind to the needs of the visually impaired.

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Effectiveness of 3D Digitization as a Tool for Indigenous Cultural Heritage Preservation

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Extolled for its breadth of applications, 3D digitization has recently emerged on the museum scene as a potential tool for Indigenous communities to practice and preserve their cultural heritage in a way that is compatible with Indigenous ways of knowing and responds to the challenges of repatriation. Unlike 2D images and original artifacts trapped behind glass, 3D data is valuable beyond its visual appeal. It allows the viewer to interact with the internal structure, surface, and visual appearance of an object, unimpeded by the physical limitations of the object. Therefore, it is able to provide an embodied experience of an object that lends itself to the stimulation, reinforcement, and transmission of generational memory “through modeling, practice and animation” more so than 2D models.¹ Digital surrogates can be used for conservation, research, and education, taking on a separate life from the original object. This has the potential to allow for original Indigenous belongings to be repatriated or, at the very least, better preserved by limiting handling of the original artifacts.

While 3D digitization may be theoretically well suited for digital heritage preservation and repatriation projects, museums should be aware that digital repatriation may be a form of “conscientization,” in which the “settler move to innocence is to focus on decolonizing the mind [...] as if it were the sole activity of decolonization; to [circumvent] the more uncomfortable task of relinquishing stolen land,” or in this

case, stolen belongings.² 3D digitization and digital repatriation are *not* a replacement for the repatriation of stolen belongings, but rather one of many complementary efforts that may enhance or further repatriation of original artifacts. Careful evaluation of early 3D cultural heritage projects is crucial if we hope to develop this technology for cultural heritage use in a responsible, community-responsive way moving forward.

It is important to note that 3D digitization sits at the intersection of a multitude of contentious issues in museums, from decolonization and repatriation to digitization and ethical data management. All of these issues are complex in their own right and deserve a more full discussion than can be provided in the scope of this paper. For a closer look at issues related to digitization of cultural heritage, I recommend reading Gwyneira Isaac's "Perclusive Alliances"³ and Zinaida Manžuch's "Ethical Issues in Digitization Of Cultural Heritage."⁴ Though not museum-specific, Eve Tuck and K. Wayne Yang's "Decolonization is not a metaphor" is a good introduction to active decolonization that should be applied when designing partnerships with source communities.⁵

As a non-Indigenous scholar, I also cannot speak to the needs or opinions of Indigenous people beyond what I have found in my research. I have incorporated Indigenous voices where possible, but Native peoples are diverse and their contributions are underrepresented in academic research. Therefore, even the Indigenous perspectives that have been published are limited and in no way a holistic representation of the diverse concerns and values of *all* tribes.

METHODS OF 3D MODELING

In Europe, museum professionals have been attempting to harness the quickly advancing field of commercial and industrial 3D digitization for cultural heritage uses in an attempt to efficiently preserve the mass of artifacts and historic sites there.⁶ Now that the practice has been proven abroad, the United States is looking to take advantage of the trend. 3D digitization can collect three different kinds of data about an object: internal structure, surface, and visual appearance. These data are typically synthesized into one 3D model that can be used as a surrogate for the original object.

Many different technologies can be used to collect this data, but each has different restraints and outcomes. For example, X-radiography allows researchers to view the internal structure of an object, but not the surface. Laser scanning can produce an "extremely accurate record of an object's physical structure" but it "does not provide information about structure below an object's surface." Computed tomography (CT) scanners, which also use X-rays, can collect data about both the internal and external structure. Lasers and X-rays only extract spatial information about an object, so their data cannot represent color. A color "texture" must be layered onto the shape of the

object like a thin skin.⁷ These are just a few of the most common techniques available. The “3D Digitization in Cultural Heritage Institutions Guidebook” by Emma Cieslik lays out other options for other digitizing technology and their strengths and weaknesses for various applications.⁸

The technique that would be most affordable and straightforward for museums to implement is photogrammetry, which “[derives] 3D measurements based on a set of overlapping images.”⁹ Photogrammetry’s “key focus is on rendering to create a visual realistic and appealing picture of reality,” rather than on creating measurements, so it is best suited for applications that value aesthetics over accuracy of measurements.¹⁰ While photogrammetry still requires special software to stitch together the images, it is the most accessible form of 3D digitization because at its very base level, it can be done with a smartphone camera. Heritage Together¹¹ and other organizations have been digitally reconstructing cultural heritage sites that have either been destroyed or endangered by crowdsourcing and stitching together smartphone camera images from tourists.¹² Although this tactic may not be feasible for Indigenous sites, which may be less photographically documented due to privacy restrictions on sacred sites, photogrammetry can also be applied to museum collections. These projects show that 3D digitization does not always require overly complicated technology, enabling Indigenous community members to run their own digitization projects without relying heavily on museum professionals. Dr. Jonathan Roberts of the Queensland University of Toronto lauded Heritage Together for “[allowing] the community to learn more about their heritage, and while improving heritage management” such as preservation.¹³

WHAT IS DIGITAL REPATRIATION?

In order to assess whether 3D digitization can improve digital repatriation efforts, we need to define what digital repatriation is and should be. In its most basic form, repatriation is the “return of objects or human remains to the proper owners.”¹⁴ ‘Digital’ repatriation specifically, is the “practice of taking some digital form of an item housed in a memory institution and sharing it with the origin community via a virtual platform.” Digital repatriation emerged as a compromise to return some version of an object to Indigenous communities in “response to the lack of proper facilities and social-political support that are needed for a successful physical repatriation.”¹⁵ Repatriating a digital surrogate may bypass some obstacles of physical repatriation, however, sharing digital copies of objects with source communities alone is not effective if the ultimate goal of repatriation is decolonizing the museum by empowering source communities to reclaim their heritage.

According to Rachel Hatzipanagos, decolonization is the “process that institutions undergo to expand the perspectives they portray beyond those of the dominant

cultural group, particularly white colonizers.”¹⁶ Museums have historically been object-centric, focusing resources on the preservation and display of objects as the main method of teaching about heritage. However, MacDonald and Alsford posit that if museums re-center their practice around people by viewing their collection items as vessels for information (or knowledge) they can create a “transactional learning situation that is not simply a response to a stimulus, but a response that acts on the environment that gives rise to further stimuli.”¹⁷ Therefore, a decolonizing digital heritage project is one that focuses on an “active interaction between the digital material and origin community members, not simply the displaying of digital images on the internet as, for instance, in an online museum catalog.”¹⁸ When repatriating cultural heritage, “photos or models that allow the examination of techniques, materials, and preparation employed to make an item are far more important than the traditional cataloging photo [...]” because the return of an object means nothing if it cannot be actively used to better the community.¹⁹ Because 3D models have a vast array of interactive applications, they could be useful for collaborative digital repatriation efforts that provide the community with the opportunity to produce new knowledge, thus adding an Indigenous perspective to the museum’s traditionally limited scope in a way that gives Indigenous people agency.

APPLICATIONS OF 3D MODELING

There are two main ways that 3D models can be used for cultural heritage preservation to meet the goals of digital repatriation: digitizing individual objects, and constructing larger virtual environments. 3D models of individual objects can be helpful for conservation, research, and the creation of replicas via 3D printing or artist reproduction. This technology was originally brought into museums to support conservation efforts because it allows for a lot of information to be collected from an object while minimizing handling. Reducing handling as much as possible is essential for repatriation candidates, which are often sacred, delicate, or even contaminated with dangerous chemicals due to past conservation and pest management techniques.²⁰

Detailed models can provide better visualization into the structure of an artifact, which can give researchers and Indigenous artists insight into how it was produced. For example, measurements collected from an object’s surface can even be “run through computer programs and databases to be compared against existing typology” in order to determine provenance or type, effectively automating part of the research process.²¹ Artists can use digital models to closely examine the structure of an object and reverse engineer traditional craft skills that may have been lost over time.²²

If Indigenous artists are successful in reverse-engineering an object, they can even provide the museum with a handmade replica to use in place of the original object.

Replicas provide an opportunity to rethink the process of repatriation because, with permission of the source community, museums can display a replica and repatriate the original object. Display of the surrogate artifact becomes a way to “add a new dimension to the [object’s] story” and “tell the story about repatriation.”²³ However, replicas are not truly a decolonial solution if their main purpose is not to support the source community, but rather to prevent detriment to the museum upon repatriation of original artifacts--more concerned with “rescuing a settler normalcy, [...] rescuing a settler future” than with supporting the source community.²⁴

Expanding 3D modeling to create not just visualizations of singular objects, but entire virtual environments that add context to objects might be more beneficial for source communities. Two popular models for these virtual environments include educational games and virtual exhibits. New to both the gaming world and the cultural heritage sector, a new genre of computer games known as ‘serious games,’ “are not limited to the aim of providing entertainment, [and] allow for collaborative use of 3D spaces that are used for learning and educational purposes.”²⁵ Serious gaming is an exciting prospect for specifically Indigenous cultural heritage preservation because it is best suited for “communication, visual expression of information, collaboration mechanisms, interactivity and entertainment,” which are all traits that overlap with Indigenous goals and ways of presenting information.²⁶

Games provide a new way for Indigenous communities to not only practice, but self-define heritage. In historical games, “the human player is immersed in the historical setting, allowing the player to re-live history.”²⁷ When Indigenous communities participate in the formation of these video games, they can define the narrative that the player will experience, asserting their perspective of histories they have often been left out of. Indigenous media such as this can be considered a form of “cultural activism,” that “[talks] back” to structures of power that have erased or distorted indigenous interests and realities.”²⁸

Virtual exhibits have the potential to bring together artifacts from far-reaching locations. This is particularly helpful in the case of Indigenous objects that have been stolen and dispersed to museums and private collections across the country and beyond. Established in the 1990s, the Four Directions Project connected nineteen American Indian schools with four university partners and two museum partners to “create virtual museums that reflect their cultures and serve to present and preserve the students’ indigenous heritage.”²⁹ During the creation of the virtual exhibits, students and community elders were able to access and curate collections of belongings from several partner museums and add their own knowledge to the virtual exhibit. These partnerships provided a framework for culturally responsive teaching, cultural revitalization, and cultural collaboration across museum collections.

WHEN IS DIGITAL REPATRIATION HELPFUL?

If a 3D model is useful because it is able to replicate the properties of an object more accurately than other digital surrogates, we should be asking “why not just repatriate the original object?” Unfortunately, physical repatriation is “presently not always an attainable goal, particularly in the instance of collections residing outside the United States or items that do not fall under NAGPRA,” (Native American Graves Protection and Repatriation Act) such as objects found on private land.³⁰ Eva Malvich, a member of the Yup’ik tribe in Alaska, explains that while it is important to steer clear of white saviorism, “some communities do not wish to have the original documents back” because “taking back collections means taking on a lot of responsibility in providing suitable facilities and care.”³¹ Some communities may ask the museum to steward the physical object until they have the resources to steward it themselves. In this case, a digital surrogate may provide access until the physical object can be repatriated.

However, digital repatriation can be a stepping stone to further repatriation efforts in the future rather than the end of the road. Ultimately, the needs of every Indigenous community will be different, so the repatriation process should be an ongoing discussion between museums and Indigenous communities. In many cases, physical repatriation may still be preferred, but it is beneficial to examine digital repatriation as an alternative when physical repatriation cannot be immediately achieved.

PRACTICAL CONSIDERATIONS

For all of its possibilities, 3D digitization also presents a new set of ethical dilemmas and practical concerns. Cost, accessibility, limitations of technology, and the complexity of digital asset management must all be considered in the project planning process. For instance, it may be tempting to try to extract the maximum amount of data out of each object in order to repatriate as much knowledge as a physical object could, but creating the highest quality scans for every object that we hope to digitally repatriate is simply not practical. In order to make the most of what little resources are available, the museum and source community should work together to define what level of detail is necessary for the kind of use the community hopes to get out of the model. For example, “geometric accuracy of 3D reconstruction is very important when undertaken in a preservation/reconstruction context,” but may not be critical when creating an educational virtual reality program where the digital reconstruction need only be accurate enough to be visually appealing.³²

3D digitization is a tremendous undertaking because the museum must not only shoulder the cost of the technology and labor required to create the models, but also because creation of a model alone is not enough if the museum hopes to host a

meaningful collaboration with the source community. The museum must also be able to support use of the models, which often involves creating a whole new platform that can facilitate easy, private, and engaging access to the models.³³ While collaborations with museums may give these communities an opportunity to represent themselves in the digital sphere in a way they previously may not have been able to, the creation of culturally-specific digital resources is only half the battle. The community must also be able to access and use these resources at home after the completion of the project.³⁴ When developing platforms for the use of these digital assets it is important to remember that “indigenous peoples are proportionately underrepresented in cyberspace—for obvious reasons such as economic poverty, technological inexperience, linguistic isolation, political repression, and/or cultural resistance.”³⁵ Especially in remote areas, origin communities may be limited by poor internet connections. Museums may have to consider creative workarounds to these barriers, such as sharing digital models “using mobile data storage, such as external hard drives, that are accessible to local community members.”³⁶ Digitization entails the creation of digital assets that the museum or community must store, back up, and maintain throughout developments in technology. This responsibility is complicated by the fact that 3D models can be “so complex or detailed that they cannot fit into the graphics memory, or even the main memory, of the computer.”³⁷ In that case, even external hard drives may not be adequate.

Privacy of digital assets is another concern when dealing with cultural heritage objects, especially in the case of sacred objects or other belongings that carry knowledge that has traditionally been restricted in order to uphold power structures within tribes. Because 3D digitization is so new, it is “not subject to the standards and regulations that would otherwise be applied.”³⁸ There is no consensus on who owns the rights to 3D data: the museum, the tribe, or the researchers who collected the data? Who should decide how it can be used? As educational institutions, museums prioritize dissemination of knowledge and prefer to make everything open access, but Indigenous and Euro-American concepts of privacy and replication can sometimes conflict. Unabridged access to public domain materials is not always a public good.³⁹ If the public is granted unrestricted access to these objects, there is a tremendous risk of misuse. In fact, open access data can even be abused to create forgeries.⁴⁰ Until legal precedent can be set, it is up to museums to set ethical guidelines for the use and ownership of 3D data. Current U.S. law does recognize Indigenous legislation protections over cultural heritage objects and intellectual property. It is possible that “intellectual property rights may not be appropriate, legally or culturally, for the digital surrogates of some objects and materials.”⁴¹

TAKEAWAYS

While 3D technology is certainly full of possibilities, it is crucial to remain pragmatic and keep Indigenous interests at the forefront of our evaluation of 3D technology. Before beginning costly digitization projects, museums should ask whether the technology is truly necessary to meet the goals of the community, or if there is a more effective solution that uses fewer resources. Ultimately, money spent on 3D digitization might be more impactful for the community if redirected toward hiring more Indigenous museum staff or paying for transportation for remote communities to access museums.

In order to be truly decolonial, digitization projects must be by and for Indigenous communities. The role of the museum in digitization projects should be that of a public utility, linking communities to resources so that they can design and carry out their own projects. Museums must be willing to relinquish their power over cultural heritage resources and trust Indigenous communities to steward and share their heritage in whatever way they deem appropriate. Ideally, digitization projects should be a catalyst or continuation of ongoing discussion surrounding each community's unique needs for physical and digital repatriation. Ultimately, digital repatriation is not a replacement for physical repatriation, but rather a separate process that bolsters or supplements cultural heritage preservation when physical repatriation is not possible.

Because 3D modeling is so new to heritage conservation, it is important to be mindful of the precedents we set with these early experiments. As Wachawiak and Karas point out, the “opportunity to influence the use and development of this remarkable technology is at hand.”⁴² 3D digitization has enormous potential, but it can be even better if we can tackle its pitfalls head on and tailor it to Indigenous needs before it is too late to change.

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The Ethics of the Virtual Display of Human Remains: A Case Study of The British Museum's Presence on Google Arts and Culture

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It is an unfortunate truth that for many museum visitors and outsiders to archaeology that there is a certain association, even expectation, of human remains.¹ This perceived conflation of archaeology and graves/funerary sites is something that museums, at least historically, have benefited from. The British Museum is no stranger to this concept, currently holding over 6,000 examples of human remains, the most notable of which are on public display in their galleries.² Because of this display in-gallery, the remains are also displayed virtually via The British Museum's partnership with Google Arts & Culture, whose Explore feature allows users to navigate the museum using the same technology as Google Street View.³ With the rise of COVID-19, virtual tours have become in large part the only way to experience museums, and even before the current situation, virtual tours allowed visitors from around the world to visit museums from the comfort of their home. Undeniably, virtual tours such as Google Arts & Culture brings access to museums that was unheard of even a decade ago, and this has certainly drawn some discussion over its benefits and drawbacks as a true alternative to in-person visitation.^{4⁵6⁷} However, as this technology has taken off, and has reaped what has been correctly argued in these previous discussions to be important rewards in universal accessibility, we may

have missed an important conversation to be had in regard to these human remains on public, virtual display.

How can we understand the ethics of the display of human remains, without the added solemnity of an in-person experience? There are certainly no shortage of questions on the ethics of displaying human remains in general, but their virtual display is one that remains under-theorized. Researchers like Dr. Angela Stienne have done some thinking about the display of human remains on social media platforms like Instagram, which is interesting to think about, however, for the purposes of this paper, I will focus solely on Google Arts & Culture.⁸ While it is difficult to control virtual display when it is only showing what is on in-person display at the museum, by looking at both the virtual Google Arts & Culture experience and the codes and laws that govern the British Museum, I argue that the current iteration of the virtual display of these remains is glaringly unethical, largely due to a lack of clear guidance. To rectify this, at the very least, a revisit of the British Museum's "Human Remains Policy" and increased collaboration between the British Museum and Google is necessary to create best practice for the virtual display of human remains and ensure it remains ethical.

The Virtual Tour

Despite not being in person, one does get much the same awe-inspiring impression of the British Museum through its presence on Google Arts & Culture as one might in real life. The home page features a prominent picture of their Great Court, with its glass ceiling, circular reading room, and neoclassical designs on the walls, looking every bit the grand museum one would expect from a "former" colonial power like Britain.⁹ A short description provides base numbers (how many visitors, how many years, etc.) as well as highlights to look for, including the Rosetta Stone, the Parthenon Sculptures, and of course, their collection of Egyptian mummies. At the bottom of the page, the two "Museum Views" can be accessed, one for the exterior, and one for the interior. Both function the same as Google Street View, with large, white arrows at the bottom of the screen that take the viewer one step that direction when clicked. The process quickly becomes somewhat tedious, as it takes many clicks to get anywhere, and they are not always intuitive, sometimes requiring you to "move" backwards in space to be given the option to "move" forward in the direction you desire. Likely to combat this slightly frustrating mechanism, at the very bottom of the screen, there are options to move directly to certain highlights, represented either by thumbnails of the exhibition or by pictures of objects. Multiple of these will take you to the Egyptian galleries, and by proxy, the mummies.

There is much to be said about how the British Museum chooses to display their remains, but suffice it to say, virtually, it is hard to pick up on the solemnity, care, and respect that the museum claims to put at the forefront of their display planning.¹⁰

Immediately upon landing in the exhibit highlighted at the bottom with a thumbnail of Egyptian coffins, one is greeted by at least two examples of wrapped human remains, without even taking a “step.” Moving through the exhibit, more and more remains make themselves apparent, including one unwrapped mummy displayed alongside skulls and bits of pottery. Exploring the rest of what is labeled in the sidebar as the 3rd Floor, one comes upon the Gebelein Man laying *in situ*, as well as a skeleton in the Ancient Iran gallery, and a crushed skull with hair and jewelry in the Ancient Saudi Arabia gallery. More examples of remains can be found throughout the rest of the museum, as well.

All human remains visible to the in-person visitor are visible to the virtual visitor with no censoring, and often, given the nature of the technology used, no way to read the wall labels. The remains seem unavoidable, as not only are they pervasive, but on a small screen like a phone, it is hard to see what is in a case until you have gotten close enough to see graphic detail. While it seems none of the human remains are such objects that Google Arts & Culture allows the visitor to zoom in on to access a separate page with more information, the remains can certainly be still be zoomed in on in the more traditional sense, allowing the virtual visitor to get an even closer look than they could in person.

Codes and Laws

According to their website, the British Museum’s “Human Remains Policy” stems largely from the overarching UK laws regarding the collection of human remains: the *Human Tissue Act* (2004) and the Department for Media, Culture, and Sports’s *Guidance for the Care of Human Remains in Museums* (2005).¹¹ The standards set by these laws taken as the default, the actual “Policy” focuses mostly on the legal proceedings of repatriation and ensuring proper collection management.¹² Beyond that, it is just contextual information and some reasoning for display, no actual policies on what they consider to be best practice.¹³ I will define these laws that make up the good majority of the actual ethical practices of the “Human Remains Policy” in the next few paragraphs, but it is interesting to note that for a museum in such a unique position with its collection of human remains, it does not have much of its own original ideas in its policy. Indeed, much of the “Human Remains” page on the British Museum website is dedicated not to specifics on how they ensure proper care, but instead defense of their very existence in the collection.¹⁴ Nowhere in the “Human Remains Policy” or on the “Human Remains” page is there mention of virtual display or how that may change their best practices, and searching for Google Arts & Culture on the website as a whole provides no relevant results.

If the British Museum is going to default its ethics to what is laid out by the British government, then it is important to understand just what these guidelines are. Great Britain is unique in its specificity in regards to legal boundaries involving human

remains. The *Human Tissue Act* (2004) gives strict guidelines as to what constitutes human remains, and how the remains must be handled.¹⁵ Unfortunately, while giving other industries that worked with human remains some much needed legal guidance on ethically handling lost loved ones, the *HTA* (2004) is specified for remains that are 100 years old and younger, leaving museums and their much older remains in a tight spot, as well as accidentally making the repatriation of the remains that did not fall under its guidance illegal. Enter the DCMS's *Guidance for the Care of Human Remains in Museums* (2005), which once again made repatriation legal and added other, much needed clarity on the care of human remains in museums.¹⁶

The standard legal ethics of the collection and display of human remains in Britain are laid out in both the *HTA* (2004) and DCMS *Guidance* (2005), however, how these laws continue into virtual display is far less laid out. When these two legal documents were passed, Google Arts & Culture had yet another six years before its release, so understandably, there is no virtual display clause.¹⁷ Because there is no legal answer to best practice with virtual display, we can look at the virtual experience and see if it lines up with the accepted best practices given by these two documents.

The DCMS *Guidance* (2005) acknowledges the ethical conundrum of displaying human remains, but validates its continued practice by citing, as we've previously seen, how much visitors enjoy and expect seeing human remains.¹⁸ Nonetheless, they say, best practice is to ensure that the remains are on display because they make an incomparable addition to the narrative of the exhibition, that no other object can supply. Furthermore, the DCMS *Guidance* (2005) strongly advises displaying remains in such a way that visitors would be properly warned/prepared to see them, rather than come upon them unawares, like placing the remains in an alcove away from the rest of the exhibit. I am not sure this practice is one the British Museum has adopted, especially not in its virtual context on Google Arts & Culture. Remains are difficult to avoid, as they are made focal points in several exhibits, even those that do not necessarily focus on remains. The lack of warning and preparation is made even more noticeable in the virtual setting, with remains seeming to pop up out of nowhere as the images load. Moving virtually around the exhibit, unlike in the real world, your scope of vision is relatively short, and smaller wall labels are difficult to read. Contexts that may serve as proper warning and preparation to an in-person visitor simply do not translate into the virtual space. Instead of creating a respectful environment that at its core accentuates the scientific and educational value of human remains, cases of skeletons and mummies jump out at the virtual visitor like a haunted house.

Problems and Solutions

It goes without saying, then, that the current virtual display of human remains visible through Google Arts & Culture does not line up with what has been ascribed as best

practice for in-person display. However, what truly is the museum's responsibility in this case? If we are to believe in true equality between the virtual experience and the in-person experience, then nothing should be changed between what can be accessed by either visitor. However, as is evident by the difference in experience between the in-person experience of viewing remains- one that is easily avoidable and much more of a personal choice- and the virtual experience- one of surprise, wherein human remains jump from inscrutable to close up- these experiences are inherently unequal, and therefore must be treated differently, even if this means sacrificing the 1:1 ratio of the displays.

Clearly, something must be changed in regards to how the remains are currently displayed virtually. However, the British Museum cannot entirely censor its human remains from its presence on Google Arts & Culture, either. The point of the platform is to give the same access to the displays of the museum to the virtual visitor as they would as have an in-person visitor. It has already been established that the difference in platform inherently changes the visitor experience, to change it in a way so tangible as censoring something people may be expecting to see as part of a large museum like the British Museum would be directly antithetical to the goal of partnering with Google Arts & Culture. A middle ground must be found wherein the museum clearly differentiates between the in-person and the virtual visitor, implementing necessary changes, while still maintaining the integrity of the purpose of making the in-person gallery display available online in the first place.

The first and foremost solution, then, is a revisit of the policies of the British Museum, specifically the "Human Remains Policy." The lack of clear guidance on how virtual display is different and should be handled is the largest culprit of the issues present with the current display of human remains one can access via Google Arts & Culture. Revisiting the policy to at least include the existence of virtual display, as well as what mechanisms the British Museum will implement to ensure the virtual display of human remains continues to adhere to the guidelines set in their current "Human Remains Policy," the HTA (2004), and the DCMS *Guidance* (2005), is an absolutely necessary step to take. The museum must take responsibility for their presence in Google Arts & Culture, and must ensure the virtual visitor can understand the same level of ethical practice as they could in-person.

Additionally, there must be active partnership and collaboration between Google and the British Museum. It is difficult to glean the true relationship between the two, but it seems that the partnership largely begins and ends with the Explore feature, with some revisitations with newer virtual and VR exhibits. A more active partnership would allow the British Museum to implement the guidance they will add into their policies, in turn creating a more ethical virtual viewing experience. Furthermore, open communication between the two would ensure that as time goes on, these changes continue to be malleable and active: not a one and done solution but an ever-changing understanding of what is ethical.

Certainly many changes are needed, but one I argue is the most important to implement is some form of warning to the virtual visitor about the presence of human remains. Perhaps a warning on the main landing page of the British Museum that human remains are on display throughout the museum. Or, as one can zoom in for more information on a specific object in the museum, a similar mechanism can be used for a warning. Even ensuring a middle landing spot before close ups of the remains, far enough to avoid graphic imagery, but close enough to be able to tell they are indeed human remains, could serve as enough of a forewarning that those sensitive to seeing human remains are able to click away. By adding in this warning, the virtual display once more falls into line with the current guidelines for in-person display without changing the display visible to both types of visitor, thus solving one of the largest problems. Of course, this is not a panacea, much more specific guidelines must be added to the policies of the British Museum to fully cover the differences inherent to virtual vs. in-person display, but adding a warning to the virtual visitor is certainly a good start.

One may argue that the British Museum's Google Arts & Culture virtual tour is far from the only way one can view human remains on the internet. Images of remains both ancient and modern can be easily found through a Google Image Search. The digitization of museum collections has also made it easier to access images of remains as pictures are taken and posted to their online databases. If one can so easily find images of human remains, frankly with better image quality, then why care so much about their display through Google Arts & Culture? This idea of what ethics follow from real life into the virtual world is not a new one. Especially as technology becomes more advanced, these questions get more complicated. In the end, minimizing risk of harm seems to be a starting point for a company in a virtual space, especially one using virtual reality, augmented reality, and the like.¹⁹ Rather than just any entity on the internet, a museum must hold itself to a higher standard, and therefore must consider the ethical ramifications and the potential harm that their virtual display of human remains could create. The British Museum, specifically, has a self-ascribed, as well as legal, duty to ethically display human remains, and just because the display is hosted on a different platform, that does not mean that the museum can shirk this critical part of their display policy.

Conclusion

This essay has examined how the current iteration of the British Museum's presence on Google Arts & Culture, due to the changes in experience a virtual visitor would have compared to an in-person visitor, has fallen out of line with what their guidelines consider to be ethical. Instead of respectful portrayal that is easily avoided by the more sensitive viewer, the sudden movement of the Google Street View-style virtual tour instead functions more as a jump-scare, with remains going straight from unrecognizable as remains to close up images. The British Museum has so far left this

unaddressed, however, the museum has a responsibility not only to the remains themselves, but also to the visitor to ensure ethical display, regardless of the format.

The British Museum's "Human Remains Policy" is up to be reexamined in 2023, and it is imperative that when they do this, they include their best practices for the virtual display of human remains.²⁰ The museum can no longer ignore its responsibility to the virtual visitor, nor can it continue to believe that they can be likened to the in-person visitor. While perhaps this is sacrificing the egalitarian goal of Google Arts & Culture, the fact remains that the change in platform from in-person to virtual inherently changes the visitors' experience, and thus, makes the virtual display fall out of line with the British Museum's "Human Remains Policy," the *Human Tissue Act* (2004), and the DCMS *Guidance for the Care of Human Remains in Museums* (2005), and therefore has become unethical. Furthermore, there must be increased collaboration between Google and the British Museum, so that when these changes are published in the new policies, they can be implemented. The virtual display of the remains at the British Museum are suffering from a lack of clear guidance in how they should differ from in-person display, which necessitates not only a revisit of their policy, but also true, active partnership with Google Arts & Culture, ensuring that the remains are treated with the same ethics virtually as they are in-person. Virtual display has become an essential part of museum existence in the wake of the pandemic, therefore it is more important than ever to ensure ethical museum practice continues no matter the platform.

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Prioritizing Creativity & Soft-Skills in Museum Makerspaces

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Since the early 2010s, museums have been invested in the maker movement, which emphasizes learning-by-doing in interdisciplinary environments through creation with various tools and technologies. Many have focused on the maker movement as an extension of the STEM movement: through hands-on projects, maker-centered learning can increase engagement and proficiency in STEM subjects and prepare students for STEM careers. However, the strength of museum maker-programs lies in alignment with the STEAM movement – integration of the arts and design thinking that encourages development of creativity, empathy, and other soft skills necessary for human-centered problem solving. Historical context of STEM, STEAM, and maker movements will first be addressed to understand the educational motivations and guiding principles before looking at museums' motivations and roles in these movements. Case studies at the Bata Shoe Museum and Children's Creativity Museum will be presented that highlight two strategies used in successful, human-centered museum making experiences: de-centering technology and guided facilitation.

A BRIEF HISTORY OF STEM IN THE U.S.

The STEM (Science, Technology, Engineering, and Mathematics) education movement gained prominence in the U.S. at the turn of the twenty-first century after the publishing of several reports that showed U.S. students' performance in STEM was

falling behind other industrialized countries.¹ In a global economy increasingly driven by science and technology sectors, STEM education and excellency was tied to ideas of national prosperity, global power, and influence. The STEM movement advocates “subjects cannot and should not be taught in isolation, just as they do not exist in isolation in the workforce.”² Since the early 2000s, the U.S. government has passed numerous initiatives to better prepare students for STEM careers, including acts that modify standardized testing and acts that increased federal funding toward STEM education and teacher training. Simultaneously, national resources were focused on STEM research, as well as economic policy aimed at growing the STEM industries.³

FROM STEM TO STEAM

From 2000-2010, growth in STEM jobs in the U.S. was three times as fast as growth in non-STEM jobs.⁴ The U.S. Department of Commerce reported that STEM workers “drive our nation’s innovation and competitiveness by generating new ideas, new companies, and new industries.”⁵ However, concerns remain about the supply and availability of STEM workers. In 2010, the U.S. Department of Education reported that only 16% of American high school seniors are proficient in mathematics and interested in a STEM career; additionally, only half of those who go on to pursue a college major in STEM choose to work in a related career.⁶

Many educators have turned to STEAM, which adds the A for Arts to the STEM acronym, as a solution to this retention problem, as well as a response to decreasing federal funding for the Arts. Research has shown numerous benefits of incorporating arts into K-12 education, including reduced boredom in school and better performance on standardized tests.⁷ More than just crafts or artistically decorating STEM projects, “integrating arts disciplines into curriculum and instruction in the areas of science, technology, engineering, and mathematics can be advantageous for generating new learning opportunities rooted in the process of hands-on design and production.”⁸ The STEM to STEAM movement was championed in 2010 by John Maeda and the Rhode Island School of Design, arguing that the integration of the arts teaches design thinking, flexibility, risk-taking, creativity, collaboration, and empathy – all essential skills for more well-rounded employees, innovation, and developing human-centered, creative solutions in the workplace during a time when automation is on the rise.⁹

STEAM education has potential to keep students more engaged by humanizing and creating meaning around interdisciplinary learning and to appeal to a broader, more diverse group of students.¹⁰ In a 2018 study published by Microsoft, 91% of girls and young women describe themselves as creative and 72% say it’s important to have a job that directly helps the world; however, only 37% associate STEM jobs with being creative or making a difference in the world.¹¹ STEAM learning can help reach this audience and bridge this gap between STEM subjects, creativity, and making the

world a better place.¹² This is crucial as creativity is commonly named as one of the most important skills to succeed in the 21st century. In a 2010 global IBM poll, more than 1,500 CEOs from 60 countries rated creativity as the “most crucial factor for future success,”¹³ and through analysis of LinkedIn data in 2018, LinkedIn Learning found that “creativity is the most important skill in the world.”¹⁴

THE MAKER MOVEMENT

The maker movement grew out of the push for STEM learning and increased accessibility of creative technology, and it is often in conversation with the STEAM movement. The maker movement refers to “an interest working with one’s hands in interdisciplinary environments that incorporate various tools and technologies.”¹⁵ It encompasses a “growing number of people who are engaged in the creative production of artifacts in their daily lives and who find physical and digital forums to share their processes and products with others.”¹⁶ The maker movement gained momentum with the launch of *Make* magazine in 2005 and the Maker Faire in 2006. In 2013, Maker Media, Inc. was born and took over publishing of the bimonthly *Make* magazine in addition to publishing books, producing Maker Faires, and operating an online site that sells supplies for “making” projects.¹⁷ Maker Media emphasizes that making represents “the democratization of design, engineering, fabrication and education.”¹⁸ Common making projects include circuitry, robotics, 3D printing, and woodworking. Maker-centered education emphasizes “learning by doing” with a self-directed, informal, iterative, and collaborative approach.¹⁹ Because of the hands-on and interdisciplinary nature of many projects, “STEAM” and “making” are sometimes used interchangeably.

Similar to the discussion of benefits of STEAM, many supporters have advocated for maker-centered learning as a method of improving proficiency in STEM subjects,²⁰ increasing interest in STEM professions, and ultimately impacting everything from the technology and manufacturing industries to the global economy.²¹ As the movement gained popularity, some have emphasized that the most beneficial maker programs are those that go beyond the technical skills and center the maker movement’s human aspect – how making is collaborative and core to human identity and expression, how it empowers individuals to build up from their existing knowledge and pursue what interests them, and how it fosters creativity and the idea that anyone can innovate for the benefit of the world.²² Matt Baker, who runs The Forge, the Science Museum of Virginia’s intergenerational makerspace for all ages, says they aim to help participants develop “persistence, collaboration, motivation ... and all those softer skills that don’t get measured but that are just as important.”²³ Maker Media promotes the purpose of incorporating making into education to be “fostering in each student the full capacity, creativity and confidence to become agents of change in their personal lives and in their community.”²⁴

The maker movement is now a global phenomenon across formal and informal learning environments. Maker fairs are held all over the world each year, and makerspaces – spaces where makers can come to share ideas, skills, and tools – can be found in a range of environments including after-school programs, libraries, museums, and higher-education institutions. One example is FabLabs, created by professor Neil Gerschenfeld from the Massachusetts Institute of Technology (MIT) as “pedagogical environments that would allow everyday people to solve their own problems by producing (rather than purchasing or outsourcing) the tools they need.”²⁵ FabLabs emphasizes principles of engineering, robotics, and design, and models have been adopted for K-12 formal and informal learning settings worldwide.²⁶

MAKING IN MUSEUMS

The early 2010s saw numerous museums and libraries merging with the maker movement, building dedicated makerspaces or incorporating maker-centered activities. Since 2011, the Institute of Museums and Library Services (IMLS) has invested over \$10 million to advance research and support making in museums and libraries. In 2017, IMLS published *Making & Learning* with the Children’s Museum of Pittsburgh, a project to “build and sustain the capacity of libraries and museums to develop effective makerspaces and programs.”²⁷ The National Science Foundation has also supported development and research of making in museums at institutions including the Exploratorium in 2013 and the New York Hall of Science in 2014.²⁸

The initial push was primarily in children’s or science museums, as these types of institutions have “long incorporated making and creative technologies in their galleries,” but the movement has reached all types of institutions, including art and history museums, and making activities and makerspaces have taken many forms.²⁹ At the Peabody Essex Museum, the Maker Lounge hosted 3D printing workshops, individual tinkering for individuals of all ages with materials from circuits to cardboard saws, Maker-in-Residence programs, and varied demonstrations by visiting collaborators, including artists, scientists, and engineers.³⁰ ARTLAB at the Hirshhorn Museum supports teen innovators through a one-on-one mentorship program with professional creatives in addition to providing free access to art materials and the latest technology.³¹ Some institutions, such as Spark!Lab at the National Museum of American History, design maker-activities to connect to the museum’s collections or municipal or national history. Spark!Lab is designed for children ages 6-12 and their families, and their STEAM activities incorporate themes that connect to the museum’s exhibitions and America’s history of innovation.³²

Recognizing that interdisciplinary programs require multiple areas of expertise, museums often partner with external organizations to implement making programs.

One such example is a collaborative STEAM program between the Innovation Hub at Florida State University, the Robert K. Godfrey Herbarium, and a local summer camp that took place in summer 2018. This program involved tours of the Herbarium and Innovation Hub and integrated arts, maker tech, museum specimen, and scientific research with the goal of showing “different ways creativity is involved in STEM.”³³ Activities included learning about plant pressing, drawing scientific illustrations, and 3D modeling and printing of nature inspired tokens.

Desi Gonzalez places making with creative technologies in a “longer lineage of creation as a form of arts engagement in museums” and in a history of amateur art practice in the United States.³⁴ Beginning with the 19th century, Gonzalez explains how museums supported creative production through formal art classes and academies. In the late 19th century and early 20th century, this declined as universities formed their own departments, new technology like broadcast media shifted arts and culture participation from creation to consumption, and American culture increasingly differentiated between popular and highbrow arts, resulting in reduced art practice and a widening gap between highly trained professionals and amateurs. Art museums, such as the Metropolitan Museum of Art and the Boston Museum of Fine Arts, shifted to collecting objects of “higher taste” and swapped their adult art-making classes for art-historical lectures, believing their role was to foster high taste and aesthetic appreciation in their audiences. Art making primarily remained in programming for children, where museum educators embraced self-directed and hands-on learning principles for youth.

Using hands-on STEAM programming and making activities is part of a shift away from the authoritative museum that operates under the banking model of education and towards participatory visitor engagement for all ages. As defined by Paulo Freire, the banking model of education places authority on the teacher, or the museum, and positions students, or visitors, as receptacles for the museum’s knowledge.³⁵ Moving away from this model, opportunity for dialogue between teacher or facilitator is created, and the visitor becomes an active participant in their own learning instead of passively receiving information. The educational goal becomes “problem-posing” – emphasizing our relations with the world, thinking about our problems and how to solve them.³⁶ This shift towards visitor participation in museums is also part of a broader participatory culture that has become widespread in the U.S. and worldwide in the last fifteen years, spurred by the Internet and new technologies. Described by Gonzalez, “In a participatory culture—as opposed to consumer culture—amateurs take the reins of the production of media and cultural artifacts... As the Internet increasingly provides easy access to tools and networks with which to contribute and distribute culture, everyone becomes a media maker.”³⁷

In *The Participatory Museum*, Nina Simon argues that museums can use participatory techniques “to develop experiences that are more valuable and compelling for

everyone.”³⁸ Just as STEAM education benefits schools in ways like reducing student boredom and increasing student engagement with STEM learning, participating through making can benefit museums in many ways. Simon explores how participatory techniques can address several commonly expressed forms of public dissatisfaction with cultural and learning institutions. Two of these complaints are “the institution is not a creative place where I can express myself and contribute to history, science, and art” and “the institution is not a comfortable social place for me to talk about ideas with friends and strangers.”³⁹ Making is a form of participation that addresses both. Providing opportunities for making supports the interests of visitors who prefer to make and do rather than just read or watch, and makerspaces emphasize collaboration and sharing of ideas.

As Gonzalez documented in 2015, “arts participation through amateur art practice is again on the rise in the United States, and subsequently museums are being reinvigorated as sites for art making for all ages and levels of professionalization.”⁴⁰ Speaking to digitally mediated arts creation upon the opening of Media Lab at the Metropolitan Museum of Art in 2013, Don Undeen, the senior manager of the makerspace at the time, commented, “Digital tools do not fundamentally alter this paradigm, they just make it possible for more people to get involved.”⁴¹ Informal learning settings like museums play an “important role in diversifying the maker movement by making tools, materials, and processes more readily available to people who may not initially self-identify as makers.”⁴² STEAM programming and the maker movement was able to enter museums because of institutional history with arts creation, engagement with participatory culture, and alignment with maker culture in several areas: dedication to sharing information as freely as possible; belief in the value of hands-on, student-centered learning; and the notion that everyone is a maker, regardless of age, profession, or level of academic achievement.

Formal K-12 school settings face many challenges in creating STEAM programming and effective makerspaces, such as funding and resources, lack of time due to the focus on testing, and lack of teacher or facilitator training. Fern Shupeck, executive director of the Betty Brinn Children’s Museum, notes, “Schools are increasingly interested in maker education for all grade levels and in creating makerspaces, but many do not have the resources, training, and support they need to get started.”⁴³ Informal learning settings like museums can help fill this gap. The Betty Brinn Museum hosts Teacher Studio, “a free, professional development series ... that provides an introduction to resources, training, and activities for K-12 educators looking to implement making, makerspaces, and STEAM learning.”⁴⁴ Jacqueline Grant and Delaney Patterson, leaders of a STEAM program at the Garth and Jerri Frehner Museum, acknowledge budget disparities in rural areas:

“Because arts programs in rural school districts such as ours are more impacted by budget than schools in affluent areas, access to arts and science educational opportunities through informal learning environments is extremely important.

Through our program, over 6000 students have accessed arts and science resources their schools do not have, and at least 90 teachers have learned how to integrate arts into STEM lessons.”⁴⁵

Some educators fear that attempts to institutionalize K-12 making through schools will suppress the creativity central to the maker movement by emphasizing the immediate math or science content and hard engineering and technology skills gained.⁴⁶ Museums can combat this. For years, museums have been integrating digital technology to build connections, encourage dialogue, and engage visitors in storytelling, empathy, and change.⁴⁷ This is important as museums continue to shift from focusing on the collections and exhibitions to focusing on the people and communities they serve. The most beneficial museum makerspaces and STEAM programs are not ones that have the highest attendance numbers or use the fanciest technology and teach the most challenging technical skills, but those that guide participants to have a human experience and utilize technology in deliberate ways to facilitate creativity, empathy, and cultural understanding. Two case studies, including a reflection on my former internship experience, will be presented that highlight different strategies used in successful, human-centered STEAM experiences: deliberate de-centering of the technology and guided facilitation.

USING 3D FABRICATION TECHNOLOGIES FOR CREATIVE EXPRESSION AND CULTURAL HERITAGE LEARNING AT THE BATA SHOE MUSEUM, TORONTO

In 2015, the Bata Shoe Museum in Toronto developed a 3D printing workshop for children aged 9-13 titled “Footwear Futures” in collaboration with the Semaphore Research Cluster on Inclusive Design in Mobile and Pervasive Computing. The workshop was developed to allow researchers and the museum education staff to evaluate the use of 3D digital fabrication technologies for young learners in cultural heritage settings.⁴⁸ Researchers saw a gap between a growing amount of discourse around the educational value of 3D technologies in museums and the strategies used to engage children with these technologies, especially in the setting of cultural programming.⁴⁹ They sought to understand if 3D printing used in conjunction with museum pedagogical tools could support cultural heritage learning, cross-cultural understanding, and allow students to connect historical technology with contemporary ones. This is vital as successful STEAM learning experiences do not merely utilize advanced technology for its own sake; rather, they should highlight how the science and technology incorporated into the activities is relevant to each participant’s life.⁵⁰

The workshop design intentionally fused technical-digital and cultural literacies. The goal was to not only teach children the technical skills required for 3D printing, but to

also “encourage children to reflect on cultural knowledge associated with artifacts encountered during their museum visit.”⁵¹ In the two-part workshop, children were first given a cultural-historical introduction to footwear and shoe buckles from the museum education team. This presentation incorporated shoes made by various cultures from the Bata museum’s teaching collection, gave students a “broad survey of shoemaking practices,” and focused on “how, when, and why shoe buckles were used, as well as methods for decoration as signs of wealth and power.”⁵² This was then followed by an introduction to 3D design software and the processes of fabrication and small-scale manufacturing. The room had design stations, where participants could digitally create their own 3D-printable shoe buckles via laptops or tablets; observation stations where participants could watch the design and printing processes and examine the shoe buckles created by their peers or in the museum’s collection; and activity stations, where participants that completed tasks could explore other applications to create additional 3D models. Although students were engaged in the 3D fabrication process, the technology component was de-centered by equally weighting the museum’s cultural heritage presentation, giving students opportunities to play with shoes from the collection, and simplifying the digital modeling process by encouraging use of pre-loaded shapes and figures on tablet devices.

A fourth station in the workshop room was used for assessments and interviews by the researchers. Researchers were looking to answer several questions: How can hands-on experiences for children with technologies like 3D printing and digital modeling be used to foster cultural understanding and literacy about objects in the museum as well as the technologies that are used? Does the construction of an artifact lead to a greater understanding of the artifact’s historical and contemporary existence? Can children draw connections to the material history of an artifact through digital design processes?⁵³

The research results showed that students were able to understand and articulate knowledge both about the cultural-historical subject matter and the 3D design process.⁵⁴ Furthermore, they were engaged and excited about both the museum content and the technologies. They were able to apply the knowledge to shoes from other cultures not shown in the workshop presentation, to contemporary footwear, and their own lives, indicating the depth of their understanding and the ability of the workshop to foster cross-cultural connection. The process of making their own objects helped the students to reflect and build on what they learned in the presentation. They were able to connect their own design choices and contemporary examples to the cultural-historical context of shoe buckles being designed for utility and to demonstrate wealth and power.

When asked about the shoe-buckles they created, “participants noted they chose designs and letters to personalize their objects,” indicating an excitement towards using 3D technologies for creative purposes.⁵⁵ Students also commented on the

creativity expressed in designs made by their peers. Researchers concluded that this workshop was successful and that activities which de-center technology, allow for “creative modes of engagement”, and “equally weight digital-technological and cultural-historical literacies at the same time are both feasible and crucial to the successful deployment of new technology interactions by museums.”⁵⁶

FACILITATING CONVERSATIONS AROUND TECHNOLOGY AT THE CHILDREN’S CREATIVITY MUSEUM, SAN FRANCISCO

As a 2019 education intern at the Children’s Creativity Museum (CCM) in San Francisco, I experienced first-hand the success of these principals emphasized by the researchers at the Bata Shoe Museum. During general admission hours, I taught basic, intermediate, and advanced art and technology skills to youth (ages 2-12) and families in six multi-media exhibit spaces. Educators and interns collaborated to facilitate field trip programs and provide a fun and engaging learning environment that supported the growth of students’ creative confidence. Nurturing creative confidence and collaboration is at the core of CCM’s educational philosophy.⁵⁷ Each of the field trips and exhibits is designed to provide opportunities for creative expression, innovation, and critical thinking, and cultural-historical connections with the surrounding neighborhood and Bay Area are often explored.

In 2017, CCM was at the center of a neighborhood under major construction. The Community Lab, which inhabited a large, domed room in the museum, was transformed into Sketch Town, a new immersive, digital experience. Partnering with teamLab and Hitachi America, a virtual city was projected onto the domed room. Colorful roads spanned the city, rockets flew in the sky, and a helicopter provided a moving view of the city projected onto another screen. Sketch Town gave visitors the opportunity to draw their own buildings, cars, trucks, flying ships, or helicopters. When completed, they could scan their creations, watch it upload and drop directly into the virtual city, and interact with their creations on the screen.

With guided facilitation from the educators, Sketch Town used art and technology to “inspire conversations about the elements of strong communities including: diversity, civic function, public spaces, environments, creative expression, design, and technology.”⁵⁸ When I worked as the facilitator in this space, I prompted children with various questions including, “What do you imagine in a city of the future?” and “What can you add to our shared city to make it more safe or welcoming?” The goal was to foster creativity, empathy for the communities you live alongside, and critical thinking around architecture, city planning, and construction.

As part of the Imagination Lab, AR Sandboxes “offer kids a hands-on introduction to topography, where they can move, dig, and shape Kinetic Sand into personalized landscapes.”⁵⁹ Through the Map Makers activity, kids explore the dynamics of water flow and watersheds on a topographic map that changes colors as they modify the landscape. The Habit Helpers activity produces land and sea animals on the sand, prompting questions about human impact on the planet and how to design a habitat that can help both land and water creatures survive.

In the Animation Studio, kids learn the basics of stop-motion animation, first by developing their own stories and creating figures from clay and wire frames, then by bringing them to life on screen. For general admission visitors that needed support creating stories, we encouraged creative expression around their identity and things important to them: spending time with family or friends, their favorite superheroes, dreams about what they want to be or do when they grow up. During field trips, students learn about the history of stop-motion animation, see examples of different tools that can be used to enhance their films, and work through the entire process of creating a short film from start to end. Depending on the needs of the teacher and the grade level, students were encouraged to explore more complex topics like history, health, and social justice. Students animated stories about family or cultural traditions, saving animals, stopping bullying, and more. The technology used were computers with webcam or iPads and the software iStopMotion, and it was setup so that visitors could learn it very quickly: all they needed to do was press a button to take a picture. The technology is de-centered, storyboarding is given equal weight, and students are encouraged to think imaginatively about how to convey meaningful stories through stop-motion without sound.

While Sketch Town, AR sandboxes, and the Animation Studio are examples of high-tech activities, CCM also utilizes low-tech to provide opportunities to practice creativity and making. In the Innovation Studio, visitors encounter the Mystery Box Challenge: they are given a mystery box of supplies and an age-appropriate prompt inviting invention such as shoes for space travel, a flying machine that can carry elephants, or a device that can eliminate polluted air over the San Francisco Bay. The mystery boxes contain an assortment of traditional arts and crafts supplies, such as cardboard, bottles and bottlecaps, straws, wire, yarn, and beads. Scissors and tape are always available, and other supplies rotate as staff and outside sources donate materials. Kids are challenged to ideate something that solves the problem presented in their prompt, then to think about how to build it and ensure structural integrity. Facilitators challenge them to articulate their design process and describe the function of different parts of their inventions. Although the Innovation Studio is a low-tech makerspace, it allows children to engage in the act of making, thinking about problems, and designing solutions that will advance society or make the world a better place. The space also encourages intra-group collaboration between children and their accompanying adults, visitors coming in large groups, and within classes of

students during field trips. Creativity is fostered with open-ended prompts and always-changing mystery boxes of supplies that challenge participants to use familiar materials in new ways.

Though the making and STEAM activities are largely self-directed, as in the fashion of the maker and STEAM movements, my experience at CCM demonstrated the importance of facilitation to help visitors achieve a meaningful, humanized experience with technology and interdisciplinary learning. Conversations were guided to help visitors think about how we can use science and technology creatively to benefit our lives and care for those around us, whether through city planning, taking care of the natural environment, storytelling, or innovation. Other professionals in museum makerspaces have stressed the importance of facilitation as well. The Science Museum of Minnesota depends on volunteer facilitation to support learning through making; in order to carry out their vision, the volunteer training focuses on “fostering conversation, since it is fundamental to their work with learners.”⁶⁰ Through a two year research-practice partnership, Annie White et al. developed and published a Model of Facilitated Making in museum makerspaces. Recognizing that facilitation “often does not get highlighted compared to the tools and materials used by children,” the model “categorizes types of facilitation moves, describes environmental influences on facilitation, offers a process for considering techniques educators may use to facilitate,” and invites museum educators to reflect on their practice.⁶¹

CONCLUSION

Since 2010, the STEAM and Maker movements have been widely embraced in both formal and informal learning environments across the country. Both movements grew out of increasing STEM proficiency and preparing a better STEM workforce, but all too often, schools place too much focus on designing the learning space and acquiring the technology, and not enough focus on the learning experiences.⁶² Being in a makerspace or using technology alone does not mean that students are engaging in standards-based STEAM learning or developing the soft skills necessary for human-centered problem solving that the STEM movement was failing to teach – creativity, collaboration, and empathy.⁶³ Museums, with their long history of creation as a form of engagement, and as public institutions with missions often centered around inspiration and social change, are well suited to create successful STEAM or making experiences that are human-centered and foster these soft skills.

STEAM and making-centered activities in museums are most beneficial when participants can engage in creative expression, dialogue, and see connections between the skills learned and their lives or how to make the world a better place. Resources and technology are important, but de-centering the technology and guided facilitation are two strategies that effectively create learning experiences that

cultivate creativity, cultural-historical understanding, and human-centered problem-solving skills. As the case studies have shown, both high-tech and low-tech are suitable, and museums can partner with other organizations to acquire the technology or develop the educational activities. Remembering to prioritize the soft-skills is essential for museums continuing to develop STEAM and making-centered activities to support schools, K-12 student growth, and our next generation of innovators.

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Cave Albam Artes: The Utilization of Technology to Showcase the Polychromy of Ancient Art

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When Greek or Roman sculptures are depicted, the image associated is almost always one of stark whiteness. This stark, white image is also what one is most likely to see today in museums around the world. Indeed, the whiteness of these sculptures is what the public largely expects to see and upholds a notion regarding classical standards of beauty.¹ However, this notion of whiteness is a fictitious representation of how these sculptures would have appeared to their audiences in ancient times. Ancient sculptures were brilliant works in vivid polychromy displaying a myriad of sumptuous colors. Bold colors such as deep blues, bright reds, and vibrant green covered the statues. While many works' past polychromy is now lost for a variety of reasons including the wear of time or even purposeful removal,² digital technology can be used to investigate and display surviving traces on ancient sculptures in museum collections. This labor is important in both informing visitors and the public on unfamiliar aspects of ancient art and in challenging ideas of white supremacy propagated by the perception of whiteness of ancient sculpture.

Why is it important to challenge this idea of whiteness? For centuries, classical imagery has been used to promote a white nationalist or supremacist ideology. The original Fascists – Hitler and Mussolini – looked back to Ancient Rome for their idea of greatness. Hitler in particular loved Classical sculpture and used it to shape the Nazi visual ideology. Rolf Michael Schneider of Ludwig Maximilian University remarked to

BBC, "The perfect Aryan body, the white color [of the marble], the beautiful, ideal white male: to put it very bluntly, it became a kind of image of the Herrenrasse or 'master race'—that's what the Nazis called themselves and the Germans."³

The utter whiteness of the sculptures showcases the false reality that everyone in the Mediterranean was and homogenous and white which is fundamentally untrue.⁴ This belief in the pure white Classical sculpture originates partially from the Renaissance. Prior to this, at least in the Western world, a statue was seen as unfinished if not painted or the client was seen as not being able to afford the costly pigments.⁵ However, Leonardo da Vinci was one of the first to believe the use of color in sculpture was "barbaric" and to look down upon sculptors who were unable to achieve lifelike figures without the use of color.⁶ da Vinci and later Michelangelo were inspired by the ancient Greeks and Romans and looked to surviving examples to base their ideas upon. However, the surviving examples that they knew of were continuously exposed to almost all of the agents of deterioration, which led to almost all traces of paint being stripped from their surfaces.⁷ These artists formed their beliefs from an incorrect basis. Therefore, when people from later art movements referred back to the Renaissance artists, the myth of whiteness and its superiority was further embedded into the historical narrative.

Art historians such as Johann Joachim Winkelmann (1717-1768) did not help matters when they upheld the white marble statues as the ideal and attributed any color remaining to barbarity.⁸ Winkelmann, while admitting works did include polychromy, wrongly attested many sculptures with polychromy as Etruscan.⁹ This may seem like an honest mistake, but it is a problematic designation as the Etruscans were seen as more primitive than the lauded Greeks and Romans. Similarly, other art historians like Gotthold Ephraim Lessing (1729-1781) outright stated that polychromy was foreign to and went against the classical ideal.¹⁰ Another art historian, Georg Wilhelm Friedrich Hegel (1770-1831), wrote in his influential work *Aesthetics* that

The final material for sculpture, the one above all most appropriate to it, is stone which has in itself the objective character of consistency and permanence...[M]arble in its soft purity, whiteness, absence of colour, and the delicacy of its sheen harmonizes in the most direct way with the aim of sculpture...Of course we cannot deny that the pure beauty of ideal sculpture can be executed just as completely in bronze as in marble, but when, as happened in the case of Praxiteles and Scopas, art begins to pass over into softer grace and attractiveness of form, then marble is the most appropriate material.¹¹

These art historians and critics are very clear in what about these ancient sculptures is the most appealing and what the classical ideal was; the pure whiteness of the marble and its "absence of color" is one trademark of the civility of the Ancient Greeks and Romans, whereas only barbarians and lesser artists would besmirch the

material with color. This harmful idea associating color with barbarity and whiteness with civility persists to this day.

In order to counteract this narrative, it is important to educate the public on the actual way these sculptures appeared in their time. As briefly mentioned above, polychromy on Ancient Greek and Roman statues is not a new finding. Greek archaeologists knew as early as the 18th century and British archaeologist Charles Newton remarked on the vulgarity of the colors when publishing his findings at the Mausoleum of Halicarnassus.¹² These findings were somewhat rare as the surviving paint traces on sculptures which were unearthed long ago or never buried are very small and difficult to understand properly with only the visible light spectrum. Even sculptures with highly visible polychromy can lead to false identification of colors because of the way the paint ages.

It was not until the nineteenth-century that museums and researchers began to set up laboratories and run experiments to start studying many subjects including paint traces on Greco-Roman statues. In the 1970s and 80s, the field began to utilize new technologies to determine the past paint colors.¹³ To due this, researchers used technology such as photography under ultraviolet radiation (UV fluorescence and UV reflectography), raking light, and capturing images on orthochromatic film.

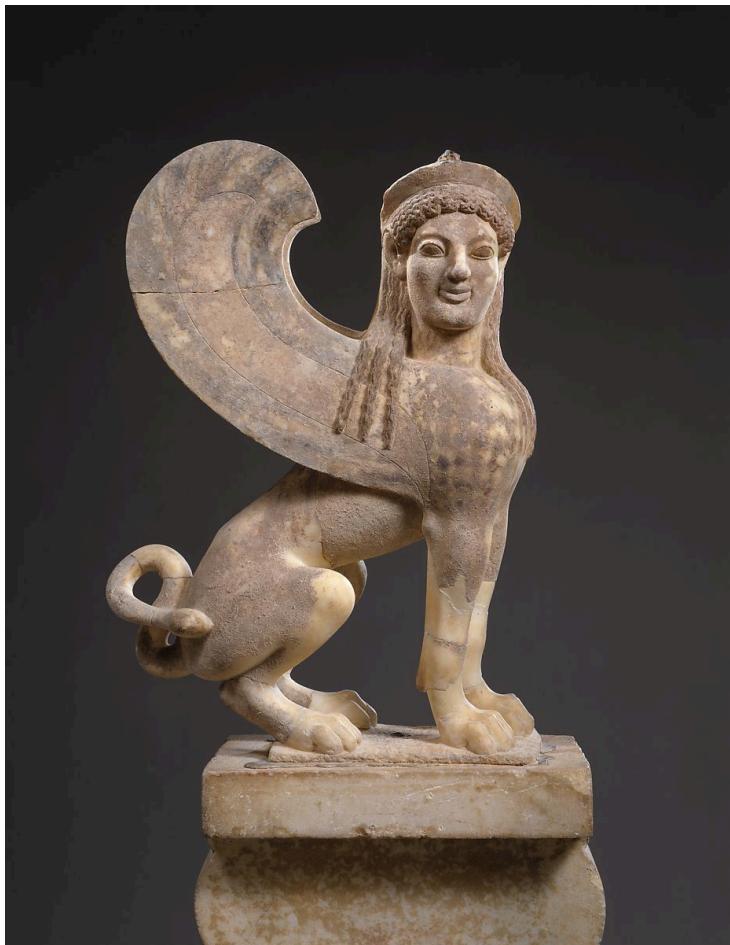


Image of a marble Sphinx from the Metropolitan Museum of Art. Details of past patterns in paint can still be seen on the wings and chest.

In addition, researchers took samples and examined them under microscopy.¹⁴ Taking samples is a destructive method, and while still used in a variety of different mediums, should only be done with the consultation of a conservator.

With the turn of the twenty-first century and the development of new technologies, non-destructive techniques such as X-ray fluorescence analysis (XRF) and ultraviolet-visible (UV-Vis) absorption spectroscopy have become much more commonplace.¹⁵ XFA works by generating and then aiming X-rays at a sample and measuring what is reflected at a detector.¹⁶



The Library of Congress's Oberlin Betts violin, a modern replica of the Library's Stradivarius Betts violin, undergoes x-ray fluorescence spectroscopy in the Preservation Research and Testing Division to test effects of use, October 8, 2019. Photo by Shawn Miller/Library of Congress.

This method allows researchers to measure chemical elements to determine the chemical structure and therefore color of the polychromy on a particular section of a statue, though this mainly works exclusively on inorganic materials.¹⁷ These inorganic compounds are normally metallic components within a material and allow a broad range of materials to be identified without taking samples.¹⁸ UV-Vis is even more analytical and allows identification of organic materials such as pigments and dyes. Light is focused on a specific point of the statue and the amount reflected or absorbed is measured by the UV-Vis spectrometer. Each color has a unique reflection and absorption spectrum so the spectrum can be compared to known pigments and dyes to determine the ancient color used.¹⁹

A specific example using portable XRF can be seen in the Medusa head shield on the frieze of the Siphnian Treasury at Delos in Greece.



Portion of the Siphnian Treasury frieze with figure, identified as Achilles, holding the Medusa shield. Attribution: Nanosánchez, Public domain, via Wikimedia Commons.

This is a small section of what remains of the treasury and measures 10 centimeters by 10 centimeters, however since this shield has an exceptionally expressive face and is several meters above where humans would be standing to observe the treasury, it would have most likely still been highlighted with polychromy.²⁰ The XRF machine was positioned approximately 1-3 centimeters from the sample and controlled with a motorized holder with a range of 20 centimeters.²¹



A portable X-ray fluorescence (XRF) machine being used in a laboratory to determine the composition of the gilded copper-alloy fittings on a drinking bottle. (c) MOLA on Flickr.

The XRF machine produces readings that quantify the remnants of past inorganic materials added to the surface. When this information is graphed, researchers can then determine what is the material of the statue itself and then look at other elements present to determine what was used for the paint. Measuring the elements remaining on the surface of the Medusa, the XRF machine found traces of calcium, iron, copper, and lead. These elements correspond to the colors brown (calcium), green (copper), and pink/white (lead). The team were unable to definitively identify what color the iron would take but they hypothesize it would have been red.²²

Even with these new methods, an investigation starts with older methods in order to make initial observations on the pigments themselves, the application method, and overall condition. Then the tried-and-true use of UV and infrared light to produce luminescence, fluorescence, and reflection are used along with raking light.²³ Specific colors can fluoresce in very particular ways such as Egyptian blue which can commonly be found in the eyes of statues. In addition, raking light can give valuable information on how a statue's surface was prepared along with some fading traces of patterns and motifs.²⁴ Another established step is to compare findings to ancient sources. Many ancient sources described how statues looked in their contemporary time, including the polychromy present. Writers such as Pliny the Elder (23/24-79 CE)

and Pausanias (110-180 CE) spoke on many subjects including color theory, biographies of sculptors and painters, and art itself. For example, Pliny discusses the Greek sculptor Praxiteles. When asked which of his own works he liked best, Praxiteles responded he preferred the works painted by Nikias as he gave the figures the finishing touch.²⁵ Even poets such as Vergil would remark on color on occasion as he did in his Eclogues when he writes, “Artemis, young Micon offers you this head of a bristling boar and the branching antlers of a long-lived stag. If this fortune still abides, you shall stand full length in polished marble, your ankles bound high with purple/scarlet buskins.”²⁶ This statue, or at least a similar one, has been identified and part of the reconstruction uses this description as part of the reconstruction.²⁷

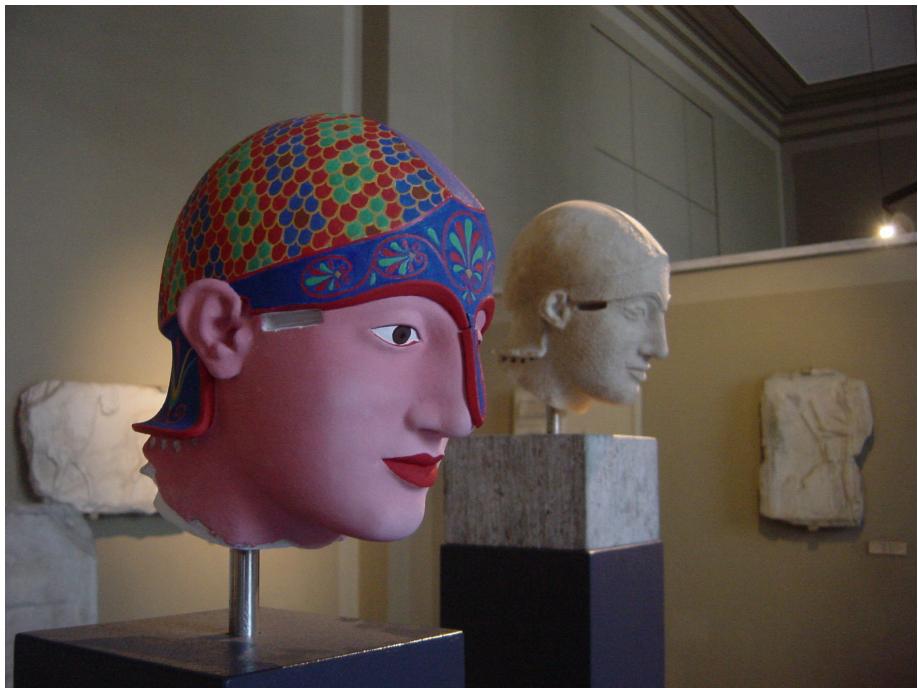
Even with the technological and literary sources available, it may be somewhat surprising that these ideas, while relatively well known in the Classics and some Art History academic circles, are not as well known to the public. While academics and students may read articles and research papers on this topic, such research is inaccessible to most of the public, both due to the technical language used and the ability to find these articles without a subscription to the journals where they are published. A further breaking point in the availability of this knowledge can be attributed to the world wars. After the outbreak of the First World War, many prominent researchers could no longer access original objects to conduct analytical research. The separation from original objects continued through the end of World War II, so any new understandings were stalled. However, for the public’s knowledge on the subject, a new aesthetic arose where the focus was on simplicity rather than the sumptuousness and ornamentation associated with the past regimes which allowed such human cruelty to occur.²⁸ One can think of the rise of art movements such as abstraction in this idea of a pared down aesthetic. This is seen primarily in Europe and especially in Germany, and as most of the research on polychromy was done in Europe there was a definite sentiment urging against this kind of research. The aesthetic and social turn was so extreme in Germany, it resulted in the destruction of many ornate buildings or the stripping of buildings of their ornamentation.²⁹ An attempt to reintroduce color when there would be so much public backlash was not possible and the ramifications are still felt today.

One way this information could be made more accessible to the public is by being featured more predominantly in museums. There have been a few small exhibits featuring polychromy in major European and American cities such as Boston and Chicago in the late nineteenth-century ancient art at museums like the Glyptothek in Copenhagen and the Getty Villa in California in contemporary times.³⁰ In the 2000s on, there has only been one large and traveling exhibition dedicated to the subject entitled Gods in Color which toured the world from 2003-2015.³¹ The exhibition featured the scholarship primarily by Vinzenz Brinkmann, Ulrike Koch-Brinkmann, and Renée Dreyfus.³² Within the museum space, there were some ancient sculptures and other ancient or eighteenth- and nineteenth-century paintings of Greco-Roman

ruins, but the majority of the exhibition featured painted reconstructions of ancient sculptures. Most of these were essentially plaster casts of the originals with the patterns and colors applied with egg tempura.



Reconstruction of the Peplos Kore from Gods in Color exhibition. Photo credited to Giovanni Dall'Orto on Wikimedia Commons.



Reconstruction of head of figure on the Temple of Aphaia with the original piece, on a loan from the Glyptotek in Munich, in the Gods in Color exhibition. Photo credited to Giovanni Dall'Orto on Wikimedia Commons.

The curators and researchers for this exhibition conducted extremely thorough research and updated the exhibition as it toured if new findings were discovered, however there has to be a more space-conscious way to display this information. In addition, this information is so intrinsically linked to the objects that it is only right that it is incorporated in a permanent way, not just in a temporary exhibition.

There are some museums which have models of what their sculpture looked like with paint, but this information is not usually featured and is more of a sidenote. A museum that actually features this information more predominantly is the Ara Pacis Museum in Rome.

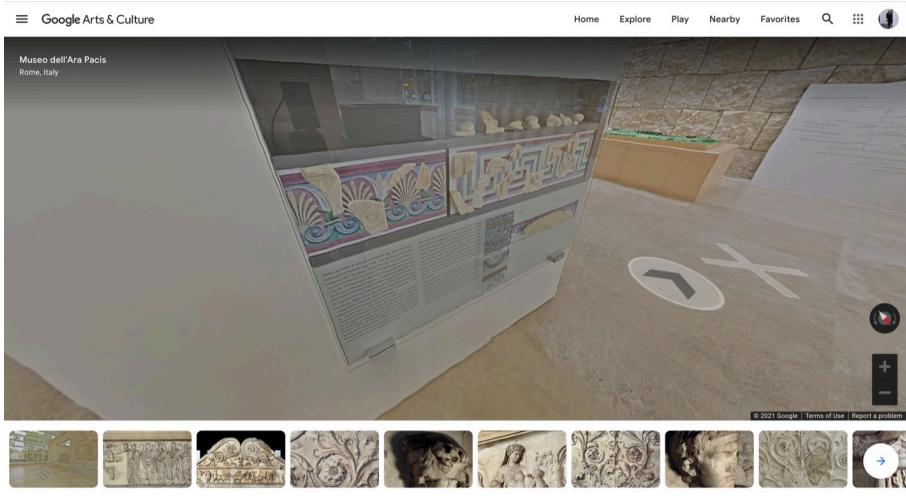
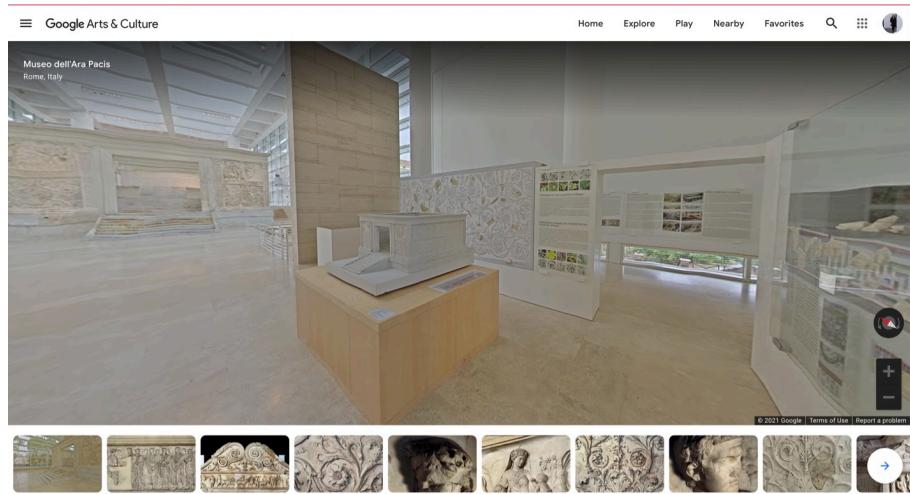


Image of polychromy of Ara Pacis featured at the Ara Pacis Museum in Rome.



Location of polychromy information in relation to the actual Ara Pacis within the Ara Pacis Museum in Rome. The polychromy section is on the right as you enter and most visible to visitors as they leave.

Both the exhibition and museums heavily utilized plaster casts and physical models of the objects to showcase the polychromy. With the continued evolution of technology, there has to be a better way to show polychromy in exhibits rather than creating physical models as this can take up quite a bit of space in an exhibit.

Two ways in which technology can be utilized in order to better interpret and showcase the polychromy of ancient art is through projection and touch screens in the exhibit space. At the Metropolitan Museum of Art (Met), projection mapping (also known as spatial augmented reality) was used in relation to the Temple of Dendur in their Department of Egyptian Art. Projection mapping utilizes a combination of physical object sand projected light in order to enhance the audiences experience with the objects. Much like other areas of the Mediterranean, Egyptian temples were once vividly colored. After investigating the temple to find its original coloring, the Met's team created a digital version of the art on the temple they could edit in Adobe Illustrator. After this step they mapped the illustrations to their place on the physical temple using the software MadMapper.³³ Using these various technologies and software, the Met was able to enhance the visitor's experience and showcase a crucial aspect of the temple's history. Reading some comments on this article show that while many were interested in this project, they were not as satisfied with the results. The main complaint was about how the temple was only illuminated some evenings and the projection was only based on one part of the temple. While attempting to project the past polychromy onto such a large structure as the Temple of Dendur, doing this on individual sculptures may be much more manageable and would be a good method to explore in a gallery space.

An alternative to utilizing projectors is installing touchscreens within the gallery. Most visitors will approach and interact with a touch screen when confronted with one in a gallery.³⁴ Images and information on polychromy of multiple sculptures, the process of discovering the polychromy, and even their respective histories and mythological tales could easily be included on the touch screens. I can even imagine an interactive component allowing visitors to guess the correct colors or color their own version of the statues. A study done at the National Museum in Malaysia showed that most people thought the touchscreens within this museum enhanced their overall museum visit.³⁵ Incorporating touchscreens into a gallery space can inform the public on crucial information on the Greco-Roman sculptures and provide visitors with a meaningful and memorable interactive component to their visit.

Regardless of how, informing the public about the correct interpretation of Greco-Roman sculpture is vital, not just for better understanding the object but for also correcting false racial stereotypes and white supremist beliefs regarding Greco-Roman art. As a museum studies emerging professional and a classicist, I can look at the future of this topic through two lenses. On the classics side, this information needs to be better incorporated into classes and textbooks. Many art history overview classes and their respective textbooks do not mention polychromy of ancient Greek and Roman statues and indeed only showcase the commonly seen stark white images.³⁶ Mark Abbe, a professor of mine at the University of Georgia, remarked on polychromy in a New Yorker article stating, "...Oh, my God! The visual appearance of these things was just totally different from what I'd seen in the

standard textbooks—which had only black-and-white plates, in any case.”³⁷ Even if someone does not like the aesthetics of the colored statues, the vividness of the colors is memorable. It may not be profound or immediate as a change, but allowing students to at least see what the statues would have looked like in ancient times is a step in the right direction. On the museum side, incorporation into the galleries and collections information should be the goal moving forwards. Time and effort are needed to research a museum’s specific collection, but it is a worthwhile venture. The statues are not represented in the correct way without their polychromy and visitors’ understanding of the pieces is skewed without them seeing such an intrinsic aspect of these works.

NOTES

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The Neo-divergent Museum: Utilizing Extended Reality for Museum Visitors with Autism Spectrum Disorder

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The American Alliance of Museums unequivocally cemented the issues of diversity, equity, accessibility, and inclusion (DEAI) as paramount priorities for the 21st century museum for in its 2016-2020 strategic plan.¹ As nexuses between history and society, its imperative museums deny no one that connection. Museological progress in addressing DEAI over the past 30 years is commendable, but especially in the areas of accessibility and inclusions, achievement benefits are mainly one-sided. Efforts in expanding these areas – sparked after the landmark 1990 Americans with Disabilities Act (ADA) legislation – disproportionately benefited individuals with physical differences versus individuals with learning differences (also called neurodivergent), often called the museums forgotten visitors. For several reasons, neurodivergent individuals today “do not always receive the accommodations [necessary] to be active participants within the museum setting,”² leaving many museums and cultural institutions inaccessible for or exclusive to them. Accessibility as well as inclusion are not only physical issues, but functional ones as well, and emerging digital technologies offer enormous opportunities to garner “full participation of all users while respecting diverse and different needs.”³ By incorporating burgeoning digital technologies like extended reality (XR), museums and cultural sites can better accommodate neurodivergent needs and alchemize these individuals into “core members of the museum community.”⁴

The term neurodiversity references a movement that initially “articulated the needs of people with autism who did not want to be defined by a disability label,” but mushroomed to cover a number of functional or intellectual conditions that diverge from what is considered typical or normal.⁵ Today, it represents “a heterogeneous groups of disorders with onset in developmental age” incorporating conditions previously diagnosed as Asperger syndrome and Pervasive developmental disorder – not otherwise specified (PDD-NOS).⁶ Whether due to environmental reasons, genetic factors, advancements in detection, or a combination of reasons, ASD is the fastest growing condition in the world with about 1-in-54 individuals in the United States alone diagnosed with the condition.⁷ I will use neurodiversity – and the related term neurodivergent – to refer to individuals diagnosed with Autism Spectrum Disorder (ASD) in this paper.

Despite ASD’s variability, it presents enough common manifestations to be identifiable. This symptomatologic nucleus features an “impairment of social communication” alongside “poor flexibility of interests” and “repetitive behaviors.”⁸ The predominate communicative challenges common among individuals diagnosed with ASD includes an “absence of reciprocity in verbal communications and the scarce or altered non-verbal communication expressions.”⁹ The predominate behavioral challenges common among individuals diagnosed with ASD includes a “strong resistance to contextual change, motor or verbal stereotypes, and fixation on specific objects or activities.”¹⁰ For this paper, I will focus on these unifying characteristics when referring to individuals diagnosed with ASD.

The “significant social, communication and behavioral” challenges from ASD can make visits to unfamiliar public places – like museums – difficult.¹¹ Individuals with ASD usually fail to adequately adapt “to crowded and unpredictable social contexts where there is a large number of sensory stimuli,”¹² navigate “interpersonal exchanges,” or understand “the general meaning of situations” stemming from a rigid adherence to detail which may lead “to an uncoordinated and confused perception and understanding of environments.”¹³ Alongside these challenges, many individuals diagnosed with ASD also suffer from what is known as sensory overload, resulting from an inability to filter sensorial stimuli (sights, sounds, smells, touch). This may turn a museum visit into a warzone as overhead lighting blitzes eyes like solar flares and surrounding conversations assault the eardrums like cannonades.

A study at Florida State University surveyed caregivers of neurodivergent children on how museums could help make their institutions more accessible for children diagnosed with ASD. They suggested providing anxiety-reducing materials, expanding ways children could “explore the museum,” reducing “lighting and audio/visual noise levels,” scheduling “accessibility times,” offering free ticketing or programming, incorporating “interactives,” and expanding ways children could “explore the museum” – the latter two suggestions I explore in this paper.¹⁴ Museums use variations on these solutions today to accommodate neurodivergent

visitors. Some focus on the pre-visit anxiety-reducing materials online via containing photos and text preparing visitors for the museum experience (called social narratives) to manage stress.

The V&A Museum of Childhood, for example, offers parents of children with ASD an online packet featuring frequently asked questions (FAQ's) and a map of busy time to avoid.¹⁵ Others manipulate the environment to help keep emotional and sensory states of individuals with ASD under control. They offer special programming, special visitation, and accessibility times to mitigate sensory overload (when one receives more sensorial input than one's brain can handle) by limiting crowd sizes as well as dimming overhead lights. The Smithsonian Institution's *Morning at the Museum* initiative, a free "sensory-friendly program for families of [individuals] with disabilities including [autism],"¹⁶ and the United Kingdom Natural History Museum's *Dawnosaurs* program which frees visitors "from the hustle and bustle of the general public,"¹⁷ employ this strategy. Others in this category, like the National Children's Museum in Washington, D.C., offer in-situ assistance like sensory backpacks (equipped with noise-canceling headphones as well as handheld distraction devices) and quiet rooms.¹⁸

Other museums see accessibility as "a technical issue,"¹⁹ and utilize digital technologies to help neurodivergent guests feel included in their pursuit of greater accessibility. The favored strategy employs mobile applications, as the technology is ubiquitous (85% of Americans own a smartphone to access these applications)²⁰ and educational as well as psychological studies prove mobile applications are optimal scaffolding in helping neurodivergent users achieve learning objectives.²¹ Several Chicago museums collaborate with a local company called Infiniteach to offer "downloadable guides in the form of mobile-friendly applications, which include sensory maps and communication tools" as well as music, interactive schedules, and advice to ameliorate the museum visit for individuals diagnosed with ASD.{^22} Infiniteach won the American Alliance of Museum's (AAM) 2017 Diversity, Equity, Accessibility, and Inclusion award for its collaboration.

Building mobile applications is a good start for museums in realizing the potential of digital technologies in expanding accessibility to neurodivergent guests, but there are more digital technologies museums can exploit to this end such as extended reality (XR) devices. XR refers to technology that renders digital environments to facilitate unique experiences for users. Contemporary representative forms of XR include mixed reality (MR), augmented reality (AR), and virtual reality (VR) – the latter who I explore in this paper. All devices "include cameras, microphones, and sensors [that] help [users] interact with the real world,"²² but diverge in their immersive experience. AR takes place in the physical world. It "overlays digital content and information onto the physical world – as if they're actually there with you, in your own space," like Pokémon Go, a mobile friendly AR application that allows you to

collect digital animals in the outside world.²³ VR, on the other hand, is more immersive and takes place in the virtual world. It “is an entirely projected [computer-generated simulation] where [users] can interact with the digital information” presented, like Meta Platform’s Oculus Quest 2, a standalone (meaning not connected to a console) VR headset containing integrated mobile computing hardware.²⁴ In each level device, sensors and cameras within the device map user movements to generate truly responsive experiences users can manipulate.

Museums use XR (AR and VR) to great success in their audience outreach efforts. The National Portrait Gallery (NPG), for example, partnered with local institutions to bring classic art to the streets in the 2018 *Art of London Augmented Gallery* exhibition via VR. Curators from participating institutions digitized select pieces of art from their respective historical sites, and through AR technologies, allowed the city’s pedestrians to access them along a designated walking exhibit in the middle of London. Pedestrian participants scanned special QR codes on their smartphones to digitally render famous Londoners and portraits on their phones.²⁵ The Louvre in Paris, on the other hand, introduced VR for the first time in its history during its 2019 *Mona Lisa: Beyond the Glass* exhibition. Visitors explored the rendered studio of Leonardo di Vinci, flew on the polymath’s flying machine, and soared above Mona Lisa’s luxuriant home through HTC’s Vive VR headsets.²⁶ These initiatives enabled NPG and the Louvre to engage with a wider audience and help visitors contextualize history in novel ways, which all help to maintain the institutions’ societal relevancy.

While museums find great success with XR (AR and VR) relative to their neurotypical visitors, this technology remains under theorized as a solution to help improve the museum experience for neurodivergent guests. It’s use with this community is not science fiction, frequently employed by researchers to help individuals diagnosed with ASD. Numerous educational as well as psychological studies used AR with “software, digital books, computers, and other devices [in] the treatment process for ASD”²⁷ as well as exploited VR’s immersive capabilities prepare autistic patients for stressful situations.²⁸ These included job interviews, neighborly disputes, dating²⁹, public speaking³⁰, and phobias.³¹ Given XR’s track record in education as well as psychology, there’s little question to its potential for museums.

Museological research, in fact, is beginning to explore this possibility. Promising research in utilizing AR to help museums become more accessible to neurodivergent museum visitors comes from the ARtis project, a mobile application navigational aid. Through the application, it’s developers hope to support “people with ASD [make] easier use of places of culture” like museums.³² It features a guide – or tutor – as well as “graphic animations, interactive characters, environmental simulations, multimedia cards, interactive and educational content” that orients and motivates the visitor to design “an appealing and interactive visit.”³³ A beta-test evaluation at a Herculaneum excavation site showed the application facilitated a “deeper

understanding of the site” and nurtured an “overall interest in the site” in about 20% of its neurodivergent users.³⁴ Additionally, it allowed them to finish in half the time it took neurotypical users (the control group), illustrating AR’s potential to offer neurodivergent museum visitors not only an immersive but efficient experience as well. Promising research in utilizing VR to help museums become more accessible to neurodivergent guests comes from Italy’s Marche region and from Australia’s ACMI museum. In Italy, the University of Macerata collaborated with and São Paula State University in Brazil to launch a pilot study investigating the potential of VR within a museum environment. Researchers hoped to create an accessible experience that achieves a higher level of inclusion in cultural context for people with ASD than most can currently receive.³⁵ Evaluations from the study showed it “allowed people with ASD to anticipate both in the external and internal environments, thus ensuring greater predictability of the [museum’s] spaces.”³⁶ VR’s capabilities in facilitating the use of “maps of the environment with 360 images,” according to the study, decreased “stress and concern regarding entry to an unfamiliar or new environment.”³⁷ Across the globe, Arieh Offman – ACMI’s Programmer as well as Public Programs and Curator of Videogames – echoes these findings. ACMI welcomes its neurodivergent guests to use its VR equipment, and while it has not conducted official qualitative evaluation on this endeavor, Offman notices a substantive positive reception from neurodivergent users of its VR equipment.³⁸

While embryonic, this research already illustrates clear potential for XR to assist neurodivergent guests in their museum experiences. There are two keys to XR’s success in this context. First is operability. Research finds individuals with ASD favor “smart devices such as computers, tablets, and smartphones,”³⁹ possibly because there is a trend in the community toward being visual rather than verbal learners where they create meanings and memorizing through pictures.⁴⁰ As a mainly visual medium, XR’s operation mimics the learning style of users with ASD and so is apt to best assist them in completing learning objectives. Second is malleability, and XR’s capability to adapt to the heterogeneous needs of the autism spectrum. Augmented reality (AR) is optimal for neurodivergent individuals with low support needs who would genuinely prefer the independence AR affords them, as it places them “at the center of the experience.”⁴¹ Virtual reality (VR), contrastingly, is optimal for neurodivergent individuals with high support needs who may desire more control over their experience. VR is more equipped “for the construction of predictable and low sensorial impact services,” permitting users more power in dictating their experiences and reducing anxiety from external sources.⁴² XR technologies like AR and VR offer unique opportunities for cultural sites like museums to dismantle traditional barriers that made cultural sites difficult to visit for individuals with ASD by working with them in real time to manage their experiences.

Hopefully this initial research galvanizes further development into the possibility of using XR technologies to assist neurodivergent guests with their museum

experience. But what would the future of this utilization look like? The next age of application rests on programming and incorporating new technological capabilities. Central to programming and implementation are the human resources who will convert dreams into realities. This includes museums collaborating with representatives of the ASD community and the frontline staff implementing the devices. Museums should include representatives of the ASD community at every step from design to application to ensure the technology will serve its purpose. Hiring frontline staff is one of “the most important step[s] a museum can take”⁴³ as they will orient users and be their first point of contact along their individual customer journeys. As “every child on the spectrum has different needs,”⁴⁴ they must be trained not only in the technology but in handling the heterogeneity of ASD manifestations. A good onboarding process will ensure loyal and return customers for the museum.

Central to the technology will be focusing on two elements, namely, interactive storytelling and making sure it is sensory friendly. The first element, interactive storytelling, is a form of digital entertainment in which the participant creates the setting, characters, and situation which the programmed narrative must address. With an undetermined storyline, the participant can experience a unique story based on their interactives. For museums, blending objects into interactive storytelling holds several advantages including strengthening memory⁴⁵⁴⁶, helping direct people’s attention, provoking inquiry, and motivating “deep engagement with content.”⁴⁷ To be most effective with neurodivergent users, educational lessons or objectives must be addressed linearly, visually, and succinctly to ensure a greater possibility of retention.⁴⁸ Museums can incorporate current event-based interactive storytelling software already in use by Disney Research.⁴⁹

The second element, being sensory-friendly, encompasses helping visitors navigate spaces based on their needs (called digital wayfinding) and either reducing sensorial irritants or at least not causing additional irritation at the very least. XR technologies can incorporate digital wayfinding by featuring easily accessible digital maps of the site with restroom and quiet rooms strategically marked. This concept may also include temperature and noise-mapping, which can be observed in current technology like Shedd Aquarium’s sensor-friendly mobile application. XR technologies can ensure their sensor friendliness through software and hardware modifications to mitigate sensorial irritants. For both augmented reality (AR) and virtual reality (VR), software modifications include granting user permissions to alter settings (i.e., screen frame rates, brightness, caption speed, translations, noise levels) and incorporating verbal text functions from technologies like the Smithsonian Institution’s AIRA technology.⁵⁰ If museums are employing mobile-friendly AR technologies, software modifications to increase sensory friendliness may include ensuring a ready-to-use library of calming music is available for users and that its compatible with Bluetooth headphones, as this technology will only become more

popular in the future.⁵¹ Libraries can reside within the museum's internal systems, or rest on audio streaming services like Spotify, Apple Music, or Tidal. Hardware modifications to increase sensor friendliness of XR technologies for neurodivergent relates more to VR than AR, as VR typically features hardware from physical consoles to encompassing headgear. Modifications may include making headsets more adjustable to accommodate varying user head sizes as well as ensuring the material is comfortable.

XR technologies (AR and VR), like any other emerging technology, are not without its challenges such as hygiene, sanitation, cost, manpower, and privacy. Regarding hygiene, frontline staff should sanitize technologies typically requiring shared devices, like VR headsets. Regarding cost, museums may be able to offset it through donations, grants from institutions such as the Kellogg Foundation or Bloomberg Philanthropies, or through partnerships with VR companies. Allured by rare marketing opportunities museums provide, these companies can donate their technologies (which can serve as a tax write-off if the museum is a 501(c)(3) non-profit organization⁵²) and provide technicians to help with upkeep. Regarding manpower, it can be time consuming to keep digital maps updated for wayfinding, but as museums feature updated maps on their websites these digital maps can easily be transferred to the XR device. Regarding privacy concerns, museums must be diligent to empower users to divulge as much information as they see fit, and have a cybersecurity expert monitor data the museum stores for necessary subsequent evaluations.

Expanding access and inclusion to neurodivergent visitors is a moral and financial imperative for museums. Cultural institutions wield immense societal value as educators, forums, heritage stewards, economic engines, sources of provide, and even as contributors to public health.⁵³ Studies reveal museum participation improves quality of life by increasing self-esteem while decreasing depressing and stress.⁵⁴ Participants have "about a five-year difference in cognitive age compared to those who had little to no access to such places."⁵⁵ As the population of neurodiverse individuals grows, and our society adapts accordingly, its morally imperative museums extend their accessibility as well as who benefits from them. Once involved, these individuals typically prove lucrative supporters. When welcomed, they are often "incredibly loyal, returning regularly" for repeat visits or to elevate their involvement as "volunteers or staff members."⁵⁶ A constant struggle for most non-governmental institutions to converting passive customers into passionate fans, but by expanding museum accessibility as well as inclusion to neurodivergent individuals, museums can empower a support network that will help maintain their solvency.

Museums are still working toward being welcoming environments for neurodiverse individuals. In their efforts, the United Nation's Convention on the Rights of People with disabilities implores institutions like museums to "focus on the central role of

technology in the promotion of inclusive context.”⁵⁷ Accessibility is a technical issue, and by employing XR technologies like AR and VR, museums can empower their neurodivergent guests to be engaged as well as participatory members of the museum community. Due to their adaptive nature, XR technologies are primed to accommodate the heterogenous needs of neurodivergent individuals and turn the museum environment from an intimidating to a welcoming one. XR technologies allow users to access different realities, and by utilizing them to expand access to neurodivergent visitors, museums can also transcend into a new reality of being a truly communal space. If museums want to be communal spaces, they must make the whole community feel welcome, and digital technology is a way to include a long-time elusive part of museums’ communities – the neurodivergent.

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The Revival of the Ancient Silk Road: Use of Modern technology in Digitization, Virtual Repatriation, and Exhibitions of Dunhuang Mogao Caves

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Modern technology has brought new blood in reviving long-abandoned historical sites on the Ancient Silk Road—the Dunhuang Mogao Caves. Dunhuang, a cultural heritage site located on the ancient Silk Road in Gansu province, China, has survived for more than fifteen hundred years.¹ The site reached its golden age when the trade and cultural exchange on the silk road was most prosperous, but it began to decline from the Ming dynasty of the late fourteenth through the mid-seventeenth century. Dunhuang was the crossroad connecting the East and the West, mainland China with the civilization of the Mediterranean. Suffering from Chinese civil unrest during the nineteenth century, the Dunhuang relics were looted by western explorers such as Aurel Stein and Langdon Warner and scattered throughout the world.²

Nowadays, international collaborations are working on-site preservation, digitalization documents, and establishing exhibitions. The International Dunhuang Project (IDP), starting in 1994, created a database that cataloged and digitized manuscripts, printed texts, murals and paintings, textiles, and artifacts from the Mogao caves. This online database is essential to international scholars, Buddhist practitioners, and Chinese people and their cultural identity. The IPD database,

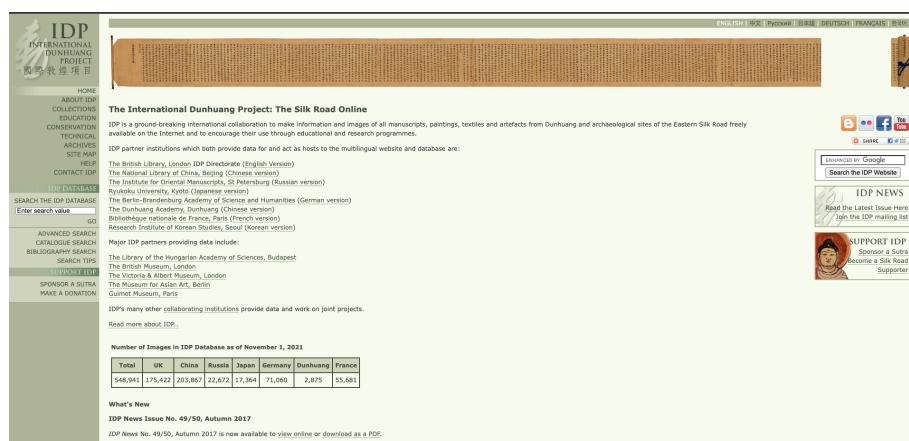
together with immersive exhibitions, could act as a form of virtual repatriation when the physical return of the relics is not feasible.

BRIEF INTRODUCTION OF DUNHUANG MOGAO CAVE AND THE IDP

Dunhuang Mogao Caves, which were carved into the cliffs above the Dachuan River, was the home for rare cultural relics and Buddhist arts.³ Four hundred and ninety-two caves hold about 45,000 square meters of murals and more than 2,000 painted sculptures, representing the highest achievement in Buddhist art from the 4th to the 14th centuries.⁴ The Buddhist artifacts from the Mogao caves provide evidence for the evolution of Buddhist art in the northwest of China, which depicts "medieval politics, economics, culture, arts, religion, ethnic relations, and daily dress in western China."⁵ Dunhuang not only serves as a house for Buddhist art, but it is also where social, cultural, religious, artistic, and economic trade encounters. A German explorer, Ferdinand von Richthofen, named it silk road; a historic network that prefigured the contemporary definition of globalization. However, Dunhuang lost its global charisma when the Ming dynasty took control of China in 1368 AD. The trade was disrupted by irregular warfare and constant shifts of political power in Central Asia. Due to a lack of political and military protection from powerful regimes, local banditry prevailed and threatened traders and local citizens.⁶

On May 26, 1900, Cave 17, the Library Cave, which contained about 50,000 manuscripts written on paper, silk, wood, and other materials, was discovered by a Chinese Taoist monk named Wang Yuanlu.⁷ The Library Cave discoveries are the documentary of "Buddhism, Taoism, Manicheanism, and Nestorian Christianity in ancient Chinese, Tibetan, Uighur, Central-Asian Brahmi, Turkic, and Syriac."⁸ Taoist Wang sold countless manuscripts to Japanese, Russians, and Stein during his third adventure. During transportation from Dunhuang to Beijing, many relics were lost or stolen because of the recklessness of the Qing government officials. Western explorers came to Dunhuang, "purchased" manuscripts, literature, peeled murals of the wall, and detached sculptures from the cave. Harvard professor Langdon Warner, who specialized in Chinese art, went to Dunhuang to study Chinese literature, history, and language. He purchased a Tang dynasty painted, kneeled attendant bodhisattva from cave 328, and brought it back to Harvard, which remained to be Harvard Art Museum's permanent collection since then.⁹ A Hungarian-born British explorer, Aurel Stein, arrived at Dunhuang during the time of civil unrest in March 1907.¹⁰ Stein acquired thousands of cultural relics from the Library cave, including the old copy of The Diamond Sutra, the oldest printed book that remains today, which was divided by several institutions.

The international endeavor assembling the fragments of the Dunhuang collection was the International Dunhuang Project.¹¹ The International Dunhuang Project (IDP) started in 1994 with the mission “to promote the study and preservation of the archeological legacy of the Eastern Silk Road through international cooperation.”¹² The project offers international insight by combining local training academies with a global network of scholars and international conferences.¹³ The collaborative teams put the information online, covering the subject ranging from manuscripts to textiles, paintings and artifacts. The online site is freely accessible, easy to operate and extremely functional for both scholars and laypeople.



A screenshot of the homepage of the IDP website.

From 1993 to 1995, the collaboration focused on categorizing the collections and conservation. Digitizing manuscripts began in 1997 and in 1998, the IDP website was open to the public including “50,000 paintings, artifacts, textiles, manuscripts, photographs and maps.”¹⁴ Digitized images of 20,000 of these items are available online and the websites were redesigned and updated in 2005. The local centers were established in London, Beijing, St. Petersburg, Kyoto, and Berlin, where collections of Dunhuang relics were held and were digitized in the database. The collaborative institutions include the British Library, the British Museum, the Dunhuang Academy, the National Museum in New Delhi, the Freer Gallery of Art in Washington, DC, to name a few.

The website not only contains digital images and information for the collection, it also offers access to related links, history of Chinese bookbinding, Buddhist documents, the archive of IDP newsletters, and the timeline for this digital project. The designers considered “search terminology, available indexed fields, issues concerning the images of the items themselves, and the availability of translations for portions of

specific manuscripts" when constructing the site to make the database more accessible to various audiences.¹⁵ In addition to the related links, the website also contains information on how each collection could be accessed in person. For example, the Chinese collection catalog gives people a glance at what they can access in China.



IDP
INTERNATIONAL
DUNHUANG
PROJECT
国际敦煌项目

ABOUT THE
COLLECTIONS
EDUCATION
CONFERENCES
TECHNICAL
ARCHIVES
SITE MAP
HELP
CONTACT IDP

SEARCH THE IDP DATABASE
Enter search value GO

ADVANCED SEARCH
CATALOGUE SEARCH
BIBLIOGRAPHY
SEARCH TIPS
SUPPORT IDP
SPONSOR A GUTRA
MAKE A DONATION

Chinese Collections

Chinese Exploration and Excavations in Chinese Central Asia
Collections: Contents and Access
Collections: On IDP
Bibliography

1. Chinese Exploration and Excavations in Chinese Central Asia

Officials edited by China's western regier during the Qing dynasty (1644–1911) provided successive accounts of the language, peoples and topography of the area (new Xinjiang Uighur Autonomous Region and Gansu province). This continued the tradition of local gazetteers produced throughout China, and the chapters on the 'western regions' which had been part of many Chinese official dynastic histories since the Hanshu (History of the Han). The Military Governor Sengsun 鄭肅 (in office 1820–9) used extracts from the compilation of a gazetteer of Xinjiang. Prominent among them were Wang Yutai 王遇泰 (1751–1815; exiled 1805–9) and Xu Song 增敬 (1781–1848; exiled 1813). Qi also wrote a history of the border regions. Xu went on a journey of exploration in 1815–16 to collect information for the project during which he visited the Buddhist cave at Dunhuang and recorded stela inscriptions about the founding of the site. He also recorded the names of the caves and their locations. Xu's work was later published in the western regions of the Hanshu (History of the Han), (Dalyan–Cohen, 1991).

Xu Song produced a book of poetry on Xinjiang, which became another important activity for the scholar-regions. The Uncle of the King of Jia (嘉定府) (1724–1805; exiled 1761) and his daines are poems of Heng Liang (恒亮) (1746–1809; exiled 1799) provide much useful first hand information on the region. Xu Naiyu continued in this tradition, composing a poem An Tie to the Thousand Buddha Caver during his posting to Dunhuang in 1813–4.

Jiang Xiaowen 江孝文 (1795–1870; originally from Henan) was not called Xu until 1813. He served as imperial secretary and companion on Aurel Stein's second expedition, 1906–8 (see British Library, 1998). Stein had served previously as a private secretary to government officials and had the experience that often required. When he arrived in Dunhuang in 1906 the two immediately got on. Jiang taught Stein colloquial Chinese during the mission and was instrumental in persuading Wang Yuanxi, the Daoist guardian of Dunhuang to allow access to himself and Stein.

Wang Yuanxi was an itinerant Chinese Daoist monk from Shanxi Province who arrived at the Dunhuang Buddhist cave complex in the 1890s and made it his home. He became an unofficial guardian of the caves and went on fundraising tours to raise money to restore the statues. In 1900, while clearing sand from cave 16, his workers accidentally discovered a hidden door which, when opened led into a small cave filled with ancient documents and paintings dating from the fourth to eleventh centuries. The cave in question is now numbered Cave 17 and is also known as the Library Cave (although it was originally constructed as a memorial cave for a local monk on his death in the ninth century).

The full significance of the library cave's contents was not immediately recognised in China after its discovery. Wang went to the county town to report the discovery to local county magistrate Yan Ze 袁澤, taking two manuscripts with him as proof. The official was not particularly learned and regarded these two yellow manuscripts as unless old paper. Three years later, a new county magistrate came to Dunhuang, Wang Zongchen 王宗憲 (1866–1911), who had a keen interest in epigraphy. Wang Yuanxi hoped he would be more interested in the preservation of the library cave's contents but, after visiting the cave, the new magistrate simply took away a few manuscripts and sent them to the Ministry of Education in Beijing. He did not return to Dunhuang again until 1909, when he was appointed to the post of county magistrate. He then arranged for the cave to be sealed off. He died in 1911, a journey of 800 li. The magistrate there was a scholar but he did not ascribe very great value to the manuscripts shown to him by Wang and did not concern himself with the preservation of the library cave. A few years later, the Provincial Education Commissioner, Ye Changchi, heard of the cave, and used artefacts taken by magistrate Wang Zongchen for his book Yu Ji Bei (On stone inscriptions). In 1904, the provincial government ordered the Dunhuang county to repair the cave and send specimens to the Ministry of Education.

When Stein and Pelliot visited Dunhuang in 1907 and 1908 respectively (see British and French collections) they were therefore able to persuade Wang Yuanxi to part with large numbers of the manuscripts and paintings for a small reimbursement, while Wang Yuanxi duly noted. Their expeditions gave birth to rich collections and the dispersal of Dunhuang documents to Europe. When Pelliot made another trip to Beijing in 1909, he showed Chinese scholars some of the documents he had obtained from the library cave, causing a sensation in scholarly circles. The first group of Dunhuang scholars, including Dong Kang, Lu Zhengy, Wang Guowei, Fang Bojian, and others, all made a pilgrimage to Wang Yuanxi's residence in Babao Alley in the hope of gaining permission to enter the library cave. With Pelliot's help, the scholars made notes, took photographs and made copies of the Dunhuang manuscripts they saw.

Meanwhile, the acclaimed scholar Luo Zhenyu heard that more than 8,000 manuscripts remained in the library cave. He realised that if the manuscripts were not quickly brought to Beijing, they might disappear completely. The concerted efforts of Luo Zhenyu and other scholars culminated in the Ministry of Education issuing a government directive for recovering the remaining manuscripts. Fu Baosu 付寶書 was appointed to arrange transport of the remaining manuscripts from Dunhuang to Beijing. He left the Tibetan manuscripts at Dunhuang. It appears some manuscripts were stolen from the Ministry of Education by Li Shengduo 李承囯, when, after the manuscripts reached the Ministry of Education (Beijing, 1903). Soon after this occurred, the 1911 revolution led to the

COLLECTIONS: BRITISH | CHINESE | FRENCH | GERMAN | JAPANESE | RUSSIAN | KOREAN COLLECTIONS | OTHER | ENHANCED by Google | Search the IDP Website |

page generated: 5/12/2015 page last updated: 12/13/10



A screenshot of the Chinese collection page on the IDP website.

The Advanced Search button is a powerful tool to use. On the left side of each page, the "Search the IDP Database" option is available for the viewers to only search for items with images. The term image refers not only to scanned photos, but also digitized objects accompanying an entry such as maps, artifacts, manuscripts, and other items related to that entry. The advanced search allowed the researchers to search by "pressmark, by index values , and by free-text searching within titles and catalog entries."¹⁶

1. Enter a pressmark (use % as a wildcard)
 contains Enter search value
 Show Only Records with Images
 Reset Submit

2. Preferred/indexed values
 Type of Artifact
 Holding Institute
 Subject or Keyword
 Short Title
 Form
 Archaeological Site
 Language(s)/Script(s)
 Show Only Records with Images
 Reset Submit

3. Free text search
 Enter search value
 Restrict by Catalogue(s)
 Show Only Records with Images
 Reset Submit

The Advanced Search section on the IDP website.

Searching by pressmark is similar to finding materials in an archive by using a database accession number. Those numbers are closely associated with specific institutions or the expeditions related to the discovery of the items. Take the IDP number OR.8210/S.767 for example. “OR” represents the Oriental section in the British Library, “8210” stands for Stein’s second expedition to Dunhuang, “S” refers to Aurel Stein and “767” is the number for that specific item. Searching by index values allows viewers to conduct very specific research for a particular artifact type, holding institution, or other options.

Many challenges and concerns emerged when developing the database. High-quality digitized images could not be permanently stored since the project required a great amount of space for any system to deliver without delays.¹⁷ The expense, time, and possible damage during the digitizing process had to be concerned. Ancient paper and other materials in Dunhuang collections are extremely vulnerable to light, which is inevitable in the photo digitizing process. Thus, the team carried out a more rigorous guideline for imaging of the artifacts to avoid possible damages. Since the collections are uploaded on websites, people are concerned about copyright protection. The technique to insert hidden encoding of messages into images solved this problem. The message will show up in the image reproduction, such as photocopying and compression.

ARGUMENTS FOR REPATRIATION AND WHY IT IS IMPORTANT

The IDP database not only offers people free online access to the Dunhuang collection, but could also reconstruct the cultural heritage on a digital platform and fulfill some roles as repatriation. Repatriation or restitution means the return of cultural materials or material heritage and human remains to their original cultural context or nation from museums, universities, or other institutions.¹⁸ Arguments for the repatriation of Dunhuang cultural relics have been going on for centuries. James Cuno, the president and CEO of the J. Paul Getty Trust, argues against repatriation, indicating that collections that are kept in museums and galleries outside China serve the purpose of education, disseminating knowledge, and eliminating ignorance.¹⁹ In the case of the Harvard Dunhuang collection, the Harvard Art Museum suggested that the removal of Buddhist sculptures and murals from the cave was to preserve the cultural relics. To better understand Asian art as fine art rather than material art, the Harvard Art Museum actively planned an expedition to China to require authentic artworks that could be used in establishing Oriental studies and Asian art history apartments. The art historian Landon Warner reached Dunhuang in 1924 when he decided not to only admire the cave himself, but to bring the murals back to school during his first expedition funded by Harvard.²⁰ Warner used a special chemical compound to remove murals from the wall; however, he unexpectedly broke the fresco and left marks on the site. Warner brought the murals back and displayed them in Fogg Museum until the museum renovation in 2008.²¹

Sanchita Balachandran, the associate director of the Johns Hopkins Archaeological Museum and Senior Lecturer in the Department of Near Eastern Studies, pointed out that the original intention of Langdon Warner's exploration of West China was to identify, excavate and collect antiquities for the western museums.²² She believed that although Warner was regarded as an "arrogant, opportunist, and insensitive creature hunter," he was deeply respectful of Dunhuang culture and relics and concerned for protecting and appreciating Dunhuang's antiquities.²³ Although Warner destroyed the sites and damaged the integrity of the original context in the name of preservation, his action called for the protection and examination of the Chinese government and scholars on Dunhuang Mogao culture.

Although there was no government official announcement asking Harvard to return Dunhuang objects, the Chinese State Administration of Cultural Heritage declared boycotting auctions of looted and stolen Chinese cultural objects and maintaining the right to restitute lost antiquities.²⁴ A professor from Guangdong Academy of Social Sciences, Zuozhen Liu explains why cultural relics, cultural heritage, and cultural identity are so important for Chinese people and the community and should be returned. Cultural relics are the symbol of China's long and continuous history, which plays an essential role in establishing Chinese cultural identity.²⁵ During the passage

of time and the changes of dynasties, abundant cultural relics which contained historical information were left for historians to interpret. In the case of Dunhuang manuscripts, a scholar of Dunhuang studies Rong Xinjiang stated that 'Dunhuang manuscripts had provided unprecedented insight for researchers on the history and civilization of China and the world.' Dunhuang manuscripts are valued for both their 'originality' and 'antiquity.'²⁶

Additionally, cultural relics represent Chinese culture which western scholars use the term 'culturalism' to distinguish Chinese civilization from others.²⁷ Chinese 'culturalism' consists of two parts: 'the belief that China was the only true civilization, and strict political adherence to Confucian principles.'²⁸ For Chinese people, the definition of being Chinese is to behave properly following the social norm and have a sense of belonging to this great civilization. Chinese art is used as an expression of social norms and as a document for social, political, economic, and religious events. Since cultural relics have a close relationship with Chinese history and culture, they are believed to be 'instrumental' to define Chinese cultural identity.²⁹ The repatriation of cultural relics that had been stolen or looted to their original context is believed to show respect to the culture.³⁰ The public of China felt offended and furious when they learned that numerous Chinese cultural relics were looted and scattered around the world. The cultural objects that were lost during war times remind the Chinese people of the bitter and tragic history of being defeated and treated unequally. The loss of cultural relics is parallel to the decline of the nation.³¹ The cultural objects are endowed with cultural values that can only have meaning in its original context. Chinese people are requiring the return of lost antiquities to heal their still bleeding wounds. To return Dunhuang Mogao relics is to show respect to Dunhuang culture. And by returning the looted objects, the broken trust between west and east could be fixed.³²

To prevent future controversies on the ownership of cultural property and future looting of cultural relics, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) implemented regulations on international museums that forbid importing or purchasing any piece that might have been illegally taken after November 17th, 1970.³³ However, the Tang dynasty murals and sculptures that were removed by Landon Warner before 1970 were not under the protection of the UNESCO convention, and the debate on whether the relics should or should not be repatriated was not settled. The repatriation would be undisputed from moral aspects if the acquisition was stolen or illegally obtained from an identified cultural group. However, as there is "no compulsory jurisdiction, no retroactivity of existing convention, the post-war settlement, and the principle of extinct prescription," the request for repatriation is nearly impossible to achieve.³⁴

Therefore, can digitization of the Dunhuang collections be a form of virtual repatriation when physical repatriation is not feasible? Helen Shenton, the Head of Collection Care at the British Museum in 2002, has written that digitization of

dispersed collections not only “enabled the reconstruction of cultural heritage but also vastly enhanced revelation of both the intellectual and physical elements of collections.”³⁵ By 2015, the IDP team had made 90% of all the collections digitized and made available online for the public. The IPD database unifies dispersed cultural relics in a virtual space and is freely available to people around the world. For lay people who would like to learn about Dunhuang culture, Buddhist scholars, and Chinese people who concern Dunhuang culture as part of their cultural identity, IDP is a handy platform to fulfill multiple roles. The database could be used as an educational tool for people who are interested in art, history, religion, etc., as James Cuno mentions, a tool to disseminate knowledge. Then a question arises: If the digital database, such as IDP, could be used to spread knowledge, could the cultural relics be returned to their original places?

Kate Hennessy, a Trudeau Scholar and doctoral candidate, explores the roles of new technologies in repatriating cultural heritage to originating communities. Museums digitized material culture in museum collections through photos and creating online databases.³⁶ The intangible cultural expression is documented via photographs, videos, and tape recordings into digital files. New technologies allow the originating communities to access images of objects, audio and video recording, texts documenting the material, cultural and linguistic history.³⁷ Visual access to the online collections and cultural heritage by the originating communities, according to Kate Hennessy, is known as “virtual repatriation.” The new media turned the analog of cultural heritage into digital form, facilitating the reconnection of cultural heritage documentation which was once not easily accessible. Also, Kate points out the transformation of cultural heritage from analog into digital form provides the opportunity for “participation in cultural engagement, creative engagement with new media, and forging new possibilities for participatory research and strengthening the relationship between researchers and the community.”³⁸

Since the IDP reunifies the scattered Dunhuang objects and pieces together the historical site, the virtual space, where most of the caves were scanned and digitized, could assimilate the physical space inside the Dunhuang caves. The digital form of the Dunhuang collection reconnects Dunhuang objects and offers an opportunity for the originating community to access and participate in cultural engagement. Chinese people, who are not able to physically visit the caves, can build connections with the site by seeing the collections and the caves remotely. They will get to know the history, aesthetic value, and cultural significance of the relics from the website. Together with the online database, the digital technology allows visitors to immerse themselves in the replica caves, preserve the agency of the caves and build connections between the site with Chinese people, as well as people throughout the world.

TECHNOLOGY IN DUNHUANG EXHIBITIONS

Modern technology, such as 3D printing, Virtual Reality (VR), and Augmented Reality (AR), helps to restore the original setting of the Dunhuang caves and maintain its agency. In May 2016, the J. Paul Getty Museum held a large-scale exhibition titled *Cave Temples of Dunhuang: Buddhist Art on the Silk Road*, commemorating the 25 years collaboration of the Getty and the Dunhuang Academy. The exhibition consisted of three replicated caves—Cave 275 (5th century), Cave 285 (6th century), and Cave 320 (8th century), two of which were made by Dunhuang replica cave maker and shipped from Dunhuang, a 3D visual experience of cave 43, and 43 objects from the Library Cave demonstration.³⁹

The Pure Land AR technology has been applied to exhibitions in Hong Kong International Art Fair 2012, NODEM 2012, and Shanghai Biennale 2012.⁴⁰ The implementation of Augmented Reality (AR) and spatial user interface allows the visitors to immerse themselves into the computer-generated historical site. Rather than being completely immersed in a synthetic world like a VR-created world, visitors enter a real space with synthetic elements constructed by AR. Digitizing the site not only protects the cave from mass tourism, but also enhances the accessibility of visiting the historical site. First of all, the digitization group scanned the cave and acquired the details and textures of the site. 3D models were made by analyzing raw data, captured by laser scanning. When exhibiting Cave 220, the exhibition walls, which shared the same size as the cave, were covered with “one-to-one scale prints of Cave 220’s wireframe polygonal mesh.”⁴¹ This provided the visitors with visual clues of which place to explore. Previously digitized high-solution images of wall paintings and sculptures were projected onto the polygonal mesh, constructing a 3D representation of the cave and sent to the handheld devices. The infrared camera captured the position and the orientation of the visitors. The computers sent out real-time images of the cave structure to the visitors’ tablet in real-time. If people placed the tablet in contact with the wall surface, the images would enlarge into 1:1 scale within the frame of the devices that reveals the finest details of the murals and sculptures.⁴²

The AR technology turned the passive learning experience into an interactive activity and gave the visitors a sense of investigating the real cave. It allows the visitors to reveal the details of the cave and artifacts which they cannot witness with bare eyes. The AR technology enables the exhibition to be displayed and installed at different locations at different times, thus freeing people from the limitations of the physical site’s accessibility.



<https://vimeo.com/70756977>

CONCLUSION

Today, more and more historical sites are being digitized and are opened to the public who have access to the internet. The International Dunhuang Project is a good example of creating a database for cultural heritage sites. Although IDP is a powerful and useful tool for Dunhuang specialists and researchers, it is not visually appealing and difficult to navigate for laypeople. The IDP homepage lacks images for highlighted artifacts and recommended research categories. If the viewers have no background knowledge of this topic, they are unlikely to know where to start their exploration. To attract more non-specialist viewers, the website should insert highlighted artworks, images, and clear navigation. Also, the database could connect or collaborate with Dunhuang exhibitions. People who visit the exhibitions could search online for more related objects and gain a better understanding of the holistic view of the collection. For the researchers and people who browse the online database, it is helpful to visit the exhibitions that offer an immersive experience of the cave and recreate the original setting for the collections. Therefore, the designer could add a section for links to Dunhuang exhibitions on the IDP page and mention the IDP online database at the exhibitions. By correlating the digitized collections with the physical exhibition space, the collections that have been long lost seem to find their way home. The implementation of modern technology, such as digitization and VR and AR, facilitates the understanding of Dunhuang culture and artifacts, as well as a new way of repatriation.

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Engaging the Public During a Worldwide Pandemic: A Critique of the Virtual Museum Tour

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When the COVID-19 pandemic hit in the spring of 2020, museums and historic sites were among the first institutions to close their doors to the public. According to the report generated by the International Council of Museums during the period between April 7th and May 7th, almost 95% of museums around the world had closed as of April 2020.¹ With no knowledge of when the world may return to a familiar sense of normality, museums faced an unprecedented challenge to overcome. While many museums had been experimenting with virtual tours and programming prior to the pandemic, the immediate shift to fully online engagement was a monumental moment that posed the unique obstacle to transfer almost all in-person engagement over to a virtual format. As people across the country simmered within a mutual sense of boredom and anxiety, many searched for a way to occupy themselves during the long days of isolation. For the curious learner and history buff alike, virtual museum tours became an increasingly popular pastime.

In this essay, I aim to explore one of the ways that museums shifted to engage their audience within the limits set by the COVID-19 pandemic — the virtual tour. Drawing from my own personal experience as a quarantined distance-learner, I will focus intently on multiple aspects of the virtual museum tour, including the relationship between the virtual museum and the in-person museum, the successes and shortcomings of this form of the museum experience and the implications of the

virtual museum on public engagement. In order to do this, I will look specifically at virtual tours offered by Ford's Theatre and George Washington's Mount Vernon, two very different tours that both highlight positive and negative aspects of the virtual museum experience.

The pandemic not only attracted a historic amount of traction on websites offering virtual tours, but the result of this immediate popularity forced museums and their programming teams to more closely examine the way they were virtually engaging their audiences. While in any "normal" period of time the virtual museum tour exists as an appendage or an added bonus to the physical space, it effectively became a complete replacement for the museum experience during the COVID-19 pandemic. With this in mind, it may not be completely reasonable to critically compare the virtual tour directly against the in-person experience. A virtual replica of a physical space will likely never be the same experience, so, to be fair, it should not be judged by the same parameters.

In order to evaluate the effectiveness, or lack thereof, of visitor engagement to virtual museums during the COVID-19 pandemic, it is important to begin by setting these parameters by which the virtual museum experience is to be analyzed. This study will focus more directly on the museum as both a source of casual entertainment as well as a space of knowledge transfer. The two often go hand-in-hand, as visitors are more likely to interact with and absorb information presented to them in an entertaining or amusing way. To apply the concept of immersive storytelling to the museum, we can consider the museum experience to be somewhat of a performance.² This element of storytelling can be seen within the Mount Vernon virtual tour through the videos available to watch within the different areas of the historic site.³ These videos feature a number of different historical reenactors (including Washington himself) as well as contemporary experts and Mount Vernon employees that add interest and context to the storyline of the historic site as a home, plantation, distillery, and more. Museums are effectively the storytellers of history; a place where visitors could go and immerse themselves into the stories of the people and places of the past. Given this, we can think of the effectiveness of the museum experience in terms of how well it has taken the visitor through its intended narrative or story. This can be measurable by looking at how well the visitor is engaged within the experience and how much and what information they ultimately take away from their exploration of the museum. It is important to note that interest and engagement looks different in every museum visitor, as certain methods of displaying information will work better for some people than others. Everyone has a unique way in which they absorb and learn new things, which speaks to the difficulty of creating a universally engaging virtual museum tour.

To begin by laying down a foundation of what exactly I am referring to, there are a number of different meanings to consider when we discuss the "virtual museum," from virtual programming and events held on platforms like Skype and Zoom, to pre-

recorded lectures and tours by museum professionals, and even to game-type activities held on the museum's website. For this essay, I will focus on the virtual museum tour that consists of the museum's physical space constructed out of a series of photos strung together to give the viewer the illusion of actually exploring within that space.

One of the most prevalent platforms that features a vast selection of virtual museum tours is Google Arts and Culture. Google Arts and Culture originally launched in 2011 under the name Google Art Project, and was created with the intent to make museum spaces and art pieces more accessible to a wider audience. Within the original format of the website, now also an App, users were able to virtually tour galleries from around the world, with the unique ability to zoom in on pieces of artwork featured at that museum. Contemporary advertisements and reviews of the website commonly mention this feature, often remarking on how captivating it was to be able to see the artists' brush strokes — an aspect of artwork that perhaps is unavailable in its in-person viewing counterpart.⁴ The original launch included material from seventeen partner museums, all of which were highly successful and well-known institutions from either Europe or the United States. For the most part, the general mission of Google Arts and Culture and the technologies behind virtual museum walk-throughs have stayed largely the same since their conception in 2011. The website does now offer a wider variety of interactives, ranging from games and "experiments" to selfie / photo filter opportunities where the user can "try on" a piece of artwork or find out which classical painting they look most similar to.

Google Arts and Culture utilizes the same technology used to create the Street View function on Google Maps. This 360° camera technology is not unique to Google, however, as there are a number of other privately owned companies utilizing this same concept of sticking together panoramic images to create a 3D simulated model of a museum space. One such company is Hullfilms, created by Brandon Hull and currently operating out of Idaho.⁵ Hullfilms, in contrast to many of the virtual tours offered on Google Arts & Culture, does present coinciding captions and more user-friendly arrows within their tours. For example, their virtual tour of George Washington's Mount Vernon was notably engaging to myself as a casual viewer, offering specialized videos and other interactives within different areas of the house.

When the first wave of COVID-19 shutdowns affected the United States in the spring of 2020, one of the most common articles I saw were pieces titled along the lines of: "Need something to do? Here's 5 museums you can visit from your couch." As someone who has always loved history and been interested in museum studies, I easily fell into the rabbit hole of virtual museum programming. The first virtual museum tour I was compelled to explore was Ford's Theatre, a historic site I visited years ago in person. This gave me a unique perspective on my virtual experience, having also previously visited the same space in-person. The virtual tour offered by

Ford's Theatre through Google Arts and Culture is unique in that it is presented as a virtual exhibit rather than simply a virtual tour.⁶ Instead of the visitor being able to freely explore the space like they would in many other virtual tours offered by Google Arts and Culture, Ford's Theatre has created a specific path that the visitor is taken on, similar to guided tour. This begins in the Theatre itself, moving onwards to the Petersen House where Lincoln ultimately died, and ending in the exhibit spaces that display artifacts from Lincoln's presidency and assassination. This curated path makes for a very effective storyline, as the visitor is taken chronologically through the events of the tragedy at Ford's Theatre. Each new page of the tour provides a short paragraph detailing the significance of the space, its role in Lincoln's assassination, and contemporary context on how museum and theater goers experience these spaces today.

Within each stop on the guided virtual tour of Ford's Theatre, the visitor is able to move throughout that space utilizing the aforementioned Google 360° degree camera technology. For spaces like the Theatre and the Petersen House, this is a particularly immersive and effective element, as it enables the visitor to feel almost as if they were actually there in that space. I would argue that this does not work as well within the exhibit spaces, however, as the exhibits themselves tend to get slightly distorted in image and difficult to read. I found myself struggling to read most of the text on the walls, and I similarly struggled to position myself virtually to get a closer look at the artifacts that caught my eye within the museum. The tour does highlight a few key artifacts, such as the replica of Lincoln's funeral train car, mourning cards, and the gun carried by John Wilkes Booth through Virginia after he fled Ford's Theatre that night. However, I do wish the visitor was given more opportunities to engage with a larger number of the artifacts within the museum. I found myself frustrated that I could see certain pieces on display, but I wasn't able to read the captions associated with them or zoom in to get a closer look as I would be able to do in person. The exhibit space was also notably challenging to navigate, as the non-descriptive gray arrows that when clicked on lead the visitor to a different area of the space can be very confusing. This is a technical issue I noticed often within Google Arts and Culture virtual tours, and in my experience, I am often left going in circles and struggling to remember which direction I came from or was going towards.

In contrast to my confusion within the Ford's Theater tour, I found Hullfilms' tour of George Washington's Mount Vernon to be impressively easily to navigate with the addition of numerous opportunities for further engagement. One very simple yet incredibly effective element of this tour is seen within the arrows the visitor clicks on to move to a different space. When you hover over these arrows, text pops up with a description of the area that that arrows leads to. On the landing page of the virtual tour, the visitor is placed directly in the middle of the front lawn of Mount Vernon. From here, you can turn yourself 360° to begin by exploring all the different areas you have the option to go to next, for example, "To the Gardner's House," "To the

Kitchen,” or “To the Study.” Not only does this provide the visitor with a better idea of their virtual surroundings and what they can expect on their tour, but I would also argue that this element keeps the visitor more engaged and excited about their experience. Having an idea of the different rooms and areas of the site in the back of my head while exploring made me more enticed to continue on with the tour. While I was exploring this site, I additionally found myself particularly grateful for the location index on the left side of the screen, which allows the visitor to jump to different spots throughout Mount Vernon without back tracking or getting lost. These navigational elements of the Mount Vernon virtual tour are incredibly beneficial to the overall experience, and make for a much more seamless and enjoyable virtual exploration.

Another aspect of Hullfilms’ Mount Vernon tour that stands out as an excellent element of the virtual museum experience is the ability to click on specific objects and artifacts in order to get a closer look and learn more about them. As I mentioned earlier within the discussion of 360° camera technology within exhibit spaces, one of the most frustrating issues within the most of the virtual museum tours presented on Google Arts and Culture is the user’s inability to read the wall captions associated with the objects displayed in the space. Without this context applied to the objects the visitor is looking at, a significant part of the story is lost. We see this especially within history museums as we consider how meaning is assigned to otherwise ordinary objects. This problem is effectively solved within the Mount Vernon tour, as clicking on objects marked with a white circle will pop up a larger, clearer photo of the artifact along with a description of its significance, provenance, and specific connection to the context of George Washington and his home. Just in Washington’s study alone, the visitor is able to engage closer with artifacts like the iron chest that held 50% of Washington’s wealth, the portrait of Lawrence Washington, and my personal favorite — the fan chair that kept Washington cool during hot Virginia summers. Without the ability to click on these objects and read more about them, I would have passed them by without a second thought and missed out on some really fascinating information and stories.

Moving into the future, museums should continue to more intently acknowledge the barriers that may prevent people from coming in physically to their space and consider ways in which they can continue to engage with people from a distance. Museums are a space that ideally are meant for everyone and encouraging of the widest possible audience they can reach. The pandemic was a unique opportunity for museum professionals to critically examine how people who are unable to physically engage within the space can still experience the museum. This has implications even as we move past the era the COVID-19, as there will always be limitations that hinder in-person engagement. We will need to reassess the relationship between the in-person experience and virtual museum, so that they may more effectively co-exist

and actually compliment each other rather than existing as two separate entities from each other.

As I write this piece, the COVID-19 pandemic has persisted into yet another wave of cases across the world as the Delta variant continues to spread rapidly. It is impossible to say when the world might return the pre-2020 “normal” we were all so accustomed to. With this in mind, I think it may be time to accept that perhaps we will never return the way things once were, and instead of longing for that familiar sense of the past, we need to begin looking towards the future as an opportunity to apply all that we have learned throughout the past 18 months. This is especially true for museum professionals working within the engagement and programming sphere. As museums historically have shown us, the past can be a great indicator of what’s to come in the future, and as the pandemic has shown us, our world can be shaken up and turned on its head in a matter of days. Perhaps what is most important moving forward is the ability to adapt, persist, and consistently implement creative ideas and ways in which we can further engage the public. This is no simple task, and as we have seen through the examples of George Washington’s Mount Vernon and Ford’s Theatre, virtual tours can ultimately be an excellent opportunity to bring museums to visitors when outstanding circumstances prevent in-person engagement. I look forward to the ways future museum professionals continue to build upon the successes of the virtual museum as well as improve upon the areas that could make the virtual tour even better.

NOTES

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Gamifying Online Museum Experiences

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ONLINE EXPERIENCES UNDER THE NEW MUSEOLOGY FRAMEWORK

As 21st century museums attempt to shift into a more collaborative, inclusive, and socially responsible role, they must find creative storytelling techniques to connect and engage with diverse communities of visitors. Under the new museology framework, museums should transform their environments into spaces of encounter and experience using alternative learning pathways. Socialization, gamification, and virtualization have contributed to the new goal of museums as, “no longer just to build a large collection, but above all to formulate a story in collaboration with visitors and communities, moving away from exhibitions as collections of objects to a focus on the discourse constructed between exhibits, the museum space, and the visiting public”.¹ Within an era of increased access to internet and internet consumption, many current online museum experiences are underwhelming in comparison to the experiences of the physical visit. The lack of immersive content points to the common conception that digital experiences are secondary to experiences from a physical visit. Though it is not necessary to replicate the physical experience in a digital format, museums must consider their virtual community with equal rigor and provide other opportunities of engagement that are just as educational, entertaining, and memorable.

In her TEDx Talk presentation, social analyst Ashley Fell revealed the key to understanding effective communication is in the understanding of how the brain

works, more specifically how the brain responds to visuals. Fell believes that good stories are inherently visual because even without the use of pictures, our brain reconstructs a mental image when it has a narrative. Video games provide immediate visuals that encourage experiential learning through play. As education and programming shifts within the new museology framework, unconventional modes of learning continue to be introduced, one of which is gamification. Learning through games has proven to be an effective way of gaining knowledge and helps individuals develop problem-solving and decision-making skills.

This paper emphasizes the need for more immersive and engaging virtual content by 1) examining games as an alternative mode of learning and 2) exploring digital reality technologies to analyze how museums use video game design to increase user engagement within the digital environment. Additionally, a review of the Google Institute's Google Arts and Culture, along with my personal reflections, will be introduced to provide a case study on the gamification of virtual content in the cultural heritage sector.

While there are a variety of new digital technologies, Virtual Reality (VR) and 3D virtual environments are key innovations in video game development. Virtual Reality is defined as "an artificial environment which is experienced through sensory stimuli (such as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment".² In their book reviewing the potential of immersive technologies in educational, artistic, and museum environments, Guazzaroni and Pillai offer these general conclusions on the use of VR in learning environments; "virtual reality (i) supports peer cooperative learning, (ii) develops the ability of learners to solve problems and discover new concepts, (iii) increases student motivation, (iv) offers a high level of interaction, (v) enables learners to gain knowledge with less effort than traditional learning environments and (vi) virtual reality makes teaching processes more realistic and secure".³ As museums move forward, visitor experience, for both physical and virtual patrons, must be realigned and repositioned at the forefront of museums.

LEARNING THROUGH GAMES

The traditional in-person, lecturer-to-lectured method of communication and dissemination of information is no longer reflective of current societal needs. Nowadays, people depend on digital technology to provide them instant access to information yet even then, the content must be captivating or controversial enough to warrant persistent attention, priority, or commitment. The survival of museums and cultural heritage institutions in the postmodern era is dependent on various factors – one of which includes finding alternative ways to offer opportunities for connection, engagement, and continued learning for visitors who may never step

foot into the physical walls of an institution. As cultural interpreters and facilitators of knowledge, museums are charged with providing enriching virtual experiences in innovative ways such as through games.

Gamification involves incorporating user interaction and user interface with the language and dynamics a game.⁴ The Smithsonian Science Education Center offers two ways in which gamification can be defined. The first defines gamification as, “adopting the act of playing a video game into everyday use” whereas the other defines gamification as, “the act of using game elements to make non-games more enjoyable”.⁵ The definition of gamification within this study aligns more closely with the first definition, as it explores how video game design can be used to improve online content in education, art, and museum settings. Through the gamification of digital technologies, museums can offer experiential learning in more personalized ways.

Game-based learning influences many of the innate motivational aspects of play with common components of games; such as: rules, narrative, challenge, and interaction, for the purposes of formal and informal learning.⁶ Game-based learning also includes instructional components like learning objectives and outcomes to offer guidance to users in easily readable formats. The motivation for creating a game classifies video games into three categories: pure entertainment, games for learning, or serious games.⁷ Participation in serious games has been shown to help change attitudes and affect players' actions in the real-world.⁸ Museums can look to use these categories to develop games and manipulate the designs and content to coincide with their specific goals for the intended user – to teach, to entertain, or both. Research from Camps-Orteuta, Escolar, and López on how videogames can impact motivate visitor experience and improve visitor learning skills found that “visitor interest increases where museums provide gaming experiences” and, conversely, that people appreciate the inclusion of games in museum exhibits.⁹

Video games are a powerful and creative tool for storytelling that can help museum professionals connect with users far beyond their institutions' physical walls. They are naturally designed to be interactive thus “multiplying the possibilities of learning and exercising a potential of immersivity and attraction that other media just don't”.¹⁰ Because “the video game universe is not dictated by the laws of physics”, they provide unlimited possibilities for visual storytelling.¹¹ Video games are traditionally seen “as a passive escape from the surrounding reality and an entertainment that alienates the player making him forget the real world” when, in reality, they offer alternative ways to learn through experience without the innate fear of failing or ‘losing’.¹² Games are used to “increase the engagement through the use of a laboratory part... making learning less stressful and notional creating an atmosphere full of emotion thanks to a wise interweaving of actions, visual environments and sounds”.¹³ Studies show that games have positively changed our vision and approach to the world “favouring a greater understanding of the other and

stimulating the imagination".¹⁴ Games can transport the user into an environment "that is not dictated by the rules of society and physics but dictated by a specific sphere of rules", allowing museums to develop limitless worlds that encourage different connections and interpretations.¹⁵

Since its creation in 2011, Minecraft, the sandbox game which uses blocks of differing colors and textures to allow players to build anything to their desire, has gained increasing popularity, especially among museums and art galleries.¹⁶ In the article *How Museums Are Using Minecraft to Gamify Learning Experiences*, Manuel Charr asserts that by introducing user agency and enjoyment into the learning process, "museums can create a virtual world in which some of their key subject areas become explorable in way that is not possible in a bricks and mortar exhibition".¹⁷ The article introduces The Tate Gallery as an early advocate for Minecraft and presents Tate Worlds, an application that "provided 'maps' that presented virtual environments inspired by artworks from Tate's collection" to enable players to enjoy artwork in new and more entertaining ways".¹⁸ In this experiment, the "gamification of the user experience helped to ensure that Tate Worlds was no mere virtual gallery" but a space that could be used to "explore how some of the most significant artworks in their collection were made, what inspired the artists concerned and to understand some of the stories behind them".¹⁹ Tate Worlds combined art appreciation and art history with the fun of free-roaming and exploration, which serves as just one example of how effective gamifying digital experiences can be for cultural heritage institutions and visitors. In order to support continued and advanced learning through games, museums must remain updated on emerging digital media tools and, more importantly, adopt them early on in order to simultaneously evolve with these technologies.

EMERGING DIGITAL MEDIA TECHNOLOGIES AND REVIEW OF CURRENT CONTENT

Emerging digital media tools, such as Augmented Reality, Virtual Reality, 3D technologies, Artificial Intelligence and GPS tracking systems, provide new ways for museums to display exhibits and interact with physical and virtual audiences. The increase in implementation of multimedia and interactive techniques within physical exhibitions show that museums see value in digital media technology as a medium for storytelling. Why, then, are these applications less prevalent or severely limited within online spaces? Virtual exhibitions could easily serve as extensions or independent components of physical exhibitions; however, most of the content that's currently available appears like the traditional museum 'tombstone' text, offering little to no engagement beyond the basic and static information. In their discussion on the application of virtual reality technology in the Han Dynasty Haihunhou Ruins Museum, Liu Han and Yang Cui recount on how traditional museum displays are

“mostly in the form of written materials and pictures, and later in the form of documentaries” to emphasize that these long-established exhibition practices do not allow visitors to become fully immersed in the history nor “experience the stories behind cultural relics, or gain immersive feelings” from their visits.²⁰ Storytelling through video games is a way to respond to the lack of current online experiences and the oversaturation of information.

Perhaps the best example of both gamification and the use of VR and 3D technologies within a digital cultural heritage environment is *Google Arts and Culture*, a product of the Google Cultural Institute. The Google Cultural Institute prides itself in “building free tools and technologies for cultural organizations to showcase and share their cultural treasures and stories with a global audience online”.²¹ *Google Arts and Culture* operates as a non-profit initiative working in open collaboration with worldwide cultural institutions and artists with a mission “to preserve and bring the world’s art and culture online so it’s accessible to anyone, anywhere”.²² This platform exists as a mobile app and website, accessible to any user with a Google account. It currently supports “over 1,400 cultural institutions in 70 countries, more than 200,000 high-resolution digital images of original artworks, 7 million archival artifacts, over 1,800 Street View museum captures, and more than 3,000 online exhibitions curated by experts”, all existing under one website domain for “a single unified experience”.²³ *Google Arts and Culture* has partnered with a few notable museum and cultural heritage institutions, including The Met, MoMA, National Museum – New Dehli, The British Museum, Rijksmuseum, Tate Britain, and National Palace Museum, to provide interactive online experiences. The 1,611 experiences include projects that “push the boundaries of art, technology, design and culture”.²⁴ The platform provides a variety of readily made chrome extensions, camera filters, and audio modifiers that use Virtual Reality, Augmented Reality, and Artificial Intelligence technologies. The variety of options allow users to choose from an assortment of immersive project based on their motives.

The separate section dedicated to Games demonstrates Google’s recognition of play as a legitimate mode of learning. ‘Learn Through Play’ encourages learning the world of art and culture by providing user-friendly, noncompetitive short games ranging from virtual crossword puzzles and coloring books to trivia contests. The games are simplistic in nature, as they are, primarily, used to encourage engagement with art and culture while requiring little to no commitment, experience, or preexisting knowledge. For example, “What Came First” is a fine arts trivia game which prompts players to select between two artworks, or actual artists, that existed first while providing only generic details. The game rewards players for selecting the correct option with a point system that is based on not just accuracy but also how long the response time – the faster you answer, the more points you get. If players select the incorrect option, they do not receive any points and additionally lose one of the three ‘hearts’, which are assumed to represent a chance, also commonly referred to as

'life', in games. Once the game ends, either from the player correctly answering all questions or losing all their allowed attempts, a 'Game Timeline' consisting of all the artworks from the game is presented. Players have the option to exit the game or remain on the site and select any piece to learn even more. The art pieces are linked to *Google Arts and Culture's* comprehensive collections database which provides the bibliography of the artwork along with additional features such as Augmented Reality and Street View viewing. The added section of the timeline provides learning opportunities that continue outside of the game with a more catered focus on the experiences of the virtual visitor.

Since my introduction to this platform in 2019, I have yet to interact with all the experiences and games provided through the application. One of my first experiences using the app was to virtually visit museums that were too far from my physical reaches. As COVID-19 abruptly shifted our daily lives, this platform quickly took over as my only means of visiting museums and consuming cultural material. During my stay-home quarantine adventures, I explored additional experiences on the site and tested different games, virtual exhibitions, and 3D immersive galleries. *Google Arts and Culture* is a prime example of how digital technologies and video game design can be utilized to provide more immersive digital cultural heritage experiences. The uniqueness of the platform comes from its usability, not to mention that it also operates as a tool with readily available educational content for teachers to use inside and outside of their classrooms. These services allow and encourage creative freedom, unlocking an unlimited range of possibilities for producing and providing more engaging virtual content. As a user, I enjoy having control over my virtual experience based on my personal motives or interests. While not every experience from *Google Arts and Culture* includes a game or game objective, most incorporate some element of video game design like short tutorials, reward systems, and user customization. Google's gamification of online experiences, combined with the sheer absence of comparative online museum experiences, reiterates the importance of creative storytelling in digital environments.

GAMIFYING DIGITAL CONTENT FOR MUSEUMS

While museums of the past have been able to get away with targeting only the physical visitor, current and future institutions must start considering virtual members in equal breadth. The traditional way of exhibitions is "not conducive to the long-term cultural inheritance and modern development needs" in an era of rapid development and information technology.²⁵ The gamification of online museum content brings heritage closer to people "so that they can feel involved in a comfortable environment in order to exploit the potential of the place to stimulate a deeper cultural learning".²⁶ Customary exhibition methods must be updated to accurately reflect the current state of digital technology and to provide more

personal engagement between the museum and visitor. Without effective story-telling techniques, online experiences are limited to only virtual tours and collections databases. Museums of today must reexamine their services and ask themselves whether they are fulfilling their newly adopted roles within the new museology framework if they are failing to provide diverse methods for learning and interpretation.

The combination of emerging technologies and the gamification of education challenges memory and cultural institutions alike to reexamine how they connect with their community, and what types of communities they are reaching. The global pandemic has shown that now, more than ever, museums must challenge themselves to facilitate more enriching online connections and experiences. Immersive and entertaining content allows museums to share knowledge in innovative and artistic ways while also competing with other entertainment industries in the fierce competition over consumer leisure time. Games and the gamification of digital content enables more interactive and entertaining experiences, that are a refreshing contrast to the static museum content that has long been a low priority to museum practitioners. Enhancing online content to provide immersive, self-motivated, and entertaining experiences increases a museum's visibility, accessibility, and fosters a deeper and more personal connection with the virtual visitor.

NOTES

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Apps and Autism: Mobile Applications Creating Accessibility in Museums

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For many decades museums have had to grapple with the questions of how to make their exhibition spaces accessible for all people. The 1990 passage of The Americans with Disabilities Act (ADA) pushed museums to become more accessible for individuals regardless of their physical circumstance. However, not all disabilities are physical. In order for museums to successfully create meaningful experiences for all visitors, they must consider the diversity of their visitors, including those who are neuro-divergent.

For many families visiting a museum is a fun and exciting time. For other families, especially those who have children with autism, visiting museums can pose a special set of challenges. The difficulties can range from sensory overloads, due to lights and sounds, to anxiety around a deviation from their daily routines. One tool that can be used to alleviate some of those difficulties is technology. Specifically, technology in the form of autism-focused museum apps developed by Infiniteach. This paper will offer an overview and review of the Infiniteach apps and consider their uses in supporting children who are neuro-divergent during their museum visits. Specifically, the Field Museum and the Shedd Aquarium's autism-focused apps will be analyzed in order to consider how they may affect a user's museum experience.

WHAT IS AUTISM?

Autism or ASD is a neurological disorder that affects the development of a child's social skills, communicative competences, and can cause behavioral challenges.¹ By the time a child is two the signifying behaviors of ASD are generally apparent, though many children are not fully diagnosed until they are older.² The Centers for Disease Control and Prevention (CDC) reported on data from 2016 stating that approximately 1 in 54 or 1.85% of children living in the United States are diagnosed with ASD.³

ASD is not a one-size-fits-all disorder. Some individuals with ASD need very little assistance, whereas others may need a great deal of assistance in their day-to-day lives. Currently there is no single conclusive medical test that is able to diagnose ASD.⁴ Therefore, diagnoses rely on observed behaviors. According to the CDC, in order for a child to be diagnosed with ASD they must exhibit persistent deficits in all three of these social communication and interaction areas: social-emotional reciprocity (an individual's ability to engage in social interactions between two or more people), nonverbal communicative behaviors used for social interaction, and developing, maintaining, and understanding relationships.⁵ In addition to meeting all three of the social communication and interaction criteria, the child also has to exhibit at least two of the four following types of restricted (limited range of focus, interest, or activity), repetitive behaviors: stereotyped or repetitive motor movements, insistence on sameness or inflexible adherence to routines, highly restricted or fixated interests, or hyper/ hyporeactivity to sensory input or unusual interest in sensory aspects of the environment.⁶ The severity at which these traits may appear vary heavily from individual to individual.

CHALLENGES MUSEUMS POSE

Navigating new places can be tough for anyone, but it can pose a particular challenge for children with autism. According to the National Autistic Society, many children who have been diagnosed with ASD have a hard time adjusting to new environments outside of their daily routines.⁷ Additionally, not knowing what to expect at a museum may cause extra stress. Long lines and large crowds at exhibitions can also pose a challenge for a child with ASD.⁸ Another barrier that may be a challenge for children with ASD to visit museums are the sensory overloads that come from the changes in lighting and noise levels around the museum.⁹ While all of these challenges make visiting a museum difficult, technology may be able to help mitigate them.

INFINITEACH AND APPS

Infiniteach is a company that has embraced the unique challenge of creating museum apps that are catered to the needs of children with ASD. Each of the three co-founders of Infiniteach has a background in working with children who have been diagnosed with ASD. Two of the three are former Special Education teachers, while the third worked as an at home therapist for children with ASD.¹⁰ Due to their past experiences, the co-founders of Infiniteach understand the complex needs children with ASD have and are able to address some of them in their apps. Infiniteach focuses on creating apps that use evidence-based strategies to reduce anxiety and increase engagement.¹¹

The Infiniteach apps are located in both the Apple and Android app stores. It can be downloaded on an iPhone, iPad, and iPod touch, with an iOS 9.0 or later¹², along with an Android 5.0 or higher.¹³ Each app has been downloaded over 1000 times. On both platforms the app is rated for everyone. Although the app is geared towards the ease of use for children, it could also be a useful tool for adults with ASD. The intended use of the app is for children to be able to interact with it while in the museum, however, it also has features that are meant for the caregiver to operate, such as schedules and timers. The specific features of the app will be further discussed in detail in later sections.

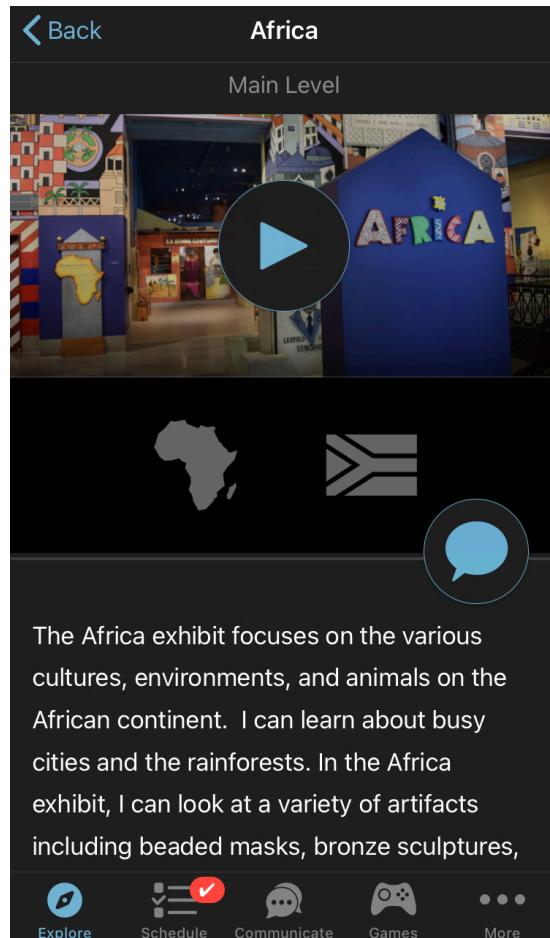
The apps that Infiniteach creates are particularly impressive considering most museum apps are mainly being used to help the visitor plan for their future visit to the museum by providing visitors with the basic information: what is in the exhibits, the museum's hours, the pricing of tickets, and possibly a special event.¹⁴ Another common use of museum apps is for visitors who are in the physical museum space to use as a map or sometimes even provide self-guided tours.¹⁵ While these uses of museum apps can be very helpful for some visitors, they are not designed specifically for children with ASD in mind.

CASE STUDIES

The Field Museum

The Field Museum's app by Infiniteach has four main features: the Explore page, the Schedule, the Communicate page, and the Sensory Friendly Map. The Explore page gives children with ASD the opportunity to access the information about each exhibit in the most effective way for them. The Explore page has several different options to provide children with ASD information about the exhibit, to enable each child the opportunity to access the information in the most personally effective way. The best way to understand the information may be by reading it themselves, having the app read it to them, or by watching a video. The information is all the same regardless of

the way the child chooses to access it. In the information section the phrases “I can” and “I might” are used throughout. These phrases help to build social narratives. Social narratives are defined as, “simple stories that visually represent social situations and appropriate social behaviors.”¹⁶



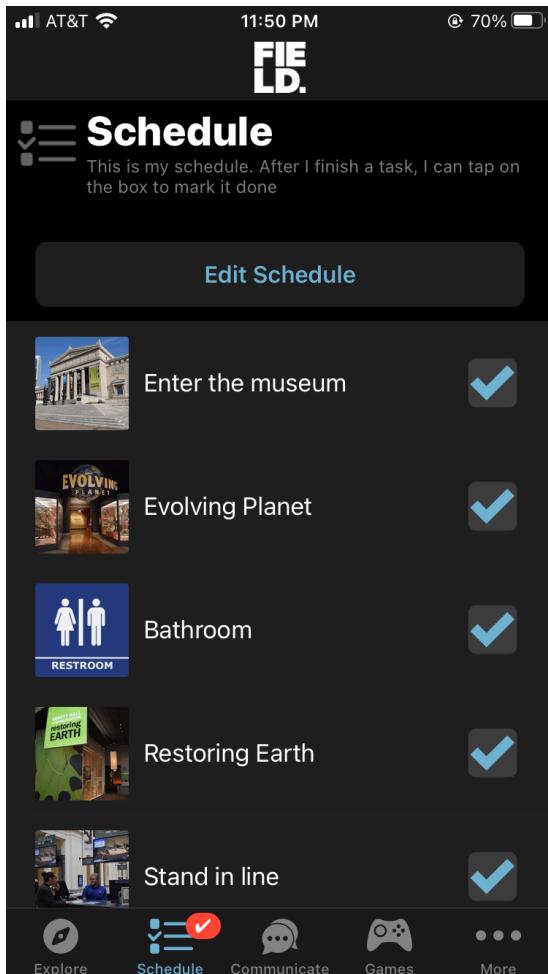
Screenshot of the Explore Page from the Field Museum App.

While social narratives have had mixed reviews in terms of effectiveness¹⁷, the National Professional Development Center on Autism Spectrum Disorder classifies the use of social narratives as an evidence-based practice.¹⁸ Social narratives are important because they illustrate socially acceptable behaviors, “The social narrative connects the important details of a setting or social situation to support the person with ASD in understanding the social context and in developing a new social skill.”¹⁹

There are normally five elements that make up a social narrative: the description of a situation, the perspective that describes a feeling or opinion, the directive such as "I can", the affirmative that provides reassurance, and the co-operative that describes other people's behavior.²⁰ For example, the information section for the Stanley Field Hall & Science Lab explains a social interaction that may occur in the museum, "In the Science Hub I can interact with a museum educator who can sometimes let me touch things."²¹ The use of social narratives in the app's information section may help a child with autism by presenting them with a situation they will face in the museum and positively affirming acceptable behaviors. Social narratives may also help children with autism that struggle with new environments, due to their insistence on sameness, become acclimated with the space they will visit before getting to the museum. This may allow for a less stressful experience when in the physical museum.

In addition to explaining the exhibit and the social situations that may arise, the app also describes the sensory levels in an exhibit space within the information section. For instance, at the end of the Stanley Field Hall & Science Lab information section it communicates the environment in the exhibit, "Stanley Field Hall is also usually busy with lots of people."²² The information section goes on to suggest places that are less populated to rest, "If I need a break from Stanley Field Hall, I can go into a quiet exhibit nearby, like the Hall of Mammals or the Hall of Birds."²³ This type of information may help children that struggle with a sensitivity to noise or who become overwhelmed in crowded areas to be better prepared for situations that make them feel uncomfortable. It also allows children with ASD the opportunity to completely opt out of going into that exhibit.

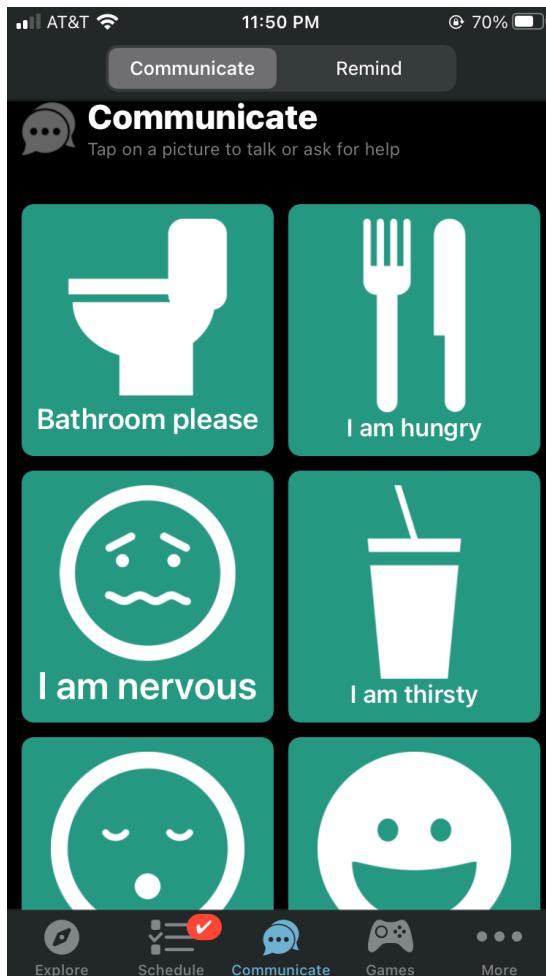
The Schedule section of the app gives caregivers the ability to tailor their museum experience to their child's interests and needs. On the Schedule page of the app, all of the exhibits in the museum are listed. The schedule even has the addition of a time to use the bathroom, eat, stand in line, go to the giftshop and finally leave. It also allows families the flexibility to add customized activities such as "take a family photo". For each of the items on the schedule there is a photo next to it, which helps create a visual schedule. Visual scheduling is defined as "a systematic technique that enhances learning and communication for individuals with ASD."²⁴ Visual schedules work to remind the child where they're supposed to be and what they are supposed to be doing.²⁵ It also creates a sense of predictability, because the child can see what will come next, which may help children that struggle with changes and transitions. This may lessen the anxiety of transitioning to the next activity. This is especially important in a museum setting because exhibits can vary greatly in their environments. Another feature to the schedule is an interactive element where after a task is completed a check mark can be added next to the task to signify its completion. This feature is useful because it shows what has already been accomplished and what is still left to do. This is another element that could reduce the uncertainty that a child with ASD may feel when visiting a museum.



Screenshot of the Schedule Page from the Field Museum App.

On the Communicate page there are many different pictures that are associated with feelings or actions. When a picture is pressed the app will read aloud the button that was pressed. The buttons range from “bathroom please”, to “I like this place”. It also has a tab that serves as reminders such as, “wear my mask” and “hold my hand”. These features can be helpful for non-verbal children or for children who are feeling overwhelmed. When children with ASD start to feel overwhelmed they may have a meltdown, which is normal. A meltdown differs from a regular tantrum because meltdowns are not bad behavior but a response to an overwhelming situation.²⁶ Sometimes the result of a meltdown leads to a suppression of motor skills that may make it difficult for a child to express their needs. One of the ways to help a child with

ASD to communicate during a meltdown is through pictures. The app's communication feature could allow a child to express their emotions and feel more understood. This is particularly helpful for visiting a museum where there are a lot of people, lights, and sounds that may overwhelm them.



Screenshot of the Communicate Page from the Field Museum App.

Another tool on the app to help mitigate sensory overloads is the Sensory Friendly Map. The map has the layout of each floor of the museum with the exhibits labeled like a regular map. A key feature of the Sensory Friendly Map is that it has an array of symbols that represent different sources of stimuli. At the bottom of the map there is a map key explaining all of the different symbols, so it is easy to understand. The

symbols include different aspects of environmental changes such as areas that are loud, quiet, or that have bright lights. It also highlights locations where there are things that can be touched and places that have movement opportunities. The map allows children with ASD to know what the environment is like for each of the areas of the museum. It can help children know where good places to rest are or places to avoid, especially if they are already feeling overwhelmed. Having the sensory features on the maps can help families that have children with ASD plan a trip that will best suit their sensory needs.



Screenshot of the Sensory Friendly Map from the Field Museum App.

Shedd Aquarium

The Shedd Aquarium's autism-focused app is created by the same company as the Field Museum's app, Infiniteach. The apps are almost identical in their structure. The Shedd Aquarium app has the Explore page, the Schedule, a Tool page, and the Sensory Friendly Map. The core difference between the apps is that the Shedd Aquarium's app has an updated suite of features not seen on the app used by the Field Museum. For example, on the Schedule page there is a way for the caregiver to set a timer in the app for a specific section of the museum. The timer depicts a picture of the exhibition along with a visual representation of the time passing and the actual time left in numbers. The timer feature is a great addition because it allows children to know and see how much time they have left at each exhibit. This may cause less anxiety when transitioning to a new section of the museum because they can see how long until the activity they are currently doing ends and their next activity begins. This may allow children with ASD to feel less anxious and feel more in control of their situation.



Screenshot of the Schedule's timer feature from the Shedd Aquarium.

The other feature that was enhanced was the Communication page. In this app the Communications page is now housed under the Tools page. The Tools page also has a timer and reminders function. Following the pattern of the Field Museum's app, the Shedd Aquarium's Communication page is used by the child in order to communicate with the people around them (be that a parent, caregiver, teacher, or museum staff etc.). On the Shedd Aquarium's Communication page there are more options of things to communicate. The app breaks down different actions or emotions based on the exhibit. For example, for the Oceanarium exhibit there are buttons and pictures for, "When does the presentation start?", "look at the sea lion!", and "I can clap".²⁷ This version of the app has all of the communications from the Field Museum's app

but also allows the child to express more of their experiences in the museum and ask questions. The expansion of communicators can be helpful for children with ASD who struggle with expressing their experiences. It offers them an accessible way to engage with the museum around them and share their experiences with others.



Screenshot of the Sensory Friendly Map from the Shedd Aquarium.

BENEFITS/ LIMITATIONS

The Infiniteach autism-focused app has very thoughtfully addressed many of the stressors that a visit to a museum may cause a child with ASD. This app has the potential to lessen some of the anxieties of visiting a new place for the first time by

explaining what to expect in each of the exhibits. It also has the ability to not only help prepare the child for the museum, but also works as a great tool in the museum with the Communication page and Sensory Friendly Map. One of the limitations to the app is that autism is a wide spectrum, so a one size fits all approach may not be as beneficial to some individuals as it is to others. While the features may be very helpful for some children, for others they might be altogether unnecessary. An example of this is the Communication page. Though it is useful for children who cannot read, due to the pictures, it is most beneficial to children who are able to read. Another limitation of the Communication page, even for the updated Shedd Aquarium, is that it is very limited on what can be communicated. Additionally, a limitation of the app in general is that in order for it to be useful, potential users have to know that it exists, and be able to download the app. While the apps are available in both the Apple and Android app stores, it does exclude those who do not have a smartphone or smart devices.

CONCLUSION

Museums should be a place where every visitor feels comfortable and welcomed into the space. For some individuals, such as children with ASD, it may take more help for them to feel comfortable and welcomed. This is where technology, particularly the Infiniteach apps, may be used as a tool that can reduce some of the environmental stressors and anxieties that come with a museum visit. Not only can this app make navigating and learning about the museum more accessible to children (and individuals of all ages) with ASD, it also invites the user to engage with the museum space they are visiting. The Infiniteach app, though not the complete solution for all things in relation to accessibility for the neuro-divergent, has the potential to help children with ASD feel welcomed and included in museums.

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Crowdfunding the Museum: Fundraising for Museums in the Digital Age

Kate Rice, The George Washington University

In order to survive unexpected financial hardships (such as the pandemic, decline in federal support, and growing operational costs) museum development departments work hard to secure future funding to adequately serve their constituents and preserve histories.¹ Development departments tackle generating individual, foundation and corporate support for their institution. Routine development activities include monitoring grant opportunities, conducting research on target audiences and their giving patterns, and consistent transactions with potential and previous donors to build strong, long-lasting relationships.² However, in response to the increasing presence of digital technology, museum processes have shifted as tasks revolve around online grant applications, copious amounts of internet research, and membership database management. Additionally, museums have begun to consider new technologically enabled funding sources and approaches to fundraising such as crowdfunding. According to the American Alliance of Museums, crowdfunding is a form of microgiving (soliciting small amounts of money from a large group of donors) that “exploits the potential of social networking tools and distributed technology.”³ In the 2012 issue of TrendsWatch, the AAM published an article on crowdfunding and its applicability to museums, stating the process relies on relationships just like traditional philanthropy.⁴ While crowdfunding works by asking a multitude of individuals for small donations and museums usually focus on a few donors for large funds, it is a worthwhile strategy for development departments as it capitalizes on the philanthropic and personalized outreach the teams engage in daily.

This paper will utilize examples from Museum of Food and Drink, the Tesla Science Center, the Smithsonian's National Museum of American History, and the American Friends of the National Gallery of Denmark to consider the role of crowdfunding in a variety of museum projects. By providing greater understanding of crowdfunding, including its history and major platforms, and its effective projects within museums, I aim to promote crowdfunding's utility for the field while recommending strategies as the industry shifts to requiring a virtual presence for success.

Historically, entrepreneurs in America sought funding from friends and family, limiting their financial backing networks to their direct contacts. The rise of the internet vastly expanded opportunities for funding as microlending and peer-to-peer lending gained popularity. While microlending – the practice of loaning small amounts of money traditionally to entrepreneurs in rural places – existed before the internet, websites such as Kiva, launched in 2005, facilitated and popularized the practice. By providing pictures of the entrepreneur, a description of the loan and the terms of repayment, potential donors could invest in causes that aligned with their beliefs.⁵ Peer-to-peer lending follows a similar format, allowing individuals to submit funding requests.⁶ The limiting factor of small networks that plagued traditional friend-and-family offerings becomes null as people bond globally through social media. Not only does social media connect unlikely friends but it provides a platform for people to share causes they believe in.

The technical capacity for crowdfunding evolved as companies such as Indiegogo and Kickstarter provided platforms for people to launch campaigns and fund passion projects. However, until 2012, legal hurdles prevented institutions from taking advantage of this potential avenue for funding. Then, President Barack Obama signed the Jumpstart Our Business Startups Act (JOBS) Act that eased restrictions on businesses, allowing them to use general solicitation, specifically those approved by US Securities and Exchange Commission (SEC). By 2015 crowdfunding portals were legally approved for companies, including non-profits, to use to gain early-stage capital, offering opportunities for smaller donors.⁷ With the legal go-ahead, museums began using crowdfunding to supplement their fundraising strategies, engaging constituents around the world.

The three major types of crowdfunding are Project Crowdfunding, Accredited-Investor Crowdfunding (Title II), and Social Media Crowdfunding (Title III). Project Crowdfunding is when an individual or company asks for donations for an idea or project and provides a tangible return on their investment. Since this is not investing in a company itself, it is not regulated by the SEC.⁸ This is one of the more popular forms of crowdfunding, empowering creative people to test their products and find worldwide supporters. Accredited-Investor Crowdfunding (Title II Crowdfunding) permits entrepreneurs to sell securities if they were not raising \$1 million in a year and only allows accredited, rich investors (who could afford to lose their investments)

to take stake in the project. Allowing companies flexibility in their approach, Social Media or Equity Crowdfunding (Title III Crowdfunding) permits startups to offer securities to less affluent investors, but still people rich enough to afford losing their investments. Most museum campaigns use the Project Crowdfunding model, sometimes offering tangible gifts in return for capital support.

While a third party is not required for a successful crowdfunded project, their streamlined payment processes and communication platforms can aid development departments in their day-to-day work. Two of the main crowdfunding platforms are Kickstarter and Indiegogo.

In 2009, musician Perry Chan launched Kickstarter to help musicians and artists raise money for their creative projects. Understanding the financial burden of recording music and touring, Chan enabled fans to support their favorite artists in reaching their goals in return for a gift like a CD or t-shirt depending on the donation amount.⁹ Today, guided by the belief that art and creative expression are essential to a healthy and vibrant society, Kickstarter's mission is to "help bring creative projects to life."¹⁰ Directly connecting creators to their community, the company aims to empower people on creative endeavors, no matter their level of expertise. In 2015, Kickstarter became a Public Benefit Corporation- a for-profit company that equally weighs project effects on society and the shareholders. As of October 9th, 2021 29 million people had backed projects via Kickstarter, donating \$6.2 million. At this point, 209,533 projects have been successfully funded.¹¹

Founded by three friends who believed the internet could inspire innovation by bringing people together, Indiegogo aims to "empower people to unite around ideas that matter to them and together make those ideas come to life."¹² Since 2008, Indiegogo has hosted 800,000 projects from 235 countries, averaging around 19,000 campaigns launched monthly.¹³ Helping entrepreneurs unveil new products before they are largely public, Indiegogo pride themselves on hosting campaigns that are projected to become mainstream, involving backers in the creative process, often offering time-limited perks for early supporters. While Indiegogo empowers creative projects like Kickstarter, there is a heavier emphasis on technology and design.

CASE STUDIES

Museums have used crowdfunding for a wide array of institutional projects from purchasing physical spaces to covering exhibition costs to funding critical conservation. The following crowdfunding campaigns from the Museum of Food and Drink, the Tesla Science Center, the Smithsonian, and the American Friends of the National Gallery of Denmark suggest applications in a variety of museum projects, inform subsequent best practices from their successes and failures.

Tesla Science Center

In 2012, the nonprofit group the Tesla Science Center at Wardenclyffe, joined by the Oatmeal's Matthew Inman, introduced the Indiegogo campaign "Let's Build a Goddamn Tesla Museum" to raise money to buy back Wardenclyffe Tower, Nikola Tesla's old laboratory.¹⁴ Intending register the laboratory as a historic site and eventually build a museum, the group was trying to outbid a company planning to build a mall on the land. Trying to match a grant from New York State, the campaign set its goal for \$850k to purchase the property.¹⁵ "Let's Build a Goddamn Tesla Museum" reached its goal in six days, thus receiving the maximum grant from New York State as well. The Tesla Science Center at Wardenclyffe announced they purchased the laboratory site and were beginning their \$10 million fundraising project for the building of the museum.¹⁶

In this example, it is important to acknowledge the involvement of Inman as he provided significant visibility via his blog The Oatmeal. Along with hosting the Indiegogo campaign, Inman used his blog, which boasted "7 million unique visitors and 30 million page views", to invite small donors and encourage corporate sponsors.¹⁷ Inman even designed some of the perks for the campaign including the bumper sticker (\$33) and the Tesla Geek Booklet (\$333) which were exclusive to donors and not sold on his website otherwise.¹⁸ The top donation tier of \$33,333 offers a feature on TheOatmeal.com where Inman says, "When I link to things I have a tendency of crashing websites due to the massive storm of traffic, so getting featured here would be fantastic for your business."¹⁹

During the campaign the Tesla Science Center and Inman actively used the "Update" feature on Indiegogo to post short, Tweet-like announcements to their contributors. The most recent updates and comments revolve around missing rewards. In August 2021, user mikeshaffer who asks "Heyo - so did this museum ever get built or was this campaign a scam?"²⁰ Before this past August, no one had publicly interacted with the Indiegogo page since 2015 showing a lack of effort by the nonprofit and Inman to update constituents on the process post-funding.

Museum of Food and Drink

In 2013, the Museum of Food and Drink (MOFAD) began a Kickstarter campaign to support their first exhibition, "BOOM! The Puffing Gun and the Rise of Breakfast Cereal" before they found a physical museum location. Aiming to explain origins of the popular American treat, MOFAD wanted to create a mobile exhibition of a puffing gun (used to create aerated cereal like Rice Krispies) mounted on a flatbed trailer to bring scientific discovery around New York City.²¹ By displaying a puffing gun, MOFAD hoped to enlighten audiences on industrial food production and mass

marketing while providing a snack. Intending to avoid corporate sponsorship by specific cereal brands and allow free visitation, MOFAD set its Kickstarter goal for \$80,000 to purchase the trailer and ingredients to puff.

Similar to the Tesla Science Center's campaign, MOFAD offered an array of gifts for donors. The lowest donation of \$10 offered insider information and updates on the exhibit as well as MOFAD wallpapers for electronic devices. Higher level gifts presented donors with custom-made snacks by the puffing gun, admission to a NYC party with prominent chefs or having your name engraved on the exhibition's puffing gun.²²

Seventeen days after launching on Kickstarter, the Museum of Food and Drink announced the campaign reached its goal and planned to debut the exhibition the next month.²³ Additionally, MOFAD instated additional benchmarks where if met founder Dave Arnold would perform food dares such as being raw vegan or paleo for an entire week.²⁴ With the help of 830 backers, "Boom! Museum of Food and Drink's Explosive First Exhibit" raised \$106,503 by the end of its campaign period. Including funds raised outside of Kickstarter, the project earned over \$136,000- 170% of its launch goal.²⁵

Throughout and after the campaign's duration, the Museum of Food and Drink actively kept backers engaged through Kickstarter's 'Update' feature, posting a total of 12 updates in relation to this project. The posts give voice to the MOFAD team, personalizing the project and inviting contributors to participate in the exhibition's creative process in the comments while constantly offering thanks. In their second update, MOFAD states its excitement and appreciation before sharing articles that have discussed the campaign from sources such as Popular Science, Eater, and the New York Times. They also engage backers by providing a list of the snacks they are planning to puff first- peppercorns, coffee beans, and hot dogs to name a few- and asking for additional suggestions on twitter or in the comments.²⁶ Backers interact directly with the post and each other, postulating what puffing a garlic clove would result in. Subsequent updates revolve around the distribution of perks, information on the opening of the exhibition and the general success of the campaign, constantly thanking backers all the while.

The 'Comments' section provides donors a platform ask clarifying questions, but most members of the community have used it as a space to offer congratulations and their excitement about being a part of the Museum of Food and Drink's origin story.²⁷

The Smithsonian's Yoga Exhibition

While the Tesla Museum and the Museum of Food and Drink show the ways that new and emerging museums have used crowdfunding to seed their projects, established

museums have also used crowdfunding effectively. One of the earliest examples of museum crowdfunding took place in 2013 when the Smithsonian embarked on their first crowdfunding campaign for the Freer | Sackler's exhibition *Yoga: The Art of Transformation*. The world's premier exhibition on yogic art, *Yoga* brought together 130 artworks from around the world.²⁸ Though the Freer | Sackler is a federal institution where operation costs are covered by taxes, this project posed significant financial requirements for shipping and exhibiting (mounting, labeling, and lighting), influencing the launch of the "Together We're One" campaign. The staff decided to utilize its development department's fundraising efforts in an innovative approach by asking more constituents for smaller amounts of money rather than relying on companies for large donations.²⁹ Run through the museum's own site, donations would also fund public programs such as workshops and yoga classes for families as well as exhibition takeaway materials. The popularity of the subject matter helped: "Since so many people practice and are enthusiastic about yoga, we're choosing a format that allows everyone to get involved, not just those who have the means to make large donations."³⁰ By the end of the campaign, around 600 funders donated over \$170,000, making the Smithsonian's first crowdfunding project a success.³¹

The Smithsonian's Ruby Slippers

The Smithsonian's National Museum of American History launched its second Kickstarter facilitated crowdfunding campaign "Conserve Dorothy's RUBY SLIPPERS" with the goal of \$300,000 in October 2016. Having been on display for over 30 years, Dorothy's Slippers required immediate care and a new, environmental control display case before taking part in a 2018 exhibition on American pop culture.

The Smithsonian explains the original fast, process of movie prop creation which meant for items like Dorothy's Slippers "to last only for the brief duration of the shoot" rather than forever.³² With the funds from this campaign, conservators will work with scientists to "understand how [the materials] have changed and the consequences of their natural breakdown" in order to effectively build a display case stabilizes and preserves the shoes.³³ They also ensure that conservation will not change the slipper's appearance so that they can continue to show their history of being worn during filming.³⁴

In exchange for donations, contributors received a wide array of slipper-related gifts and experiences – some of which were designed by Tony award-winning Broadway costume designer William Ivey Long. Perks ranged from tote bags to exclusive experiences like tours, events, and lectures at the National Museum of American History. With each gift, the Smithsonian outlined how much of the contribution is tax deductible, providing the estimated value of the goods and services offered at each level.

On November 16, 2016, the project was funded successfully with 6,451 backers pledging \$349,026 in total.³⁵ Throughout the campaign process, the Smithsonian engaged followers with updates that featured objects from other Smithsonian museums that relate to Wizard of Oz.

Matisse Conservation

In November 2021, the American Friends of the National Gallery of Denmark (SMK) are seeking funding via Kickstarter to conserve a recently found Matisse painting Nymph and Faun so it can be featured in a 2022 Museum of Modern Art exhibition. Henry Matisse: The Red Studio reunites the paintings and sculptures present in the namesake work that showcases the artist's making space.³⁶ To provide essential care before shipment, SMK is requesting \$30,000 to fund this conservation.³⁷

The American Friends of SMK clearly outlines their treatment proposal for Nymph and Faun, informing donors on the specific care they are funding. The conservation required includes deliberate and careful cleaning to restore its original color, retouching previous amateur fixes, and stabilize fissures to prevent further damage. Donations will also support the reframing of Nymph and Faun in a micro-climate frame that would protect the piece from humidity and surrounding temperature changes.

As of October 28th, 2021 "Unique Matisse Painting in Need of Conservation Treatment" has received a total of \$9,763 from 33 backers, with 26 days remaining in the campaign.

CONCLUSION

An overarching theme between the five case studies is their urgent sense of purpose. For Tesla Science Center it was to outbid a corporation; MOFAD wanted to launch their museum, and NMAH and American Friends of SMK had to preserve unstable and influential pieces. This urgency works in tandem with the popularity of the campaign's topic (Tesla, snacks, the Wizard of Oz, and Matisse respectively) to create a dialogue about the campaign. Since these projects are housed on the internet, it allows museums to expand far "beyond board of director's network and [taps] into networks of all stakeholders."³⁸

Crowdfunding employs skills development departments utilize daily, making it a worthwhile strategy to engage in. Like traditional solicitation, crowdfunding involves consistent, clear communication, gifts in exchange for a donation (the good feeling from a charitable act or something like a tote bag), and the opportunity to be a part of a large project of personal interest at the ground level. Not only does it build on these existing practices, but it also helps expand museum communities, connecting

people based on their passions instead of focusing on geographic location. By facilitating crowdfunded projects, development departments reach a wider demographic of potential contributors, allowing the possibility for new members and loyal donors even if their base contributions are smaller than traditional corporate partners. From her own campaign experience with the Chabot Space & Science Center Melissa Russo speaks to the accessibility of crowdfunding stating, "The crowdfund model will not replace traditional fundraising practices of facet face cultivation and stewardship in soliciting major gifts from high net worth individuals. Yet, one of the great promises of crowdfunding is that it promotes philanthropy beyond the traditional wealthy donor, allowing for broader public awareness and inclusion in giving."³⁹

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Digital Dialogues About Human Evolution: A Case Study of Frequently Asked Questions (FAQs) Computers at the Smithsonian's Hall of Human Origins

NATURAL HISTORY MUSEUMS AND EVOLUTION

How should science museums handle doubt and alternative belief systems when curating scientific knowledge? The Hall of Human Origins exhibit in the Smithsonian Museum of Natural History (NMNH) has set out to explore some Frequently Asked Questions like these through their installation of various computers around the exhibit which ask visitors to engage with topics like religion, science, and methodologies. During the exhibit design process, the curation team made the decision to install two interactive Evolution Frequently Asked Questions (FAQs) computers to provide insight into the methods of paleoanthropological science and questions of how Human Evolution occurred. So, why is it that these particular khaki-colored unpretentious-looking computers were chosen to mediate questions between the research scientists and visitors?

At first glance, the nature of exhibits and education about evolution in America calls for meaningful engagement with visitors' questions and doubts about the science behind the exhibit.¹ The Evolution FAQ computers handle rather difficult questions

about methodologies and religion, and this investigation critically examines this digital engagement in public dialogue happening through these kiosks. The charmingly plain appearance of the computer interface complements the environmental and “natural” theme present throughout the exhibit.

Near the entrance to the Ocean Hall, the visitor encounters two khaki-colored computer monitors with matching metal keyboards. These Evolution FAQ computers ask hard-hitting questions like “Can the concept of evolution co-exist with religious faith?” and “How can we reduce the conflict between religion and science?”. Unlike other monitors and technologies in the hall, the FAQ computers have a touchscreen interface, stainless steel keyboard, and trackball mouse. Users are invited to choose from a variety of questions that ask the research scientists about their methodologies, the mechanisms of human evolution, and religion’s relationship with evolution.

Besides the categories of the frequently asked questions, visitors have the opportunity to “Ask your own question,” and can type their questions into the computer to be read by the exhibit educator later on. Some of these user-generated questions are used to modify and develop new FAQs and content. It is the technological choices behind the FAQs computer and the “ask your own question” feature that are central to this investigation. Why is this particular style of computer interface and public engagement present at the Human Origins exhibit? To what extent was this installation driven by the desire to install technology into the exhibit? How are alternative belief systems viewed and framed through the museum educators’ discussions and the exhibit itself? It is these questions about the technology and its style that are central to the investigation.

On Monday November 1st 2021, I met virtually with Dr. Briana Pobiner on Zoom to discuss the installation of the Evolution FAQs computers and the use of technology in the Hall of Human Origins exhibition. The goal of the interview was to understand how the Hall of Human Origins curation team perceives the use of technology in their exhibit. The Evolution FAQs computers allow for a dialogue between visitors and researchers on a public platform. In addition to questions about methodology, religion, and how humans evolved, users can ask their own questions to be viewed by the exhibit’s educator later on. The computer then notifies users that their questions can be posted on the computer and the exhibit’s website. Another aim of this interview was to trace the user’s question, observe how the question is answered, and analyze how visitor data is collected and used in the FAQ computer exhibit.

In 2007, Rick Potts - a paleoanthropologist who researches human prehistory - spearheaded the campaign to open a Human Evolution exhibit in the Smithsonian Museum of Natural History, which had been a goal of his since he joined the Smithsonian in 1985. When the exhibit opened in March of 2010, paleoanthropologists, geologists, and ecologists finally displayed a massive record of

fossil and artifact data from field sites linked to human evolution. It is commonly believed that a tension exists in the United States between religious believers and evolutionary scientists and the curation team consistently engages in meaningful discussions about philosophy and sensitive exhibit design. Core to this mission was the development of a Broader Social Impacts Committee, composed of individuals from all across the US who participate in these discussions to make the museum more inclusive and engaging to its diverse national audience. This effort emphasizes the Human Origins team's dedication to inclusivity and public engagement as it materializes in the design and phrasing of frequently asked questions. Research into the exhibit, the evolution education literature, and a conversation with Smithsonian research scientist and Human Origins education and outreach coordinator Dr. Briana Pobiner supports the idea that such values towards public education and the perceived contention of evolution education in the US are centered in the design of the Evolution FAQ computers. There is a lot to be discovered in the Smithsonian Hall of Human Origins, including digital interfaces where the user can better understand their own beliefs in reference to human evolution.

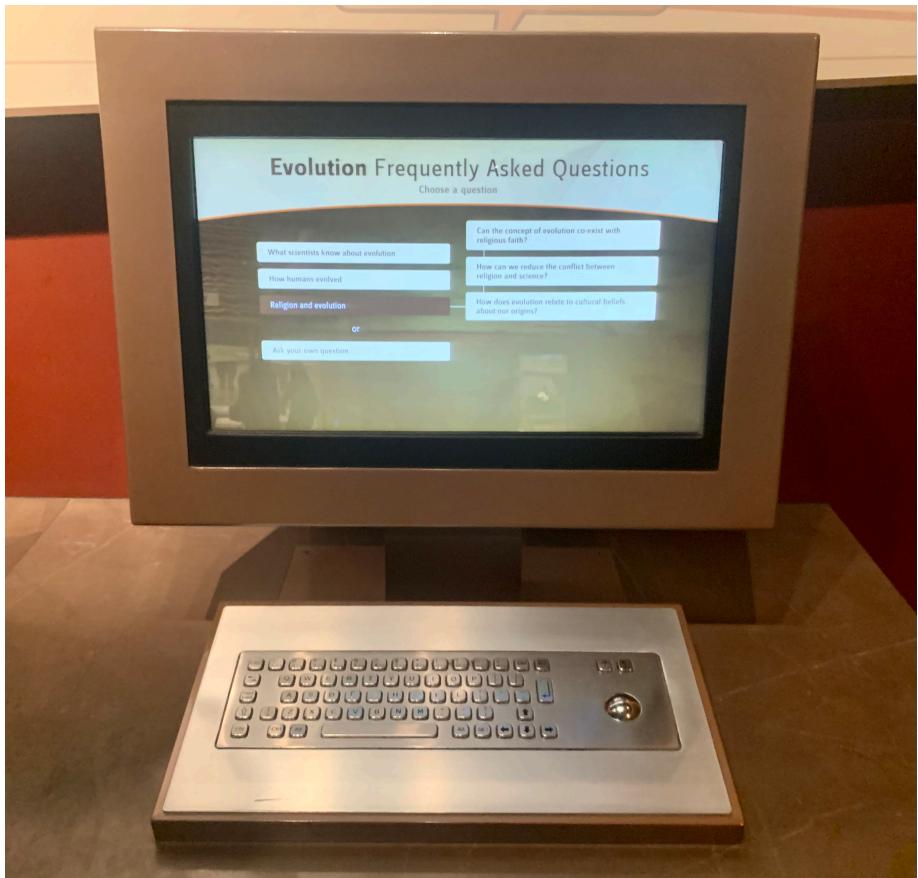


Figure 1: Evolution Frequently Asked Questions Computer

THE ROLE OF RELIGION AND TECHNOLOGY IN A HUMAN EVOLUTION EXHIBIT

The Smithsonian Museum of Natural History in Washington, DC is known for its interactive exhibits and public outreach programs. Public engagement series like HOT (Human Origins Today) Topics in Human Evolution and virtual seminars already open the exhibit to public dialogue and interaction. These events invite the public to learn and ask questions about developing topics in paleoanthropology and related fields. It is at these seminars where scholars engage with the public's questions as they pertain to the science-in-the-making being discussed.

In an editorial in *The American Biology Teacher*, Dr. Briana Pobiner writes about how she developed her lifelong love of paleoanthropology: “All of a sudden, science started to take on an entirely new meaning for me, because it was about ME. It was about the deep history and unity of ALL OF US.”² Human Evolution in this way is viewed to be inviting as a commonality and a uniting narrative. So, why is it that technology is included in an evolution exhibit where fossils, artifacts, and text are the primary sources of evidence? The Human Origins team believes that technology is a way to have visitors engaged with the material. The Hall of Human Origins is filled with screens for viewing content and there are various stations where visitors can generate their own content or play games. For example, the “morphing station” is an incredibly popular interactive where users can take a photo of themselves and the software will produce a merged image of the user and an image of a Neanderthal or Australopithecus, resulting in what the viewer would look like if they were a member of that species. The Hall of Human Origins is clearly designed to be contemplative and engaging, and this is evident through their dedication of several spaces to technology and artistic representations of the faces of ancient relatives. The Evolution FAQ computers follow this theme of visitor engagement and fit into the natural theme present across the exhibit displays.

There still exists a significant population of the US that still does not accept the conclusions of evolutionary science.³ Human Evolution is considered both a historical and biological science. Its research findings are starkly different from creationist origin stories and other narratives from religious communities. Gallup polls on the “Views of Origin of Human Beings” show that a large percentage of the American public believes that human beings were either created by a God and remain in the same form, or that God was the guiding agent of Human Evolution.

In a study that interviewed high school teachers about evolution education, it was found that teachers perceived the topic of evolution to be controversial, although none of the teachers were able to explain an event or known cause of this controversy.⁴ This discrepancy between evolution education and public acceptance of this science drives Dr. Pobiner’s work as a science educator and researcher. In 2016, she wrote about the obstacles and opportunities that exist when presenting evolutionary science that includes human beings. Here, it is shown that mistrust in science can be stimulated by these discussions, so an ethic of transparency is crucial to effectively teach the findings of human evolution research.⁵ Reflection and contemplation of both students’ and teachers’ beliefs are additional ways to create a comfortable environment to learn this type of science.⁶ Ultimately, respect towards educators and students’ beliefs is the best strategy to teach evolutionary science and avoid obstacles.⁷

In 2018, Pobiner and others found that including examples of human evolution in A.P. Biology curriculum has a positive impact on student understanding and acceptance

of evolutionary science.⁸ The Teaching Evolution through Human Examples (TEtHE) project used in that study includes several “mini-units” on topics like “the Evolution of Human Skin Color” and “Adaptation to Altitude and Malaria.”⁹ While the research design of this study of A.P. Biology students can not definitively show that these mini-units on human evolution positively impact test scores, it demonstrates that these curricula can be used to better engage students in evolutionary science with examples that are more relevant to them. This research into the public’s understanding and acceptance of evolution, I believe, is central to the construction and presentation of the Evolution FAQ computers.

The Smithsonian Museum of Natural History opened its exhibit on Human Evolution in 2010, a time when religious and scientific perspectives on human origins were still tough to reconcile in America. “Can the concept of evolution co-exist with religious faith?” is one of the questions asked by a computer interface to visitors during their walkthrough of the Human Origins exhibit, and the answer provided by the exhibit is a positive one. It was found that cultural sensitivity and the framing of questions is central to discussions about these frequently asked questions and the subsequent design and phraseology of the questions themselves. The process of evolutionary science-in-the-making is highlighted through the category of questions that focus on the researchers’ methods. Various implications of evolutionary science, specifically in reference to the individual’s personal conception of religion in relation to science, are carefully considered as these questions are drafted by a collaborative team. Finally, an analysis of the “ask your own question” feature reveals how this dialogue between the public and curators of Human Origins takes shape. Smithsonian privacy regulations prevent users from receiving individual answers to the questions submitted in this interactive from the exhibit team. However, the way in which these questions are transmitted to the Human Origins team still remains dialogic as these questions play a role in the amendment of current content and the creation of new content for the public.

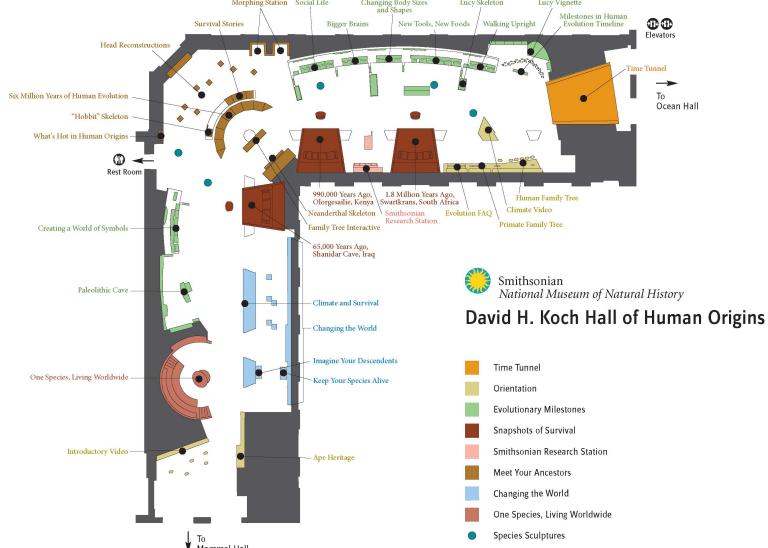


Figure 2: Map of The Hall of Human Origins

EVOLUTION FREQUENTLY ASKED QUESTIONS - ETHNOGRAPHIC DATA ABOUT THE DEVICE

The Evolution FAQ computers are purposefully tucked away near one of the entrances of the exhibit so that visitors can take a personal moment to reflect and ask questions. As mentioned previously, human evolution can be a difficult topic for visitors to grapple with because its implications can conflict with visitor's religious beliefs. The curatorial team directly targets these concerns through the Evolution FAQs computers. Dr. Pobiner and others on the team "don't believe you [the visitor] has to make a choice" in how science and religion reconcile in the individual's head. Rather, the Human Origins team welcomes everyone who wants to engage with the science and believes that transparency in the process of science knowledge-making should empower the visitor.

This sentiment of transparency is built into the modest, unembellished design of the computer and the frequently asked questions themselves. The sturdy design of the computer supports long-term use and a "if it ain't broke, don't fix it" mentality on behalf of the team. The Evolution FAQs computers have not undergone any hardware modifications since the exhibit opened back in 2010. Rather, only the questions and software have been updated periodically when new topics are introduced. All of the frequently asked questions presented in the kiosk undergo an iterative collaborative

process where questions are authored by the exhibit writer based on raw material provided by the curatorial team and then reviewed by the Broader Social Impact Committee. The FAQs are thoroughly reviewed by this committee to ensure that phrasing is not insensitive and does not exclude other cultures and their ways of understanding their own religion and beliefs. The goal of these frequently asked questions is to include visitors and their beliefs in the development of new content for the exhibit.

Transparency and showing “behind the curtain” to reveal the process of science is central to the message of the exhibit. For this reason, the first category of FAQs highlights the methods and questions that people may have about how researchers actually know what they know about evolution. Science, as Dr. Pobiner puts it, can be misunderstood as a mere “collection of facts” to be memorized. This is not how science is defined according to the exhibition team. Process here takes on two meanings: the process of science as an ongoing process of discovery, and evolution as a process of adaptation and change over time. These notions of process are integral to public outreach at the Hall of Human Origins. When asked how evolution can produce ‘complex’ organisms like human beings, the kiosk responds: “Modern humans are the product of evolutionary processes that go back more than 3.5 billion years, to the beginnings of life on Earth.” The process of developing ‘theory’ in science is also highlighted as an accumulation of evidence and consensus, rather than the common usage of the term which defines a theory as a ‘hunch’ or an inkling of suspicion. While the curatorial team believes that “evolution is the cornerstone of modern biology,” they remind the visitor of the ever-changing landscape of evolutionary science itself by stating: “scientists continue to investigate the details of how evolution occurred and to refine exactly what happened at different times.” Evolutionary science has broadened and changed since its development, and the “what do scientists know about evolution” series of FAQs highlights the ever-changing nature of scientific research.

One of the most misunderstood topics in human evolution research is the relationship between humans and monkeys. For this reason, it is not surprising that this particular question is included in the “how humans evolved” subset of FAQs. As mentioned, the Human Origins team is aware of how visitors internalize the implications of this research. They provide the explanation that humans, chimpanzees, and other primates share common ancestors. A shared ancestor 8-25 million years ago is much different than suggesting humans are direct descendants of “monkeys” (a category that is not even applicable to many of the species alive at that time).

Not only are visitors typically confused by the mechanisms of evolution, Dr. Pobiner notes, they are also concerned about the implications of what happens if they accept evolution. Sensitivity and careful phrasing are already central to content-creation at

the Human Origins exhibit, but such efforts of the collaborative question-writing process come out through the questions about religion and evolution. It is important to state that the museum has no intention of convincing or persuading visitors into accepting evolution, nor suggesting anyone should abandon belief systems. Rather, the museum uses the Evolution FAQs computers as the place in the exhibit where such sensitive topics are brought up and not ignored. The phrasing of questions and answers, Dr. Pobiner mentions, is an iterative process where multiple readers ensure cultural sensitivity and prevent the museum from imposing beliefs onto visitors.



Figure 3: The Broader Social Impact Committee meets to discuss the public understanding of evolution, religious understandings, and the message of public outreach

A fourth category of question allows for the user to “Ask their own question” to be read later by museum staff. Dr. Pobiner reveals that this feature serves a functional purpose to mediate the public’s questions when a volunteer is unable to answer. These computers allow the user to type in their own questions and the interface notifies the user their question could be posted on their website. These questions are downloaded from the kiosk every month and examined for common themes to use in generating new educational material or editing existing material. Another function described was to “blow off steam,” as users will sometimes input sarcastic or inauthentic questions. Such is expected in a museum exhibit where the theories are misunderstood or create an emotional response in the visitor. Another example of non-serious questions includes when certain users would say something like “my brother smells.” Dr. Pobiner and other Human Origins team members view such inputs as a natural byproduct of a national audience, many of which come in the form of large school or institutional groups. Another function of the computers that Dr.

Pobiner described is that the area surrounding computers can act as a space wherein the visitor can pause to reflect and investigate these questions if they are invested in the answers. It was mentioned that the devices are intentionally placed off to the side in an area where the visitor can feel out of the way to have their moment of contemplation. The inclusion of benches in the area near the computers supports the idea that visitors are meant to pause and reflect.

The sturdy design and “natural” color palette of the computer interface complements the rest of the exhibit which looks like the ecosystems of early human ancestors. The Evolution FAQ computer, the “What Does It Mean To Be Human?” computers, and the Morphing Station (Photo Booth) were all installed for the exhibit opening. The computer interface itself is a touchscreen software surrounded by a khaki blockish monitor and a stainless steel keyboard (see Figure 4). The high volume of visitors in the National Museum of Natural History requires the computer to be intentionally simplistic and sturdy. The inclusion of the keyboard ensures that more users can access the interface to type. While the morphing stations are the most popular areas of the exhibit, the spaces near the Evolution FAQs computers are supposed to be a similar contemplative space. The Human Origins team uses digital technology to engage the audience and form emotional connections with the exhibit material.

Frequently asked questions are collected from the kiosk every month and Dr. Pobiner looks for common themes across many questions. Due to Smithsonian privacy policy, the exhibit does not collect any visitor data besides the questions themselves. Even in the morphing photo booth station where visitors can email their portraits to themselves, the email data and addresses are never stored in Smithsonian databases. User data, in the case of the Evolution FAQs computer, is only made of questions and these common themes are used to update and add new information to existing content. While not every question gets answered individually, the Human Origins team makes an attempt to show they care and are listening through the Evolution FAQs computers. This deeper insight into the design and intentionality of the Evolution FAQ computers reveals how collaborative writing and sensitivity can produce this device that promotes public dialogue.

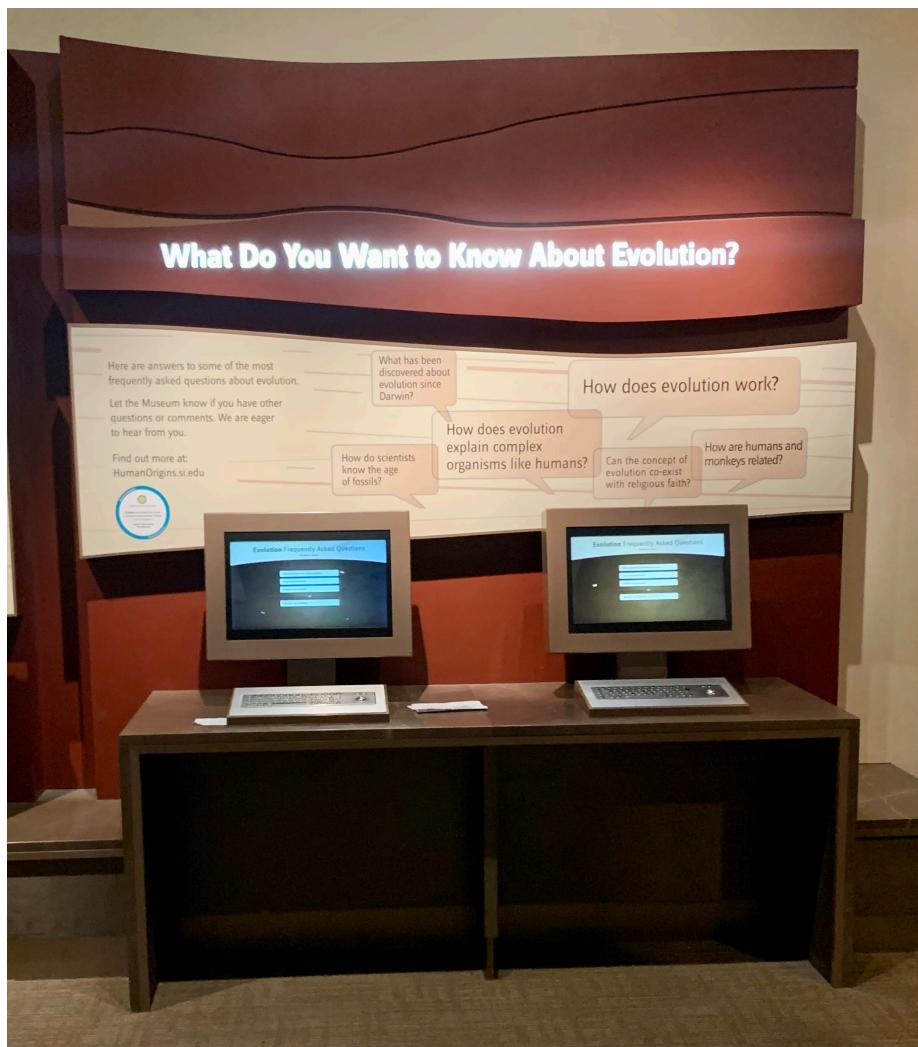


Figure 4: The Evolution Frequently Asked Questions exhibits, located near the Time Tunnel and Entrance by the Ocean Hall

CONCLUSION

The Smithsonian's Hall of Human Origins Evolution Frequently Asked Questions computers bring up rather sensitive topics in the hopes of clarifying common misconceptions about the exhibit and evolutionary science in general. While the public's understanding and acceptance of evolutionary science is increasing, an American audience was typically less interested in and receptive to evolutionary

science in the past¹⁰. Natural History museums are rethinking the use of digital technologies in exhibit design, and more interactive rhetoric like the FAQ computers are beginning to appear. The Evolution FAQ computers are analyzed here for their unique approach to mediating public concerns and questions about an already misunderstood topic in natural history. The “ask your own question” feature is an additional step taken by the Human Origins team to tune into public concerns and amend exhibit content from there. These computers are one of the few sites in the exhibit where topics related to methods and religion are presented. Many years later, the kiosk still remains as the mediator between the public, the curation team, and sensitive topics that challenge the exhibit’s knowledge.

Curious to see what is in the exhibit? Check out the Narrated Virtual Tour of the Hall of Human Origins below.

NOTES

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The Mutually Beneficial Relationship Between Influencers and Museums

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Throughout the last decade, as social media platforms have grown in prominence, a new kind of celebrity has emerged. The “social media influencer”, henceforth referred to as influencers, is a figure with a platform, who has the power to affect the decisions of their followers based off their number of followers they have gained and their relationship with these followers making them an asset for brands to collaborate with when trying to reach their marketing goals.¹ Social media influencers tend to have a distinct niche and have built a reputation for their knowledge in a specific subject. There are influencers at every scale including micro-influencers who have a follower base of 10,000-50,000 followers, macro-influencers who have a follower base of 500,000-1 million followers and mega influencers who have a follower base of over 1 million.² Nano influencers have recently gained recognition as being experts in their field despite only having a few thousand followers.³

With their visibility and connection with a defined audience, influencers have become attractive to brands and companies looking to capitalize on their popularity and influence. A brand deal occurs when a company hires an influencer to promote their label or a certain product by posting a picture with “#ad” or a swipe up link. The amount influencers get paid from the brand depends on the amount of followers they have while also accounting for engagement levels and different niches.⁴ Museums also use influencers as part of their social media and marketing strategies. Institutions collaborate with Instagram influencers by using the influencer’s specific

niche to strategically target the audience gaps within their museum. In this paper, I am going to discuss the relationship between social media influencers, specifically on Instagram, and museums, different marketing tactics and how they contribute to a museum, and how this relationship will continue to grow. I will argue that the relationship between social media influencers is a positive one and will only help the institution better their online platforms.

Museums constantly look for new ways to market themselves and target the public to attract more engagement with the museum, whether that be online or in person. One emerging method museums may use is working with social media influencers to help them strategize ways in which they can create content and help their platform grow. If museums want to engage with people under 30, 59% of individuals in the United States are active on Instagram.⁵ To meet their audience goals, museums then also need to be on Instagram. When creating content, there needs to be constant new innovative ways to draw in followers and stimulate their connection with the publics. When deciding to work with an influencer, museums must consider a range of factors, including mission alignment, and target audience. Museums can search for relevant influencers by posting on platforms such as Tribe⁶ or Takumi⁷ which connect institutions with influencers, post online about their search, or reach out to an influencer directly. Different types of institutions such as art, history or children's museums may want to search for different influencers that fit specifically with their message. Each influencer has a niche of followers related to a particular institutions wants and needs. Because many influencers are influential within a particular niche, museums may seek to work with influencers on a specific exhibition or project. After an institution discovers the influencer they want to hire, it is important to set clear expectations so both parties are aware of the full aspect of the job. It is also important to keep a transparent and communicative relationship so both parties will benefit.⁸

Although Instagram was first launched in October of 2010, many museums did not join the platform right away. The Metropolitan Museum of Art began setting up their Instagram account in Spring of 2013 and immediately after began working with a specific Instagram influencers brainstorming strategies. Instagram influencer Dave Krugman has helped institutions such as the Met as well as the Intrepid Air and Space Museum, and the New York Public Library discover their voice on the Instagram platform. From his then 50,000 followers (now 321K followers) he quickly saw the ability to reach thousands of people with the touch of a finger and knew he could help these institutions harness this power as well. After the Met first posted their instagram pictures in collaboration with Mr. Krugman, the account suddenly gained thousands of followers and traffic jumped significantly.⁹ Krugman worked with the Met's community manager to create the the hashtag #EmptyMet and Instameets. Instameets are gatherings of people "coming together to create, connect and share an experience through Instagram photography" which usually includes a behind the

scenes tour that normally isn't available for the general public.¹⁰ This strategy helped by Mr. Krugman not only led to the Met's instagram account to gain followers, but it drove foot traffic and buzz around exhibits as well. This relationship between Mr. Krugman and these institutions has proved beneficial for both parties. Due to his relationship with high profile museums, Mr. Krugman gained attention and more followers. More importantly, the institutions working with the cultural influencer create better marketing tactics and bring in substantial traffic to their social media platforms. Therefore, the relationship between the social media influencer and the museum can be highly beneficial to the institution. Mr. Krugman working with these institutions is a paramount example of influencer marketing, but is only the beginning.

In 2015 the Natural History Museum of Los Angles County and the La Brea Tar Pits and Museum launched a campaign called #HowDoYouMuseum using digital media to keep up the recent demand both institutions had been receiving as well as align these two museums that were separate. This campaign used celebrities such as Will Farrell and Instagram influencers that had thousands of followers. The influencers appeared in several videos created by both institutions where they shared their individual perspective of their visit to the museum hoping to inspire others to attend and create their own experience.¹¹ To launch this campaign, both institutions invited 50 influencers from a variety of niche's in the Los Angeles area to visit the museums and share their experiences using the hashtag #HowDoYouMuseum. Using influencer marketing, both museums "were able to generate more than three million video views and reach more than 2.3 million viewers who were able to see their UGC (User Generated Content) posts in just a matter of months."¹² From this point on, the institutions would continue to reach out to local influencers and invite them to the museum to continue to post on their platforms. This digital media would then be reposted on the museum websites and promoted through paid media. One example of ways in which the campaign worked with influencers was partnering with fashion influencer Tommy Lei. The campaign team conducted a photoshoot for an editorial series at the National History Museum of L.A. and used this shoot to highlight fashion aspects within the museum.¹³ In this example, the campaign targeted a specific audience the museum might otherwise be unable to reach.

The Children's Museum of Indianapolis uses a social influencer program that started in 2013 to connect with the community and build their brand. Since the program's inception, the institution has worked with over 200 influencers with a wide variety of niches for the museums different exhibitions.¹⁴ When the museum looks for influencers to work with, they focus on accounts that have any type of engaged following regardless of the number of followers. The museum focuses on the importance of building a strong relationship with the influencer, like with Indianapolis local blogger "The Queen of Free", by building a sense of loyalty and trustworthiness.¹⁵ The museum invites their connection of local and regional

influencers to events such as exhibit preview parties. This hosts not only as an insight to the exhibition but it also provides as a great networking event organically exciting influencers to post about the upcoming exhibit.¹⁶

In a more recent example, the Museum of History and Industry (MOHAI) in Seattle, Washington has a strong commitment to focus on collaboration with community partner organizations and has worked with influencers in the past as well. During their Seattle Style: Fashion/Function exhibit in 2019, the museum collaborated with Seattle based fashion exhibit Instagram influencer Sydney Mintle on a couple of public programs for the museum and also an influencer conference she held at the MOHAI. The goal of collaborating with Mintle was to learn from her knowledge of the local fashion industry, and to promote the exhibit through her connections and followers.¹⁷ This relationship came about through the Corporate Relations Manager when looking for contacts to support the upcoming exhibit and to participate in the exhibits Community Advisory Committee. In addition, the MOHAI convened the Community Advisory Committee that Sydney was a part of which helped MOHAI staff understand and connect to important issues and people in the local fashion scene, resulting in an extensive slate of public programming. The institution chose to work with Mintle because of her unique experience with multiple sides of the industry, including manufacturing, distribution, and promotion, as well as her specific interest in supporting a fashion exhibit. Mintle made important contributions to the content of MOHAI's public programs, and even spoke on one of the panels. She continues to mention MOHAI occasionally in her own social media posts. However, the influencers who attended her conference did not generate significant social media promotion of the museum.¹⁸

While MOHAI had this positive experience when working with an influencer, they did have a second involvement where the traction they wanted didn't quite kick off the ground. The museum contracted with two queer influencers in the Seattle area for an online campaign #ObjectsOfPride in June of 2021. The institution offered a small honorarium to the influencers to make a video that aligned with their mission of their #ObjectsOfPride campaign then post this video with a call to their followers to invite participation.¹⁹ Instead of coming from the museum's marketing team, their Public Programs team ran this project not having much experience working with influencers. The museum ended up paying two influencers who created posts in which the MOHAI was pleased with but ultimately the campaign never gained much traction.²⁰ This example shows that even if you do have a strong post aligning with a museums mission, the content from the influencer may not always gain popularity or bring in the traffic that you want it to.

Museums all over the world are using social media influencers to not only assist in creating content for their platform but to promote their institutions platform as well. Museums reach out to influencers whose audiences are most geared towards the

arts because their familiarity and experience in that department can help the institutions brand better. The influencers are invited to the museum where they then create and post content about their experience, spreading awareness to their followers and piquing interest in the exhibits. Institutions may reach out for an increase in visitors for a specific exhibit or overall attendance to the museum as well as becoming culturally knowledgeable on the subject of the post. Not only do they reach out for physical engagement within the institution, but for online traffic as well whether that be an increase in traffic of social media, blogs, or their online collections. Through these posts, followers of influencers are able to see parts of the overall collection or a certain exhibit and experience this directly from a visitor.²¹ In addition, museums work with Instagram influencers to improve their community engagement by using hashtags, creating a dialogue with Instagram users, and shouting out individual followers. Museums also reach out to niche influencers to collaborate in strategically filling the audience gaps they do not have the connections to. Before the craze of social media, museum goers visited for a number of reasons but now there is a rise in people feeling the desire to go through the influence of the internet.²² Frequently people are attracted to what others obtain and have experienced so the more we witness influencers in a museum space, followers will be more likely to visit as well.²³

There are several benefits to this recently-formed relationship between influencers and museum institutions. One positive is that influencer marketing targets one specific audience rather than trying to just reach everyone at once by working with niche accounts. This can help museums reach a niche audience in which they normally wouldn't have a strong relationship with. The influencer is able to post polls of questions or interact with their followers to better target their audience. In addition, research shows us that there is a potential that influencers posts will inspire people that may not be as interested in museums to go and visit.²⁴ Those who may have not had an interest in a show or certain exhibit may now be more inclined to visit after they see a post by an influencer they follow. In an interview conducted by the American Alliance of Museums with former Smithsonian National Museum of African American History and Culture manager of social media Lanae Spruce, she exemplifies that institution's are taking advantage of this instrumental relationship. Spruce states "Partnerships allow me to see those opportunities to expand our audiences, to expand narratives around the stories that they tell, and also to get new people engaged around cultural institutions who perhaps had never thought about it because they were never targeted for these spaces."²⁵ Social media professionals within the museum field are taking advantage of the power social media influencers yield within their platform and how beneficial this relationship can be. Within influencer marketing campaigns, there is a strong relationship that may develop between the museum marketing team and the influencer which can make the partnership last long term. The benefit for an influencer of this long term partnership includes driving up views, followers, and engagement on their platform resulting in

monetary value. A for the institution, this long lasting marketing relationship saves time, money, resources, and also helps to establish credibility.²⁶

In a study conducted by Erasmus University in Rotterdam, Femke van Leeuwen looks at how influencers can be beneficial to Dutch art museums marketing strategies. To find out if the followers of influencers are actually affected by the posts and drawn to go and visit, he looks into consumption research of both museums and the internet. There are three general motivations for individuals to want to have a cultural experience in a museum. They include “the intrinsic value of the art, one’s personal or group identity, and people’s social background.”²⁷

The study showed that the largest age group targeted by the influencers was between 18 to 29 and are reaching a larger younger audience through Instagram. This group has also stated to be visiting museums more post-pandemic which shows the importance of museum marketing towards a younger audience by these institutions. In this study, the demographics of the target audience of the culture influencer is mostly educated, female, white and has somewhat of an interest in the arts similar to those visiting a museum. Opposed to these similarities between the social media audience and museum audience, Instagram reaches a younger audience in comparison to those visiting an institution. The data received shows us that both posts coming from the institution and the influencer are utilized as informative and inspiring as well as that each group is influenced differently by the posts they see. The data also shows that more than half of the respondents learned something from the posts that the influencers created and the demand for those who prefer to follow an influencer rather than the institution’s increases due to the fact they visit art museums more often. Those influencers with a higher number of followers are seen as more authentic and therefore have more of an impact of getting people to visit a museum. Furthermore, it is found that influencer marketing can be used in getting attention to the institution as well as driving up visitor numbers because there is a large audience on Instagram that prefer to follow the influencer over the museum. This research conducted in the Netherlands is a primary example of museum’s affect by influencers and this type of influencer marketing can take place globally.

As the relationship between influencers and institutions continue to grow, we look towards the future with advancing technology. Since the shutdown of the world took place with COVID-19, museums have been having to turn to their online platforms more than ever to continue to engage audiences. Instagram specifically is one of the most popular platforms for influential engagement, and now TikTok has become another popular platform institutions can use to get their message across. Tik Tok which has been the most popular app ever created, was designed for sharing short videos that constantly are on loop reaching an audience of mostly 13-21 year olds.²⁸ The Metropolitan Museum of Art in New York was one of the first museums to launch their TikTok account.²⁹ In creating for this newly in-demand platform, museums have

the ability to hire influencers to collaborate with institutions' Social Media Managers in creating content. Not only can museums create accounts and post on TikTok, but individual influencers as well as institution accounts have the ability to post about certain exhibits or collections while making it appealing to a very young audience. The content within museums such as popular immersive experiences that are posted on social media from influencers can draw in a crowd as well. With the growth social media has taken throughout the last decade, museums and influencers relationship will only get stronger in the future. There will be more apps and new innovative ways to attract audiences, and institutions will continue to come to influencers for collaboration using their expertise.

Museums utilize social media influencers in a number of ways including hosting exclusive events, hiring the influencer to help create marketing strategies, and enlisting to create posts about a certain exhibition. Due to gaps in audiences within these institutions, museums look to Instagram influencers with a specific niche to reach these audiences as well as the community at large. Although there can be examples where influencer-museum campaigns do not reach the number people planned, the relationship between institutions and influencers is mutually beneficial. Due to the continuing growth in technology, museums now have an important digital role. With the help of niche social media influencers, institutions can better their museums platform as well as reach a larger number of potential visitors from the influencers creative content.

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Augmented Reality: An Edited View

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The relationship between museums and their audiences is rapidly evolving with the introduction of new digital landscapes. In this piece, I will be using the term digital landscapes to define any computer-generated element of an exhibition. Digital landscapes allow museum professionals to introduce ideas in creative new ways, either by adding to a pre-existing exhibition or by creating a new mode of exhibition altogether. In general, digital landscapes can be an extremely useful tool for adding additional context, helping the audience visualize, and producing a unique form of engagement; however, choosing the right digital platform to expand an idea can be a difficult decision. When making these considerations, it is important to choose a digital landscape that seamlessly integrates into the exhibition itself. With this framework in mind, museums should consider using augmented reality to create their digital landscapes, due to its flexibility in use and its potential for creating rich, complex histories.

Why augmented reality?

Augmented reality (AR) is the use of digital technology to superimpose a digital rendering on top of an image in real life, often using a smartphone camera. There are a lot of advantages to choosing to produce a digitally integrated exhibition with augmented reality, as opposed to a technology like virtual reality. Virtual reality (VR) uses a computer-generated simulation to depict or represent a three-dimensional environment, creating a totally immersive experience, often using specialized headgear or other equipment. Unlike VR, augmented reality is not a totally immersive

experience. Instead, augmented reality enables the viewer to compare the real-world object alongside an augmented version of it, layering the digital information over the physical. Compared to virtual reality, augmented reality is relatively more affordable and accessible. While one might still need access to a smart device to use augmented reality, for virtual reality a participant needs a specialized headset in addition to much more complex and expensive software.¹ Essentially, augmented reality allows an exhibition team to manipulate the digital landscape of an exhibit without requiring a whole digital world to be designed. As Matt Power and colleagues put it, “Though other technologies may perform the same function, rescaling in Augmented Reality systems provides the user a clear representation of spatial and temporal concepts as well as the extra advantage of contextualizing the relationship between the virtual object and the real-world environment.”² Other digital technologies, like virtual reality, just do not have the same advantages of being able to layer information on top of an already existing exhibit, making it generally less useful and accessible for the field as a whole.

Augmented reality can therefore be an important technology in the creation of digital experiential learning environments. Experiential learning is the process by which an individual learns by actively participating in an experience.³ Museums have a long history of creating experiential learning environments, such as lift-up panels or other hands-on experiences. While these techniques are useful, they are often limited to what can physically be done in the space. Physical techniques are also nearly impossible to personalize for the guest, as the environment remains the same from person to person. By creating a digital landscape, the audience has the opportunity to customize how they see and interpret the environment of the exhibition. Not only does this help to customize the experience to an individual’s needs, but it allows the participant to become a part of the experience, assisting with the learning process. While this can be done through a variety of different digital technologies, augmented reality has some clear advantages.

A study by Moorhouse and colleagues found that schoolchildren in a museum setting that had the opportunity to use augmented reality found an “increased engagement with the learning environment, evoked curiosity, personal achievement, and motivation to continue learning with AR,”⁴. Moreover, in another experiment done by Peter Sommerauer and Oliver Müller in 2014 on a mathematics exhibit, wherein participants were tested on their knowledge prior to the experience and again at the end, participants did significantly better on the questions related to the augmented parts of the exhibition. Of the 101 participants, they found that “62 participants gained more on questions related to augmented exhibits, 20 participants gained more on questions related to non-augmented exhibits, and 19 participants showed no difference.”⁵ This is just a small fraction of the research done on the interplay between augmented reality and education, the vast majority showing that when used appropriately, augmented reality is a powerful and helpful tool for the learning

process. By using this educational framework as a backing, augmented reality easily integrates into the museum setting as a form of experiential learning.

WHEN AUGMENTED REALITY WORKS

When designing an augmented reality experience, there are some lessons that can be learned from recent experiments in the field. For example, in the augmented reality system Mobile Augmented Reality Touring System (M.A.R.T.S) for Bayonne's Basque Museum, the team developed a comprehensive augmented reality system to test its usefulness and engagement in an art exhibition compared to other systems, like labels and audio-tours. They found that visual assets were very helpful to the users, pointing out elements they might have missed otherwise in the artifacts. However, the team also implemented a "virtual human," which was a digital avatar that gave narration similar to what you might find in an audio tour. Many visitors found this distracting and felt that they would have preferred audio tours in these instances.⁶ In this case, the successful elements pulled from the reference material to either point something specific out or manipulate the original artifact in order to give it more context. When a visual augmented reality element was added without expanding on the context of the original artifacts or source materials it interrupted the engagement of the user.

Augmented reality is also a powerful tool when working in less-than-pristine environments outside of the museum. In 2018, the National Portrait Gallery in London collaborated with several other institutions across the city to display art in the streets with their Art of London Augmented Gallery exhibit. In this case, curators designed a walking exhibit in the middle of London that presented rectangular outlines with a QR code. When passing bystanders took note and used the QR code, the rectangle was filled using augmented reality with a portrait of a famous Londoner.⁷ This use of augmented reality worked well for a variety of reasons. First, the National Portrait Gallery was enabled to engage with a variety of people they might not usually interact with, along with promoting the physical museums where these objects live. Secondly, they are protecting the physical artifact while developing high-quality renderings that allowed users to see the artwork outside of a museum context. Ultimately, this exhibition makes classic art accessible to a broader audience, and hopefully, encourages interest in people who might not have taken interest otherwise.

In a similar vein, in 2018 artist Alex Mayhew produced an augmented reality exhibition for the Art Gallery in Ontario called ReBlink. In this exhibition, he took classic pieces from the Canadian and European collections and reimaged them in the 21st century.⁸ In several instances of self-portraits, he added cell phones, making them into selfies. In another case, he added industrial smoke columns in the

background of a scenic farm landscape. The big idea behind this digital exhibition was to see how different and similar these historical figures are to us. The exhibition is an interesting example of the use of AR in a museum context. When interviewed by the Financial Post via email on launch day, Mayhew spoke in-depth about why using augmented reality to manipulate the viewers' context was important to him. Most museum guests will only observe a work of art for 16 seconds on average. To encourage his audience, in particular the younger generation, to slow down and fully absorb the pieces they were seeing, his use of augmented reality transformed the pieces, making them more relatable to a modern audience.⁹ This approach allows the artwork to be reframed in a modern context by bringing it into the digital era, while also helping the audience to relate to the artwork more, promoting a general interest in the stories of peoples past. Like many of the other exhibitions we have talked about above, this exhibition is also included in general admission, allowing more accessibility to digital technologies than what might be possible with something like virtual reality, which often comes with an additional charge or fee.

The integration of augmented reality is not just a phenomenon we are seeing in art museums; it is being integrated across the entire field. In cultural and heritage centers, augmented reality can be used in unique ways. For example, augmented reality can show a historical site through a variety of different time periods. This can help the audience to develop a stronger sense of place for a historical site, which can lead to more interest in local heritage.¹⁰ Science centers and natural history museums are also trying to integrate augmented reality into their exhibitions, to varying degrees of success. Because of the inherently visual nature of AR, art and culture Museums have a natural path to using augmented reality seamlessly. For artifacts like bone, lithics, and ceramics, other ways of approaching augmented reality that focus on reconstruction or movement are perhaps the most powerful tools. For example, the Smithsonian National Museum for Natural History's Bone Hall has an interactive augmented reality app called "Skin and Bone".¹¹ This app allows participants to see the skeletons side-by-side with a reconstructed version of themselves. This helps the participant see how the actual articulation of the skeleton creates the structure for these species. In addition, there have been several exhibitions attempted in science centers, however, because science centers tend to be hands-on, there can be concerns that the augmented reality systems takes away from the physical interaction element. As Steven Snyder and Karen Elinich wrote in 2010, "The gear, essentially, becomes the experience. And, the gear effectively forces the learner to learn alone – in contrast to the social learning goals associated with most science exhibits."¹² There is a point in which the digital augmented reality experience becomes the exhibit, not just a tool for it. When designing digitally integrated installations, a tool like augmented reality should be used to help facilitate the learning process across the exhibition, not become the main source of focus for the exhibition. Often, this can leave the exhibition feeling more like entertainment than it is educational.

Entertainment is not the antithesis of education, and exhibitions can strike a balance between the two. One exhibition in the National Museum of Singapore in conjunction with teamLab does this exponentially well. The ‘Story of the Forest’ is a digital art installation that features flora and fauna native to Singapore. A rotunda and hallway have been converted with massive digital monitors that encompass the space. As the viewer steps closer to the wall, different animals will come forward to interact. With the use of a smartphone app, participants use augmented reality to record the plants and animals they are interacting with on the monitors and to receive further information about that species.¹³ This exhibition is visually stunning while providing regional context with further information. This balance is done well, and it allows the participants to choose their own level of engagement without disrupting the whole.

HOW WE CAN EXPAND

As these digitally integrated exhibitions can be hard to plan and develop, one route for digitally integrating a museum might be to add context to a pre-existing exhibition. This usage can also be applied through an activist lens. For museums founded in colonial American history, this could mean breaking down the stories of “great men” and augmenting contextual information that helps depict their whole history, including practices like enslaving people. For sites of historical protest or of political unrest, augmented reality could be implemented to superimpose archival footage on top of these historical sites. This use might provide a deeper understanding for a wider variety of audiences, furthering the goal of making museums an inclusive and inviting place for everyone within our communities. The more we can include voices and perspectives typically left out of historical narratives, we will not only be engaging different, underrepresented parts of our communities, but we will allow those narratives to become authoritative actors in their own histories. Augmented reality should be a useful tool in this context, as it allows for multiple perspectives to be superimposed in one setting. As history continues to deviate from the traditional linear narrative, tools that allow multiple sets of information to be displayed will not only help with developing future exhibitions but also with revisiting current exhibits with a new lens. Without further research, the interplay between augmented reality and curatorial activism is relatively unknown but should be researched moving forward.

Of course, while augmented reality can be used to expand the context of new and pre-existing exhibits, it does require that participants opt-in to the experience. Without the information being readily available, participants may overlook the presence of a digital landscape within an exhibition, or they might not have access to the technology required to view the expand content. When designing augmented elements for an exhibition, the design team should be especially sensitive to the in-exhibition marketing done for the experience. With clear signage and instructions,

along with several reminders throughout the exhibit, the audience has a higher chance of being able to engage with the digital landscape. In addition, when adopting a digital landscape for an exhibition, museums should provide access to the technology required for participants who would not have access otherwise. By providing access to tablets or charging stations, along with providing the wireless connection necessary to run these digital landscapes, we can provide greater access while continuing to further our dive into digital landscapes.

Ultimately, augmented reality can enhance the learning experience by providing the user with an experiential addition to the exhibition. However, when applied unsuccessfully, augmented reality can distract from the exhibition and leave the user feeling like they lost part of the experience. Because augmented reality is so context dependent, the question remains; when should augmented reality be applied? In general, augmented reality is most useful when applied to visual mediums, either through manipulation or reconstruction, and when additional information is being conveyed, in a non-disruptive way. Augmented reality can also be incredibly useful when working in unique or experimental conditions, i.e., public streets. When deciding whether to develop an augmented reality asset in an exhibition, the design team should consider the purpose of its usage: Does it add additional context? Does it support the message of your exhibition? Does it engage the audience in a meaningful way? If the use of augmented reality meets these criteria, it is likely that it will be received well, and will help to guide guests in a more meaningful way.

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Uses of Technology in Exhibition Design: A Critical Analysis of Exhibits at The Planet Word Museum

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Before my first visit to the Planet Word Museum I had no idea what I was walking into. I knew that the museum was about language and I knew that it incorporated many interactive display methods, but I did not know how those methods would be incorporated into the exhibit designs. I was excited and hopeful that I was about to discover a unique museum experience. Planet Word did not let me down. Walking into the lobby felt different than any museum I have experienced before. The space is modern; bright and sleek, with accents of vivid color throughout. While some museums feel as if the threshold is a gate and to pass through you must be worthy of the knowledge held inside, Planet Word is inviting and open. As I made my way through the space, I noticed that this museum does not rely on the display of traditional physical artifacts. Every exhibit is about some aspect of language made tangible through a variety of technologies, brilliantly and creatively crafted to facilitate linguistic experiences.

Momentarily excluding practical uses such as audio tours or wayfinding so that we can focus on the exhibit design and not the organizational logistics, at Planet Word, there are two categories of incorporating technology into exhibition design which can describe any exhibit in the museum. These are not comprehensive to all technology in all exhibition design, but rather are useful lenses with which to discuss design of an exhibition in relation to visitor experience in this particular museum. The first is to

use the technology as the experience itself. This would be where the purpose of the exhibit is for the visitor to sensorily experience the technology; a projection or something on a screen, a soundscape played throughout the space, or lighting effects on a wall. The second is where the technology is used as a tool to facilitate or enhance an experience between people. There are many other motivations and intents behind incorporating technology into exhibition design, but every exhibit at Planet Word can at least be described in either of these two ways.

Where Do Words Come From?

Imagine a thousand words written out on a white piece of paper. Now imagine that piece of paper is thirty feet high. Words at the bottom of the page stand as high as your waist and get smaller as they go up until the top is barely legible. Now imagine these words are three dimensional, they pop out of the page, off the wall, as physical objects in the room. This is what it is to stand in the exhibit entitled *Where Do Words Come From?*. In the middle of the room is a row of benches behind a line of microphones. The room darkens, a voice plays over speakers, and the wall of words lights up through a series of projectors hanging above the benches. The projectors use light and shadow to highlight certain words at certain times and use colors and shapes to communicate ideas graphically. The voice through the speakers leads the visitor on an interactive journey through the history of language and particular linguistic devices. The voice asks questions and the flow of information changes based on the first word spoken by a visitor which is picked up by the microphone. At the beginning of the program the voice explains that some English words come from French, some from Germanic languages, and some from Latin. But there are many words in English that do not come from any of these three roots so the voice asks “But what about all those other words? Now it gets really interesting. Say one of these and I’ll show you.”¹ The structure of the rest of the program is determined by which word the microphone picks up first.



Word wall and microphone in the exhibit *Where do Words Come From?*

This exhibit falls under the category of technology as experience. The room is devoted to the projection on the wall and the visitor's role is to sit, experience, and engage with the color, light, and sound. To make this exhibit successful the designer is relying on some nonverbal cues, the instructions given by the voiceover, and the trust of the audience. Darkening the space and directing focus to a lit projection area creates the environment of a movie theater. Going to see a movie is a somewhat ritualistic experience. You enter the room and if the lights are on you know that you are allowed to keep talking, but as soon as the lights go out and the screen awakens you know to be quiet and pay attention. The mimicking a movie theater in the design of this space actively discourages interaction between visitors while the projection and voice are playing. As opposed to a movie theater, however, the verbal direction of the voiceover lets the visitor know that there is an expectation of interaction with the screen.

The first time I experienced this interaction I was convinced that the microphone in front of me was simply a prop and that the program wasn't actually listening to my voice and the voices of those around me. My second visit was highly informative. I

watched the projection and realized that it was slightly different than my first experience. In speaking with a staff member in the area, Charles, I learned that the program does, in fact, listen to the words spoken into the microphone. It picks up on the first word uttered within a certain time frame and changes the response based on that one word. The voice creates a dialogue between itself and the visitor. The call and response format creates a desire within the visitor to influence the technology in front of them. I wanted the computer to pick my word because I wanted to see how it would react to my choices. The success of this exhibit relies on the visitor's trust that they are not being tricked by the technology. It was frustrating to feel like the artificial voice wasn't listening and that the signal for me to respond was slow. There were times where I became frustrated with the exhibit which I'm sure was not the intent of the designer.

Unfortunately, the instructions from the voiceover on when to speak are a bit vague. "See these mics? They're for you. Any time you see this icon, it's your turn to talk. It's ok to talk at the same time, I'm listening."² Firstly, the voice assumes that you know you are sitting in front of a microphone. When most people think of a microphone they picture a rod with a bulbous end. The microphones for this exhibit are flat circles on a stand which could easily be mistaken for speakers rather than microphones. The only visual connection between the voice's instructions and the microphones is the icon used to indicate that the visitor should speak, a spinning rainbow of light. This icon is mirrored in the microphone itself which has a circle of rainbow light in the center which brightens when the same circle appears on the wall. Secondly, the voice tells you that talking over each other is acceptable and implies that it can hear everything that is said. In reality, it only hears the first word to be said at the correct time. Often the voice will instruct the visitor to pick a word or answer a question and then, a second later, the circle will appear. My friend had a tendency to start speaking as soon as the voice gave instructions rather than waiting for the light. He became very frustrated when his word was not picked. I noticed that this lag not only incited frustration, but additionally caused visitors to lose interest in the show presumably because they did not feel they were being listened to. Once I got the hang of the timing, though, the interaction with the projection became fun and interesting.

In some cases the program would react to a visitor's choice simply by responding to the word or changing the trajectory of the program, but other times the program's reaction was in the form of shapes or light that would show up on the wall. In attempting to explain onomatopoeia, the projector highlights a series of words on the wall: buzz, sizzle, pop, sprinkle, splat, and so on. The voice prompts you to shout out words and when it hears one a graphical representation is projected onto the appropriate word, almost as if the voice and the projection are attempting to reward the viewer's participation. I observed, in myself and on the faces of others, a sense of delight and empowerment in provoking a reaction from the technology in front of me. This feeling of joy in provoking response from technology would be mirrored in

further rooms and is, I believe, one of the reasons why touch screens and other types of interactive technology can be so captivating.

THE SPOKEN WORLD

The exhibit where I think this response and reward system is most evident is called The Spoken World. This room is large; with high ceilings and, unusually for a museum, tall windows all across one of the walls which let in sunlight. In the center of the room, suspended from the ceiling, is an enormous globe made out of hundreds of small, LED circles which are colored in just the right way to create the earth's continents out of light. Surrounding this globe, standing on the floor, are individual touch screens on stands. Each one has an image of a person from a different part of the world and a word in their native language. The ethnicity of the person on the screen correlates to its placement in the room compared to the globe. For example, standing in front of eastern Asia, the Pacific Islands, New Zealand, and Australia, I was presented with the image of a young South Korean woman.



Globe at the beginning of the South Korean video in *The Spoken World* exhibit.

She said hello in her language followed by a written prompt on the screen to repeat the word. When I touched the screen or spoke the word out loud the woman began teaching me a few phrases in South Korean and a few fun facts about sentence structure. When she was done, she said goodbye and an image of an older Maori man replaced her to repeat the process. I have not listened to every person in the exhibit, but I have experienced enough of them to know that there are about six or eight different languages per screen, they are grouped by geographic location, and the visitor has no control over which language will be shown next.

Periodically the person will stop and ask you to repeat a word or a phrase. About three quarters of the way through each video, after the most difficult word or phrase, the screen directs you to look up and the circular lights on the globe change their colors to create a short moving graphic relating to the word or phrase you just spoke.



Globe with the graphic from the South Korean video in *The Spoken World* exhibit.

The first time I experienced this, I was so surprised and excited that I practically yelled at the globe. I wanted to move to every single touch screen in the exhibit just to see what the lights would do for different words or phrases. Eventually my friends had to pull me away or we would have spent all day in that one room.

This exhibit falls into the category of digital technology as a tool to facilitate human interaction. Yes, the largest object in the room is the light up globe and yes, you are watching a film on a screen, but in my experience the result of the technological interaction in this space is to prompt a conversation within your group. This exhibit creates a short conversation with the recorded person across space and time rather than a one sided interaction with a digital reproduction of a person. On my first visit watching these videos sparked lots of debate about language or laughing together about how we were utterly unable to pronounce some of the words or phrases. My friends and I talked amongst ourselves through our entire time in this room and reveled in the graphic rewards together. Not providing headphones for this touch screen interaction turns the experience into a communal one. Other screens around the museum do have headphones and those exhibits create a very solitary experience. On my second visit to this space I was alone and I found the experience to be not nearly as enjoyable as it was with my friends. I listened to a few of the videos on the screens, but without others to talk with about the languages I quickly lost interest. If there had been more people in the space I could have, potentially, connected with strangers through the shared experience, but since the room was mostly empty I found myself feeling lonely and craving social interaction.

JOKING AROUND

Perhaps a more explicit example of an exhibit which facilitates human interaction is one which can be found in a room titled *Joking Around*. This room is bright like *The Spoken World* because it too has windows. Three stations of curved yellow couches facing each other fill the space. In front of each couch is a touch screen. Each screen shows a joke and challenges the viewer to make the person sitting across from them laugh. First to elicit five laughs wins the game.

This exhibit could achieve the same outcome without a single piece of digital technology, but the screens allow a number of things which an analog exhibit would not. First, a computer database can provide many more jokes than an analog space. Without using digital technology I would probably design this space as a wall with jokes written across it between the two couches so that friends could tell each other jokes without seeing the answers written on the wall. However, this would ultimately constrain the amount of space available for jokes. Second, the users can be placed opposite each other without a large barricade between them which is what would happen if previously mentioned wall were involved. Third, the computer can keep track of scoring so that the visitor only has to worry about being funny, and not counting how many times their friend has laughed. And fourth, as a bonus, there is potential for each visitor to experience that warm fuzzy feeling of delight when they get to press buttons on a touch screen. While there are some nice touches added by

the digital aspect of this exhibit, ultimately it is facilitating an interaction between human beings rather than an experience of digital spectacle.

WORD WORLDS

While many of the exhibits at Planet Word take on aspects of both categories I have described, an exhibit called Word Worlds falls plainly under the heading of digital spectacle. The room is much smaller than any I have examined so far and is an almost perfect cube. Three walls are covered in a seamless projection of a photo-realistically illustrated outdoor scene shifting from forest to grassy hills, a lake, and then into an urban setting. At about waist height is a counter with cylindrical cutouts spaced out along it. There are a few objects which look like a cross between a PlayStation controller and a paintbrush sitting in the cut outs. When you dip the controller into a cutout you hear a sound like a paintbrush being dipped into a can of paint. There is nothing to indicate that these are meant to be paint cans except the sound so on my first visit to this room I was very confused about what I was supposed to do. Each cutout has an adjective written out in the projection right above the cut out; corpuscular, magical, nocturnal, surreal, autumnal, verdant, and a few others. As you move the brush end of the controller along the wall it changes the style of illustration to match the word of choice. In this way the visitor can make a visual connection between a word and its meaning. When you brush the wall with the adjective 'Magical' colors become deeper and digital sparkles appear beneath your brush. As you move over the frog next to the pond he turns into a handsome prince, the airplane in the sky turns into a dragon, and the house in the woods turns into a fairytale castle.

This exhibit relies entirely upon digital technology instilling wonder and excitement in the mind of the visitor. However, the technology involved in this exhibit is projection mapping, combining a motion sensor with a projected image so that when a movement happens in a certain way it influenced the image, which is a notoriously finicky technology. On my first visit to this room something wasn't working properly. It may have been low batteries in the paintbrushes, it may have been a bug in the projection mapping code, the sensors may have been out of alignment; whatever the cause, when I dipped the paintbrush into the different word cutouts the brush did not change and when I moved it along the wall, the image did not line up properly with where I was moving. Not only was this frustrating, but because there is very little text in the room to instruct the visitor so I did not know what was supposed to be happening and therefore did not know what the problem was. Because I have some experience with the technology involved, I knew that something was not working the way it was supposed to, but the average person off the street does not necessarily know what projection mapping is and would probably have just thought that the exhibit was poorly designed. These types of digital spectacle exhibits can be

absolutely amazing when they function properly, but when something goes wrong it tends to go very wrong; they are high risk, but high reward.

SOMETHING FOR EVERYONE

Use of digital technology in museum exhibits can be risky, but that is true of any type of technology used in any space. Things break or need troubleshooting, but visitors understand that that can happen and, hopefully, are patient with the museum and don't let that ruin the experience. Overall, Planet Word does a phenomenal job of integrating digital experiences into their exhibits. Some are more successful than others, relying too heavily on specific technologies which may or may not work all the time. The most successful exhibits are the ones which use technology in combination with spatial design. The word wall is incredibly powerful because it uses physical space to create an atmosphere to facilitate the technological experience. Some of these exhibits fall flat simply because some people just don't enjoy digital experiences. But audience preference is present in a more traditional type of museum as well. Some people spend hours looking at one painting on a wall. Personally, I walk through a traditional art gallery in minutes, stopping at each piece for only a few seconds before moving on to the next. Planet Word has a variety of experiences even within the category of digital technology. I believe that there is something for everyone at this museum. Even if technology is not your favorite medium, I think everyone walking out of this space will be able to pick at least one exhibit that they enjoyed.

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Contributors

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Matt Lynch is a graduate student at George Washington University on the visitor experiences track. He hopes to eventually curate at a history museum or historic house/site. Before GW, he worked in non-profit marketing for five years and received his BA in History at Cornell University with a focus on the Near/Middle East.

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Madeline Mungo is a first-year Museum Studies student at George Washington University. Raised in small-town Texas, she received her B.A. in Liberal Arts concentrated in Art History and Museum Ethics from Sarah Lawrence College in Bronxville, NY, as well as spending a semester at the Institute of Archaeology through University College London in 2020. She has a particular interest in museum ethics and a long-held love of Ancient Egyptian and Near Eastern Art. Connect

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Megan Nguyễn



Megan Nguyễn is a first-year graduate student pursing a degree in Museum Studies at George Washington University, with a focus on Exhibition and Visitor Experience. She believes 21st century museums are spaces for continued learning, creative storytelling, human connection, and social justice. Megan commits herself to examining museology with equity at the forefront, and hopes to provide more engaging and inclusive experiences to the next generation of museum visitors.

Kate Rice



Kate Rice is a second year Museum Studies student at the George Washington University. With her concentration in Museum Management, Rice hopes to work in project management or development after graduation in May 2021. Rice has previously interned with the National Asian Art Museum and the George Washington University Museum and the Textile Museum.

Jake Sanford



Jake Sanford is a first-year Museum Studies student at George Washington University and is currently working on an upcoming exhibit at the National Museum of American History. He is 23 years old and focused on making sure that the museum of the future is a just and accessible space for all. He wants to thank Julia Beu, without whom this work would not exist, and the many experts whose diligent research helped him immensely in shaping this piece.

Norman Storer Corrada



Norman Raúl Storer Corrada (he/him/his) is a second-year Museum Studies master's student at the George Washington University. He is originally from San Juan, Puerto Rico. After graduating with a BA in Archaeology and Romance Languages & Literatures from Harvard University, he completed a Humanities Fellowship at Dumbarton Oaks and Smithsonian Folkways Recordings. He is currently a virtual museum teacher at Planet Word.

Hannah Stubee



Hannah Stubee is a first year Museum Studies masters student with a concentration in collections management at George Washington University. Originally a painter, she received a BA in Studio Art at Lewis & Clark College, where she gained an appreciation for the power of objects from a maker's perspective. Hannah went on to assist painting conservator, Nina Olsson, and transcribed oral histories for Vietnamese Portland. She currently works at George Washington University's Visual Resource Center.

Devon Valera



Devon Valera is a second year Museum Studies graduate student at George Washington University. She received her B.S. in Biopsychology from Tufts University in 2019. She is currently the Curatorial Assistant at the National Institute of Health's Office of NIH History and Stetten Museum as well as an intern with the Education and Outreach Department at the National Museum of Natural History. Passionate about science communication, she values institutions that center accessibility and community engagement.

Museum Studies at GWU

The *Master of Arts in Museum Studies* program at The George Washington University responds to the evolving museum profession by combining hands-on training with future-focused theoretical engagement. Students gain foundational knowledge about the state of museum work today, practical skills and the ability to critically engage with developments in the field. Our location in the nation's museum capital offers a unique opportunity to connect to national and global conversations at the cutting edge of museum practice.

Coursework offers both breadth and depth in *Collections Management, Museum Management, Exhibitions and Visitor Experience, and Public Engagement*. Our students come from a range of academic disciplines, from history and anthropology to art history and the natural sciences.

The MA program of study is flexible so students can personalize their academic experience to help accomplish their own goals. Our 36-credit program can be completed by full-time students in two academic years. Part-time study is also permitted, but the program must be completed in a maximum of four years.

PROGRAM REQUIREMENTS

All students complete:

- ◆ one core course entitled Museum Ethics & Values
- ◆ one internship
- ◆ five (5) courses as required in the selected concentration
- ◆

five (5) electives, which may be drawn from within Museum Studies (including a second internship) or from outside the program. Up to four (4) non-museum studies courses are permitted.

- ◆ a Museum Studies comprehensive exam in their concentration
- ◆ the graduate writing requirement
- ◆ an oral presentation related to their internship

Throughout the program, students work with an advisor to ensure that they will meet program requirements and their own career and educational goals.