

Technology in Museums: New Tools for Traditional Goals

By

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Table of Contents

Abstract.....	v
List of Figures and Tables.....	vi
Introduction.....	1
Chapter 1: Engagement.....	5
1.1 Paths to Engagement.....	6
1.2 Augmented Reality.....	7
1.3 Assumptions about Mobile Communication Devices.....	9
1.4 Fieldtrips.....	12
1.5 Shared Displays and Shared Listening.....	14
Chapter 2: Social-media.....	18
2.1 Social-media and Engagement.....	22
2.2 Marketing.....	23
2.3 Strategies.....	26
2.4 Caveats.....	34
Chapter 3: Museum Technology Now.....	36
3.1 Art Institute of Chicago.....	38
3.2 Museum of Fine Arts, St. Petersburg.....	40
3.3 The Andy Warhol Museum.....	44
3.4 Cleveland Museum of Art.....	45
3.4.1 ArtLens Gallery: Wall.....	46
3.4.2 ArtLens Application.....	46
3.4.3 ArtLens Gallery: Exhibition and Studio.....	49
Chapter 4: Recommendations for Museum Mobile Application Features.....	52
4.1 Features for Users.....	55
4.2 Education and Groups.....	59
4.3 Offsetting Costs.....	62
Conclusion.....	66
Figures and Tables.....	68
Appendix.....	94
Bibliography.....	96

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social-media, museums, Twitter, Instagram, mobile applications, engagement, museum mobile apps, museum mobile applications, museum apps, museum technology, augmented reality, virtual reality, art museums, museum learning, museum visitors, museum audio-guides, museum mobile guides, museum marketing, museum outreach, museum engagement, shared display, shared listening, social media marketing, ArtLens

Abstract

This thesis has examined the ways that museums might theoretically incorporate technology in addition to current technologies employed in museums. Analysis has been done on the ways that technology can be useful in engaging visitors who might come to museums alone, in a group, or as part school fieldtrips. The various uses of social-media are discussed, including social-media strategy recommendations for museums. Museum mobile applications are investigated and features for such applications have been analyzed for how they might benefit both museums and visitors.

List of Figures

- Figure 1.** A selfie taken in the Biography mirror at the National Gallery of Denmark. Michael Williams, “Being arty,” January 6, 2015, *Instagram*, <https://www.instagram.com/p/xg5cE6lJOB/?tagged=smkselfie>..... 68
- Figure 2.** A PowerPoint slide showing an example of a branded photographic opportunity at a museum for social-media sharing. Kerry Bellinger, “The Warhol: Polaroid Exhibition,” (Marketing Fundraising and Planned Giving, University of Michigan Flint, Flint, Michigan, December 2016.).....69
- Figure 3.** A Polaroid photograph with Andy Warhol’s stamp in the lower right corner. Andy Warhol, Mick Jagger, Study for ‘Love You Live’ Album Cover, 1977, unique Polaroid print, 4 1/4 x 3 3/8 in., private collection.....70
- Figure 4.** A screenshot of the sketchbook section of the MFA Viewpoint application. HD Interactive Inc, “MFA Viewpoint,” Google Play Store, vers. 1.1.9 (2017). <https://play.google.com/store/apps/details?id=com.hdinteractive.mfaviewpoint>.....71
- Figure 5.** A screenshot of the poetry section of the MFA Viewpoint application. HD Interactive Inc, “MFA Viewpoint,” Google Play Store, vers. 1.1.9 (2017). <https://play.google.com/store/apps/details?id=com.hdinteractive.mfaviewpoint>.....72
- Figure 6.** A screenshot of the poetry section of the MFA Viewpoint application. HD Interactive Inc, “MFA Viewpoint,” Google Play Store, vers. 1.1.9 (2017). <https://play.google.com/store/apps/details?id=com.hdinteractive.mfaviewpoint>.....73
- Figure 7.** A screenshot of the MFA Viewpoint application information for the painting *Julie as Flora, Roman Goddess of Flowers* (1799) by Elisabeth Vigée-Lebrun (1755-1842). HD Interactive Inc, “MFA Viewpoint,” Google Play Store, vers. 1.1.9 (2017). <https://play.google.com/store/apps/details?id=com.hdinthdintera.mfaviewpoint>.....74
- Figure 8.** Photograph of the digital display of *American Pictures* by Jacob Holdt. Inside the Museum of Fine Arts, St. Petersburg, Florida.....75
- Figure 9.** A photograph of the Interactive Amiga exhibit with a recovered digital artwork by Andy Warhol, on display at the Andy Warhol Museum, Pittsburgh, PA.....76
- Figure 10.** A photograph of the museum text for the Interactive Amiga exhibit on display at the Andy Warhol Museum, Pittsburgh, PA.....77
- Figure 11.** A photograph of early graphic software, a part of the Amiga exhibit on display at the Andy Warhol Museum, Pittsburgh, PA.....78

Figure 12. A photograph of an *Amiga World* magazine and floppy disks, a part of the Amiga exhibit on display at the Andy Warhol Museum, Pittsburgh, PA.....79

Figure 13. A photograph of Salvador Dalí’s (1904-1989) screentest being viewed at the Film and Video Gallery at the Andy Warhol Museum, Pittsburgh, PA.
Andy Warhol, *Screen Test: Salvador Dalí*, 1966, The Andy Warhol Museum, Pittsburgh.....80

Figure 14. A photograph of a visitor in the Film and Video Gallery at the Andy Warhol Museum, Pittsburgh, PA.....81

Figure 15. A photograph of the Film and Video Gallery at the Andy Warhol Museum, Pittsburgh, PA.....82

Figure 16. A screenshot of the Gallery section of the ArtLens application. The ArtLens Wall and Gallery are labeled in blue towards the bottom of the image. The museum galleries are located across a large atrium, towards the top of the image.
The Cleveland Museum of Art, “ArtLens,” Google Play Store, vers. 3.0.83 (2018).
<https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>
Dtdht.....83

Figure 17. A photograph of the 40-foot ArtLens Wall, at the Cleveland Museum of Art, Cleveland, Ohio.....84

Figure 18. A photograph of a visitor interacting with the 40-foot ArtLens Wall, at the Cleveland Museum of Art, Cleveland, Ohio.....85

Figure 19. A screenshot of the Map section of the ArtLens application.
The Cleveland Museum of Art, “ArtLens,” Google Play Store, vers. 3.0.83 (2018).
<https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>
Dtdht.....86

Figure 20. A photograph of the Aperature and ArtLens icons above the museum text for the painting *The Miracle of Saint James the Greater* by Noël-Nicolas Coypel on display at the Cleveland Museum of Art, Cleveland, Ohio.
Wall text, *The Miracle of Saint James the Greater*, Cleveland Museum of Art, Cleveland, January 26, 2018.....87

Figure 21. A screenshot of the augmented reality content in the ArtLens application overlaid on the painting *The Miracle of Saint James the Greater* by Noël-Nicolas Coypel on display at the Cleveland Museum of Art, Cleveland, Ohio. The circles and accompanying text can be selected for additional information.
The Cleveland Museum of Art, “ArtLens,” Google Play Store, vers. 3.0.83 (2018).
<https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>
dtdht.....88

Figure 22. A screenshot of the augmented reality content in the ArtLens application overlaid on the painting *The Miracle of Saint James the Greater* by Noël-Nicolas Coypel on display at the Cleveland Museum of Art, Cleveland, Ohio. This content is available by selecting the text “Saint James the Greater,” which is visible in Fig. 21.

The Cleveland Museum of Art, “ArtLens,” Google Play Store, vers. 3.0.83 (2018).

<https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>

Dtdht.....89

Figure 23. A photograph of a visitor interacting with the interactive digital pottery wheel in the ArtLens Gallery at the Cleveland Museum of Art, Cleveland, Ohio.....90

Figure 24. A photograph of a visitor interacting with the digital collage maker in the ArtLens Gallery at the Cleveland Museum of Art, Cleveland, Ohio.....91

Table 1. This table shows the 25 largest museums in the United States, if they have a mobile application available for Android and/or Apple devices, and the cost of the applications for users. The table shows that 48% of these museums have Android applications and 68% have Apple applications. Note that these applications are all free to download. This data was collected in June 2018.

Faith Chelangat, "The Largest Art Museums in the United States," WorldAtlas, August 14, 2017, accessed June 09, 2018,

<https://www.worldatlas.com/articles/the-largest-art-museums-in-the-united-states.ht>.....92

Table 2. This table gives a breakdown of available features on the mobile applications that I tested for this thesis.....93

Introduction

In 1996 Roger Bruce wrote an article for *Image* magazine titled, “Digital Photography-Liquifier of Museums?”¹ This was an alarmist title, no doubt, but Bruce was actually writing to assuage fears that technology, namely digital photography coupled with the internet, was going to drastically impact the landscape for museums. Though this article is over twenty years old and the internet was a vastly different place than it is today, Bruce made some startlingly accurate predictions.

New channels for distribution of information are rapidly transforming the social and cultural landscape. First the television and later the VCR have changed how people consume culture. This has led to a transformation of cinemas and a gravitation toward consumption of culture within personal environments where the user has more control over the time and pacing of their interaction with the culture. The widespread dissemination of networked digital information from the cultural arena is likely to have a similar effect on other forms of culture, moving them into personal spaces where the user asserts more control over pacing and over when interaction takes place.²

Does this sound familiar? This excerpt could be used to describe Netflix, Spotify, DVRs, YouTube, and television OnDemand. Cultural consumption is increasingly personalized and available when and where users wish to hear or view it. Netflix and Spotify both give users personalized recommendations based on shows, movies, or artists that they already like. Access to these services are almost always available on users’ mobile devices, making it easy to watch television and movies or to listen to music wherever one can access fast Wi-Fi. The internet has certainly impacted the way that audiences consume culture, but they are still consuming it.

Another insightful observation made by Bruce was that digital tools are “...more efficient replacements for older tools that supported traditional institutional tasks.”³ Some examples of

¹ Roger Bruce, “Digital Photography-Liquefier of Museums?” *Image* 39, no. 3/4 (1996): 10-17.

² Bruce, “Digital Photography,” 12.

³ Bruce, “Digital Photography,” 12.

this are digital files replacing paper files, audio-guides supporting docent tours, emails and websites replacing the need to call a museum for information or scheduling, and so on.⁴

Bruce went on to advise museum administrators of some precautions for instituting new technology. One relevant warning was to not use it for the wrong reasons, “employing the pure sizzle of interactive multimedia to secure visitors to Web site or gallery has demonstrated the capacity to be effective in engaging visitors without delivering any content of real value.”⁵ This is still a relevant warning today, and one that might make museums wary of embracing everything that technology can bring to the museum experience. This thesis will explore whether or not museums benefit from the use of digital technology to attract, engage, and educate visitors; at this point in the twenty-first century, museums are still grappling with these questions. Is it possible for museums to embrace technology and use it for engagement, education, promotion, and expanding reach- all without sacrificing “nutritious content?”⁶

Scholarship Review and Research Limitations

The first chapter of this thesis is indebted to previous research that has been conducted specifically on digital devices in museums. Karen Hughes and Gianna Moscardo’s studies on mobile communication devices were instrumental in dispelling the myth that devices are a distraction and hinder engagement.⁷ Studies conducted by Joel Lanir et al. exposed the challenge of devices in relation to groups of visitors: sharing a device contributes to group cohesion and facilitates interaction between groups of visitors, but visitors dislike sharing devices because they must forfeit individual agency.⁸ Finally, scholarship by Paul Aoki et al. and

⁴ Audio-guides certainly have not “replaced” docent tours, but they allow users to glean information at any time during a visit without needing to schedule around when a guided tour might take place. In this manner, they broaden the reach of educational components.

⁵ Bruce, “Digital Photography,” 14.

⁶ Bruce, “Digital Photography,” 14.

⁷ Karen Hughes and Gianna Moscardo, “Connecting with New Audiences: Exploring the Impact of Mobile Communication Devices on the Experiences of Young Adults in Museums,” *Visitor Studies* 20 no. 1 (2017): 33-55; Gianna Moscardo and Karen Hughes, “Museums Unplugged: Exploring the Impact of Removing Access to Mobile Communication Devices on Chinese Students’ Museum Experiences,” *Journal of Leisure Research* 48, no. 5 (2016): 395-412.

⁸ Joel Lanir et al., “Shared Mobile Displays: An Exploratory Study of their use in a Museum Setting,” *Personal and Ubiquitous Computing* 20, no. 4 (2016): 635-51; Joel Lanir et al., “Visualizing Museum Visitors’ Behavior: Where Do They Go and What Do They Do There?” *Personal and Ubiquitous Computing* 21, no. 2 (2017;2016): 313-26.

Rebecca Grinter et al. offered a solution to the problem of group cohesion versus individual control.⁹ Their digital interpretive device, *Sotto Voce*, allows for individual control while also limiting the isolating impact of traditional audio-guides. Because this is still an emerging area of research there are still gaps in the scholarship comparing newer digital technologies to traditional didactic methods. It is unclear whether digital technologies provide more learning and information retention and if visitors prefer these technologies to traditional museum learning resources, such as docent guided tours and wall texts.

The second chapter of this thesis explores previous scholarship on social-media and museums. Kylie Budge's research study illustrates how museum visitors' Instagram posts are an indicator of engagement with exhibitions.¹⁰ Iva Buljubašić, Marta Borić, and Ivana Hartmann Tolić's study provides evidence of the superior promotional value of social-media compared to more traditional channels.¹¹ Finally, the research conducted by Stacy Baker and Jonas Heide Smith gives valuable data and strategies for museums who wish to use Twitter and Instagram to their fullest potential for marketing and engagement purposes.¹² Much of the research related to social-media and museums has been conducted internationally and has not been tested regionally. It is unclear if the strategies that have been successfully employed abroad would have the same results in the United States, this would be a valuable area for future research to explore.

It should be acknowledged that the primary source material in this thesis is limited in several ways. In the third chapter, I will be using my own observations of museum visitors and

⁹ Paul Aoki et al., "Sotto Voce: Exploring the Interplay of Conversation and Mobile Audio Spaces," *ACM*, 2002. 431-38; Rebecca Grinter et al., "Revisiting the Visit: Understanding How Technology Can Shape the Museum Visit," *ACM*, 2002. 146-55.

¹⁰ Kylie Budge, "Objects in Focus: Museum Visitors and Instagram," *Curator: The Museum Journal* 60, no. 1 (2017): 67-85.

¹¹ Iva Buljubašić, Marta Borić, and Ivana Hartmann Tolić, "The Impact of Promotion in Creative Industries--the Case of Museum Attendance," *Ekonomski Vjesnik* 29, no. 1 (2016): 109-24.

¹² Stacy Baker, "Identifying Behaviors that Generate Positive Interactions between Science Museums and People on Twitter," *Museum Management and Curatorship* 32, no. 2 (2017): 144-59; Jonas Heide Smith, "The Me/Us/Them model: Prioritizing Museum Social-media Efforts for Maximum Reach," *MW2015: Museums and the Web 2015*. <http://mw2015.museumsandtheweb.com/paper/the-meusthem-model-prioritizing-museum-social-media-efforts-for-maximum-reach/>

museum technologies as a primary source. However, most of these observations were conducted in midwestern museums. Because these technologies were observed regionally, other geographic locations may have different results. Furthermore, the technological features studied cannot be considered comprehensive. Finally, new questions arose during the course of this research that I was unable to pursue. In subsequent research, it would be beneficial to collect additional qualitative data from museum visitors on their experiences with digital technologies in museums. Appendix 1 contains a list of interview questions that could be used for future research in this area.

Chapter 1: Engagement

Mobile devices coupled with the internet can be perceived both positively and negatively. In a survey centered on positive and negative perceptions of the internet, the Pew Research Center found that the most common reason given for the negative impact of the internet was, "...the internet isolates people from each other or encourages them to spend too much time with their devices."¹³ While this certainly can be the case, the ways that digital technology allow users to engage with things that interest them and engage with other people should also be considered. FaceTime is an application available on Apple products which allows users to send and receive video phone calls. FaceTime facilitates face-to-face conversations between people who are not co-located. As another example, the internet gives open access to information on topics of interest. Most of the research I have conducted for this paper was facilitated and enhanced by digital technology via the internet. While the internet and digital technology could be used to engage in mindless activities and procrastination—I would be lying if I said that I did not engage in some of these activities while researching this thesis—my argument will lend to the positive impact of digital technologies when used as a tool. In this chapter I will discuss the ways in which museums can implement digital technologies in a useful way to promote visitor engagement.

Paths to Engagement

When studying how museum visitors engage with exhibits, Swedish researchers, Eva Insulander and Staffan Selander, found that "engagement is context specific and is prompted by different semiotic resources."¹⁴ The interests and knowledge of the viewer is a sort of "starting point" to engage with the exhibit and materials.¹⁵ These forms of engagement will likely look very different from one person to the next, but they can be categorized into three forms of engagement: "Expressive," "Meta Reflective," and "Narrative."¹⁶ Expressive engagement has to do with "value statements and astonishment."¹⁷ So, a visitor might see a photograph that he or

¹³ Aaron Smith and Kenneth Olmstead, "Declining Majority of Online Adults Say the Internet Has Been Good for Society," Pew Research Center: Internet, Science & Tech, April 30, 2018.

¹⁴ Eva Insulander and Staffan Selander, "Designs for Learning in Museum Contexts," *Designs for Learning* 2, no. 2 (2009): 18.

¹⁵ Insulander and Selander, "Designs for Learning," 18.

¹⁶ Insulander and Selander, "Designs for Learning," 18-19.

¹⁷ Insulander and Selander, "Designs for Learning," 19.

she considers to be beautiful and say “Wow.”, “I love this.”, or “This is incredible!” These are value statements, or statements of astonishment. Which photographs or artworks prompt these statements will vary by visitor. Narrative engagements have to do with a person or an activity.¹⁸ For example, this might be something like seeing an exhibit of Polaroids from the 1960s and thinking about what it was like at that time and place or engaging in whatever activities are being depicted. Narrative engagement could also include “connecting what they saw to their own personal experiences.”¹⁹ As an example, a person who remembers the time or place depicted in a photograph can relate those images back to own personal experiences. A Meta Reflective engagement might consider the ways that the Polaroids are displayed or interpreted. A visitor might comment on the low light in the exhibit and discuss the difficulty of preserving Polaroid images, due to their sensitivity to light. These comments require specific knowledge and interest, but they are also about the exhibit or the objects themselves outside of their meaning within the exhibit. As the researchers in this study point out, engagement goes beyond “cognitive understanding” and includes “emotional engagement, interest, and identity construction.”²⁰

Augmented Reality

While there may be some ways that augmented reality can be beneficial for increasing engagement and learning in museums, it may not be advisable to use any and all augmented reality technology in museum contexts. For example, there is an “adaptive augmented reality” system, ARTSENSE, that was designed for the use in museums and cultural heritage sites that seems to be incredibly impractical.²¹ ARTSENSE uses glasses that overlay digital information into a user’s vision, collects audio information from the surroundings, and collects “biofeedback”

¹⁸ Insulander and Selander, "Designs for Learning," Figure 9.

¹⁹ Insulander and Selander, "Designs for Learning," 12.

²⁰ Insulander and Selander, "Designs for Learning," 19.

²¹ “ARTSENSE is a three-year research project grouping ten partners coming from six European countries, which can further be divided in five technology research partners (Complex Event Processing, AR visualization, Cognitive Psychology and Physiological Computing, Acoustics, Interpretative use of ICT technologies in Cultural Heritage), two industrial partners and three museum partners.” ²¹ A. Damala, and N. Stojanovic, "Tailoring the Adaptive Augmented Reality (A2R) Museum Visit: Identifying Cultural Heritage Professionals' Motivations and Needs," IEEE, 2012, 74.

including “a. heartbeat activity, b. skin conductance, and c. brainwave activity.”²² All of this information is then used to detect the viewer’s level of interest and helps the program to decide which content to display.²³ This seems like a system that is unnecessarily complicated, as visitors are people who have brains and can make choices. I do not see the advantages to a system that makes educated guesses on what a viewer might be interested in learning about, especially when viewers are capable of choosing content for themselves and moving on to another selection if the content they have chosen proves to be uninteresting to them as individuals. However, the system could be useful for researchers trying to understand how the brain responds to stimuli during a museum visit and that information could benefit museum administrators when making decisions on how to present information. But implementing this system into an average museum visit seems unlikely and impractical.

Augmented reality does have some benefits. TombSeer, an augmented reality prototype developed by Isabel Pedersen, Nathan Gale, Pejman Mirza-Babaei, and Samantha Reid from University of Ontario Institute of Technology, was created for an Egyptian tomb exhibit at the Royal Ontario Museum.²⁴ This application was designed to allow visitors to interact physically with digital holographic replicas.²⁵ According to Pedersen et al., “The goal is to change the role of the user from passive observer to tomb visitor, one who imagines himself or herself moving, learning, and reacting in a new cultural context. This existential change, while subtle, enlivens the museum experience.”²⁶ This experience combined physical and mental activity, thus, avoiding “the ‘stand and read’ paradigm that inevitably takes place when people are trying to learn more about a display.”²⁷

²² Damala, and Stojanovic, "Adaptive Augmented Reality," 71-74.

²³ Damala, and Stojanovic, "Adaptive Augmented Reality," 73.

²⁴ TombSeer was designed for the *Tomb of Kitines* replica exhibit, which is on permanent display at the Royal Ontario Museum in the Egyptian Gallery. The augmented reality program does not appear to be available to the public. More information on the Tomb of Kitines may be found on the ROM website, rom.on.ca/en/node/7477.

²⁵ Isabel Pedersen et al., “More than Meets the Eye: The Benefits of Augmented Reality and Holographic Displays for Digital Cultural Heritage,” *ACM Journal on Computing and Cultural Heritage* 10, no. 2, (2017): 11:1.

²⁶ Pedersen et al., “Benefits of Augmented Reality,” 11:7.

²⁷ Pedersen et al., “Benefits of Augmented Reality,” 11:7.

Assumptions about Mobile Communication Devices

I think there is a widely held belief that if people are engaging with their digital technologies (smartphones specifically), then they are disengaged with what is happening in “real life.” This presumption leads to a negative association with technology and individuals who are engaging with their smartphones instead of what or whom is in front of them at any given moment. The distrust or dislike for new technologies, and the way it changes how society functions, is not a new phenomenon. Socrates, as recorded by Plato, famously stated that writing would lead to forgetfulness.²⁸ I would assert that Socrates’ fears about writing were unfounded and that writing has been an asset rather than a detriment to society; additionally, some studies show that writing has a positive impact on both memory and learning.²⁹

One of the primary objectives of all museums is for visitors to engage with the museum’s collections. Given the negative associations with digital technology and its ability to distract users from what is in front of them, it makes sense that museums would be slow to incorporate technology into their programming. However, when harnessed correctly, technology can be used to serve museums and their visitors in obtaining this objective.³⁰

Karen Hughes and Gianna Moscardo, researchers from the University of Queensland and James Cook University, respectively, conducted an experiment to analyze how access to mobile communication devices (hereinafter referred to as MCDs) impacted students while visiting a museum exhibition.³¹ Students were split into three groups: a control group, a directed MCD group, and a no-MCD group. Researchers instructed the control group to “Go through the exhibition as if you were on an ordinary visit to the museum.”³² The directed MCD group was given a task to complete using their MCDs. They were asked to pretend as though it

²⁸ Reginald Hackforth and Plato, *Plato’s Phaedrus*, (Indianapolis: Bobbs-Merrill Co., 1952), 157.

²⁹ Pam A. Mueller and Daniel M. Oppenheimer, "Technology and Note-Taking in the Classroom, Boardroom, Hospital Room, and Courtroom" *Trends in Neuroscience and Education* 5, no. 3 (2016): 139-145.

B. Abuhamda and A. Soliman, "Impact of Expressive Writing on Everyday Memory Functioning," *European Psychiatry* 33, (2016): S557-S557.

Hughes and Moscardo, "Connecting with New Audiences," 33.

³¹ The exhibition used for this study was *Colour – Secret Language of the Reef* at the Museum of Tropical Queensland in Queensland, Australia. This exhibition opened in 2014 and is still on display. More information on this exhibition can be found on the museum’s website: <http://www.mtq.qm.qld.gov.au/>

³² Hughes and Moscardo, "Connecting with New Audiences," 38.

was their "... job to present information about the exhibition to (their) friends, family, and colleagues so that they can understand the key messages of the exhibition. You can take up to five photos of parts of the exhibition and use any information from the exhibits that you think is important."³³ The no-MCD group was given the same instructions as the control group, but they had to surrender their MCDs while visiting the exhibit.³⁴

Researchers had the students fill out questionnaires at the end of their visit and they also collected observational data. The directed MCD group spent the longest amount of time in the exhibit.³⁵ This should not be surprising, considering that this group was given a task to complete which required them to interpret and imagine how they would explain the main takeaways of the exhibit to others. The no-MCD group spent the least amount of time in the exhibit. What is more interesting is that the belief that MCDs are distracting is a common assumption in our society, as evident in the perceptions of the no-MCD group. The participants who did not have access to their MCDs "reported being less distracted and that this enabled them to focus on the exhibition."³⁶ However, the data from the experiment suggests otherwise.

First, they [students in the no-MCD group] spent significantly less time in the exhibition overall than the other two groups; second, they were significantly more likely to stop at exhibits with audio-visual elements and less likely to engage with text; and third, this group had the lowest scores on mindfulness and perceived learning. This pattern suggests that without their devices, respondents browsed rather than engaged with exhibits...³⁷

The perception that MCDs are distracting is common, as shown in the respondents' discussion of their experiences, but this research suggests that it is a perception that is not supported with evidence. Students in the no-MCD group engaged less than either of the other groups. What seems even more significant is that directed MCD usage can actually "facilitate mindfulness," as the researchers suggested in their analysis of the experiment: "Overall, these results imply that instructing young adults to use their MCDs to describe exhibitions encourages

³³ Hughes and Moscardo, "Connecting with New Audiences," 38.

³⁴ Hughes and Moscardo, "Connecting with New Audiences," 38.

³⁵ Hughes and Moscardo, "Connecting with New Audiences," 43.

³⁶ Hughes and Moscardo, "Connecting with New Audiences," 46.

³⁷ Hughes and Moscardo, "Connecting with New Audiences," 46.

them to take control and enhances their experience. This facilitates mindfulness and, in the present study, led to more positive outcomes...³⁸

An earlier study conducted by the same researchers looked at the effects of not having access to a MCD on Chinese students studying abroad in Australia. These students were split into two groups only, access to their MCDs and no access to MCDs. More than 40% of the students in the no-MCD group reported that not having their devices as a “large negative influence.”³⁹ Additionally, when students in the no-MCD group were asked how it affected their visit, the top two responses were, “I could not translate words I did not understand.” and “I could not search for extra information about things seen.”⁴⁰ These two responses combined make up 50% of the total responses to this question. However, the results of this particular experiment have to be viewed through a discriminating lens. All participants were visiting an exhibit that was not presented in their native language.⁴¹ And, as the researchers admit, there could be cultural differences that skewed the data.⁴² That being said, what is significant was the use of MCDs to access information.

There is a perception that when people are looking at their devices, then they are not engaged with what is around themselves. The study with Chinese students illustrated that without access to their devices, students believed themselves to be limited in their ability to engage with a museum exhibit because they had less access to resources for translating information. They did not report being negatively affected by their inability to text, access social-media, or browse the internet. It is easy to assume that someone who is using his or her phone in a museum is not engaging with the exhibits; however, the reality is that devices can be used to access additional information, which can lead to a better understanding of the information being presented. This is true for museum visitors regardless of whether or not they are native speakers.

³⁸ Hughes and Moscardo, “Connecting with New Audiences,” 46.

³⁹ Moscardo and Hughes, “Museums Unplugged,” 405.

⁴⁰ Moscardo and Hughes, “Museums Unplugged,” 406.

⁴¹ Moscardo and Hughes, “Museums Unplugged,” 407.

⁴² Moscardo and Hughes, “Museums Unplugged,” 407.

Fieldtrips

Several studies have shown how digital technologies can be incorporated into fieldtrip activities for students with positive results. Tien-Yu Hsu, Hsin-Yi Liang, and Min-Feng Lee, from the National Museum of Natural Science and Fan-Ray Kuo from National Taiwan University, teamed up to develop a “curriculum-based virtual and physical mobile [hereinafter referred to as CVPM] learning model”⁴³ for elementary education at the National Museum of Natural Science in Taichung, Taiwan. The physical resources were the museum exhibitions, while the virtual resources were mobile-learning content accessed by students and teachers via tablet computers. This learning model was developed collaboratively by museum staff and teachers.⁴⁴

(T)he CVPM learning portal which includes a pre-visit learning service, a post-visit learning service and an onsite-visit learning service. The pre-visit learning service and post-visit learning service are designed to allow teachers to plan the learning activities before visiting and to review the learning outcomes after visiting, respectively, while the onsite-visit learning service is designed for the implementation of the learning process during the museum visit.⁴⁵

Teachers assigned tasks to students before the visit, which the students accessed via tablet computers. After the museum visit, teachers could “download the students’ learning portfolios.”⁴⁶ The “m-learning activity” for this study was “Plant Exploration.”⁴⁷ Students’ tasks included taking photographs of their favorite plant features, drawing plants based on observations from the exhibits and microscope viewings, and responding to a set of questions.⁴⁸ The study involved 405 students and 39 teachers, who completed the onsite learning activities and provided feedback afterwards via surveys.⁴⁹

The feedback from the surveys was overall extremely positive in all categories, which included enjoyment, inspiration, knowledge, attitude, and skill.⁵⁰ Students felt that the m-

⁴³ Tien-Yu Hsu et al., "A Curriculum-based Virtual and Physical Mobile Learning Model for Elementary Schools in Museums," *The Electronic Library* 34, no. 6 (2016): 997.

⁴⁴ Hsu et al., "Mobile Learning Model," 998-1000.

⁴⁵ Hsu et al., "Mobile Learning Model," 1000.

⁴⁶ Hsu et al., "Mobile Learning Model," 1001.

⁴⁷ Hsu et al., "Mobile Learning Model," 1003.

⁴⁸ Hsu et al., "Mobile Learning Model," 1003.

⁴⁹ Hsu et al., "Mobile Learning Model," 1003-4.

⁵⁰ Hsu et al., "Mobile Learning Model," 1006.

learning experience was interesting, fun, and improved their knowledge of the subjects studied and their skills with mobile devices.⁵¹ Teachers also had very positive responses to the learning model. Nearly 90% of teachers felt that the learning model successfully supported formal education and “considered this CVPM learning model highly satisfied the needs and expectations of elementary education.”⁵² Additionally, 100% of teachers would recommend the learning model to other teachers.⁵³

Thomas Hillman, Alexandra Weilenmann, and Beata Jungselius, from the University of Gothenburg in Sweden, conducted a study involving school field trips at a natural science museum in 2015. The purpose of the study was to “[investigate] how school children engage using their own technologies.”⁵⁴ Students completed tasks in small groups using a worksheet designed with questions that avoided having explicit answers in the curatorial text accompanying the exhibit. This also allowed students to incorporate their mobile devices and pursue exhibits in which they felt interested.⁵⁵ For example, one of the tasks was to use a mobile device or camera to document animal characteristics that they “believed to have arisen through sexual selection.”⁵⁶ Questions like this allowed students to think critically about information that they had learned in the classroom and then apply it when visiting a museum exhibit. It encouraged them to incorporate their devices which, based on the studies in Taiwan, students enjoy. Additionally, there is research that suggests that taking photographs of details of museum objects (versus the object as a whole) increases recall.⁵⁷ It is important to note that this research also found that taking photographs of objects as a whole reduced recall. This information should be a caution on blindly incorporating technology into programming for educational purposes. It is important to understand both the advantages and disadvantages.

⁵¹ Hsu et al., "Mobile Learning Model," 1006.

⁵² Hsu et al., "Mobile Learning Model," 1007.

⁵³ Hsu et al., "Mobile Learning Model," 1007.

⁵⁴ Thomas Hillman et al., "Traces of Engagement: Narrative-Making Practices with Smartphones on a Museum Field Trip," *Learning, Media and Technology* 41, no. 2 (2016;2015): 2.

⁵⁵ Hillman et al., "Traces of Engagement," 5.

⁵⁶ Hillman et al., "Traces of Engagement," 7.

⁵⁷ Linda A. Henkel, "Point-and-Shoot Memories: The Influence of Taking Photos on Memory for a Museum Tour," *Psychological Science* 25, no. 2 (2014): 396.

The results of the aforementioned study showed that students given the same tasks to complete took very different approaches in their “production of narratives that display their knowledge...”⁵⁸ By structuring the tasks in such a way that allows for freedom, the students were able to complete the tasks using different approaches and exhibits. As discussed earlier, visitors have different “starting points” of knowledge and interest that give them a path to engagement. It makes sense to structure tasks for coursework in museums in such a way that students can engage with exhibits that are interesting to them as a way to facilitate learning. If the options are narrowed for an assignment or task, instructors run the risk of students becoming disengaged because they are forced to focus on exhibits and methods that might not be interesting to them or even presented in learning styles that work them.

Another important thing to note is that these learning activities were designed as a collaboration between the researchers and the museum’s educators.⁵⁹ The researchers did this “based on a comprehensive review of the literature on the educational role of school field trips...”⁶⁰ Additionally, the worksheets were also shared with the teachers of the students studied prior to the fieldtrip.⁶¹ While the researchers in this instance were “Following the experiences of DeWitt and Storksdiack (2008) amongst others, who emphasize the importance of focusing on the design of tasks for museum field trips and creating them through collaboration amongst stakeholders...”⁶², I would assert that the need for collaboration expands beyond fieldtrips and can also be critical when considering how museums implement technology for various outcomes.

Shared Displays and Shared Listening

When discussing how technology can enhance the museum experience for visitors, it is important to understand that not all visitors experience the museum alone and not all visitors

⁵⁸ Hillman et al., "Traces of Engagement," 15.

⁵⁹ Hillman et al., "Traces of Engagement," 5.

The researchers also shared the worksheet with the teachers of the students involved in this study.

⁶⁰ Hillman et al., "Traces of Engagement," 4. The authors are referencing Jennifer Dewitt and Martin Storksdiack’s research here; see "A Short Review of School Field Trips: Key Findings from the Past and Implications for the Future." *Visitor Studies* 11, no. 2 (2008): 181-197.

⁶¹ Thomas Hillman et al., "Traces of Engagement," 5.

⁶² Thomas Hillman et al., "Traces of Engagement," 5.

come in groups. Ideally, technology will accommodate different types of museum visitors and their varying interests and objectives. In the previous section, I discussed how technology can be implemented to enhance educational activities for students. Going forward, discussion will be about how technology can be used to facilitate engagement for groups of visitors who wish to experience the museum together. However, some findings could also be applied to group work for students visiting museums as a part of their coursework.

In 2016, Joel Lanir, Alan Wecker, Tsvi Kuflik, and Yasmin Felberbaum, researchers from the University of Haifa in Israel, published two studies that were conducted at the Hecht museum; this museum is located on the University of Haifa campus in Israel and its collection is focused on art and archeological artifacts.⁶³ The studies compared different mobile devices for groups of three participants. Participants used a “mobile guide as a navigational and interpretive aide.”⁶⁴ The mobile guide could be used for wayfinding and also offered multimedia presentations of items on display in the proximity of the device.⁶⁵ The first study compared individual iPods for each person in the group against an iPad as a shared display for the group. The second study compared iPads against mobile projectors for shared group displays.⁶⁶ Logically, the results of the study confirmed that sharing a display “contributed to group cohesiveness as compared to individual devices...”⁶⁷ What is interesting in the results is that the participants acknowledged that the iPods were “not suited for group work” and that the tablets “caused more conversation,” however, they still favored the iPods.⁶⁸ The researchers’ findings suggest that “many people still value individual control even in group situations.”⁶⁹

Per the results of the Lanir et al. studies, a shared device was shown to be better for group activities, but individuals still preferred to have control over their experience. In a group

⁶³ For more information on the Hecht museum and its collection, see their website

http://mushecht.haifa.ac.il/Default_eng.aspx

⁶⁴ Lanir et al., "Shared Mobile Displays," 639

⁶⁵ Lanir et al., "Shared Mobile Displays," 638.

⁶⁶ Lanir et al., "Shared Mobile Displays," 639.

⁶⁷ Lanir et al., "Shared Mobile Displays," 647.

⁶⁸ Lanir et al., "Shared Mobile Displays," 647.

⁶⁹ Lanir et al., "Shared Mobile Displays," 647.

situation with a shared device, not everyone in the group will be able to exert control over where the group goes and what presentations its members will engage with via the device, taking away individual agency. It is also worth mentioning that “tablets were preferred by most participants over mobile projectors.”⁷⁰ Reasons for this included “technological problems,” privacy concerns, and “visual clutter.”⁷¹ It is easy to see how projecting multimedia presentations onto the walls and floor of a museum would easily become a nuisance. In that same vein, it should also be a concern that using a shared device to play multimedia presentations inside a museum could also become an aural nuisance. So, while having multimedia audio-guides that facilitate group conversation and engagement with exhibits is exciting, it would not be advisable to implement this technology at the expense of other visitors.

Paul Aoki et al., from the Xerox Palo Alto Research Center in California, created an electronic guidebook that addressed some of these problems and used it in a visitor study; the results of this study were presented in 2002 at the SIGCHI Conference on Human Factors in Computing Systems, in Minneapolis, Minnesota.⁷² The guidebook *Sotto Voce* was designed with paired visitors in mind and was studied in-use at Filoli, a historic house museum in Woodside, California.⁷³ Visitors were given their own guidebooks and could move around the exhibit and engage with the material available on their electronic guides however they chose; audio presentations were heard through a headset. The feature of this device that facilitated interaction is called “eavesdropping.”

Paired visitors share audio content as follows. When visitor A selects an object on her device, she always hears her own audio clip. If A is not currently playing an audio clip, but her companion B is, then B’s audio clip can be heard on A’s device. In other words, audio clips are never mixed, and A’s device always plays a personal clip (selected by A) in preference to an eavesdropped clip (selected by B).⁷⁴

⁷⁰ Lanir et al., "Shared Mobile Displays," 647.

⁷¹ Lanir et al., "Shared Mobile Displays," 647-8.

⁷² SIGCHI stands for “Special Interest Group on Computer-Human Interaction.” More information on this organization may be found on their website, sigchi.org.

⁷³ Aoki et al., "Sotto Voce," 431, 433. More information on Filoli may be found on the museum’s website, Filoli.org.

⁷⁴ Aoki et al., "Sotto Voce," 432.

The eavesdropping feature could be turned on or off by one or both parties. If person A turned off the feature, he or she would not hear what person B was listening to; but if person B had the feature on he or she could still “eavesdrop” on person A. Additionally, the volume of eavesdropped audio could be adjusted so that it was played at a lower volume than the user selected audio.⁷⁵

The audio clips in *Sotto Voce* were similar to typical audio-guide content with the exception of length. The lengths of the clips were shorter because the designers wanted to provide “frequent opportunities for visitors to take a conversational turn.”⁷⁶ Additionally, the headsets were designed with a single earphone. This design allowed users to converse and it reduced the isolating effects of two-ear headphones.⁷⁷

When the researchers studied how paired visitors at Filoli utilized the eavesdropping feature, they found “four activities in which visitors engaged while using the guidebook: shared listening, independent use, following, [and] checking-in.”⁷⁸ “Shared listening” was when visitors both had the eavesdropping feature turned on; “independent use” described visitors who turned off the eavesdropping feature entirely; “following” described one person in the pair using eavesdropping to only listen to what the other person selected. In other words, one person operated the device while the other person listened. “Checking-in” was used to describe the eavesdropping feature being used to check on a companion. Examples of this included, finding out where their companion was located and figuring out if their companion was ready to move to another location.⁷⁹

An interesting aspect of this technology is that it solved the concerns of the shared displays deployed in the Hecht museum. *Sotto Voce* did not contribute to visual or aural distractions within the museum, because the visuals were displayed on a handheld device and

⁷⁵ Aoki et al., “Sotto Voce,” 432.

⁷⁶ Aoki et al., “Sotto Voce,” 433.

⁷⁷ Aoki et al., “Sotto Voce,” 433.

⁷⁸ Grinter et al., “Revisiting the Visit,” 149. It should be noted that the studies by Aoki et al. and Grinter et al. were conducted by the same six researchers at the same historic house museum (Filoli) using the same electronic guidebook, *Sotto Voce*.

⁷⁹ Grinter et al., “Revisiting the Visit,” 150-2.

the audio was played through a headset. Additionally, each visitor was given his or her own device and thus did not have to relinquish control over where he or she went and what features he or she engaged with—an issue that participants in the Hecht museum study pointed out. The system is designed was facilitating conversation between visitors but could also be used for visitors who prefer to enjoy the museum alone. The different ways that visitors adopted the features to fit their personal preferences during a museum visit illustrated how this audio-guide design could be used for museum goers with varying expectations for their visit. As mentioned earlier, not every visitor will go to a museum alone and not every visitor will go in a group.⁸⁰ It is important when looking at how to incorporate technology that different visiting styles are considered. Another aspect to consider when designing technology is ease of use. The study on *Sotto Voce* found that most visitors were able to use the device with minimal instruction and that in one case when a visitor was uncomfortable with technology, the method worked perfectly to accommodate that visitor.⁸¹ It seems pertinent here to point out that 47% of the participants in this study were over the age of fifty.⁸² This highlights that technology can be adopted and enjoyed in museums for visitors who are not digital natives.⁸³ Finally, there is research that has found that audio-guides increase visitor engagement with exhibits, but decrease social engagement when “compared to visitors who did not use the mobile guide.”⁸⁴ *Sotto Voce* has the benefits of a typical audio-guide while also allowing for social engagement between visitors, cementing the benefits of its design over traditional audio-guides.

The last thing I would like to touch on in my discussion of engagement is the idea of taking selfies or photographs for social-media in a museum context. While it might be easy to disregard these activities as mindless or unengaged, there is research data that would suggest

⁸⁰ In her study on museum visitor demographics and motivations, Marilyn Hood found that most museum visitors come to museums in groups; however, solitary visitors are more likely to visit museums more frequently and “accumulate the most visits over a year.”

Marilyn Gilbertson Hood and Ohio State University. "Adult Attitudes Toward Leisure Choices in Relation to Museum Participation." 1981. 109-110, 259.

⁸¹ Grinter et al., "Revisiting the Visit," 153, 151.

⁸² Grinter et al., "Revisiting the Visit," 149.

⁸³ A “digital native” is a person who has been exposed to digital technologies for most of their life and is therefore much more accustomed with its use. The antonym of “digital native” is “digital immigrant” which refers to a person from an older generation who had to adapt to new technologies later in life.

⁸⁴ Joel Lanir et al., "Museum Visitors' Behavior," 316.

otherwise; there is evidence that posting about museum visits on social-media is actually a continuation of the museum experience and can also demonstrate a visitor's engagement with an exhibit.⁸⁵ Furthermore, social-media posts by museum visitors can be a resource for museums to facilitate engagement, as explained by Kylie Budge: "Understanding points of meaning-making for audiences attending exhibitions can lead to a huge number of possibilities in terms of curatorial decisions, exhibition design, the architecture of gallery space, and deepening engagement more broadly."⁸⁶ I will discuss these ideas and social-media in museum contexts in greater detail in the following chapter.

⁸⁵ Jordi López Sintas, Ercilia García Álvarez, and Elena Pérez Rubiales, "Art Museum Visitors: Interaction Strategies for Sharing Experiences," *Museum Management and Curatorship* 29, no. 3 (2014): 250.

⁸⁶ Budge, "Objects in Focus," 82.

Chapter 2: Social-media

There is some evidence that museums are slow to adopt social-media technologies. Linda Lotina, a doctoral student at the University of Tartu in Estonia, found that museum professionals in Latvia did not engage in social-media for the following reasons: “scarcity of financial and human resources, social-media activities are not a high priority for the museum to reach institutional goals; and personal anti-social-media attitudes also play a part.”⁸⁷ Of course, museum professionals in Latvia do not speak for the entire field, but in this chapter I postulate that social-media might in fact be a better strategy than other forms of promotion. In many instances, social-media would be a better use of financial and/or human resources that can help museums to reach institutional goals. Additionally, negative attitudes toward social-media by museum professionals may be overcome.

Jordi López Sintas, Ercilia García Álvarez, and Elena Pérez Rubiales, researchers from the Center for Research and Studies in Humanities at the Autonomous University of Barcelona, studied the social aspects of museum visits from 2008-09. They found that whether a participant went to the museum alone, with another person, or a group of people, there was always a social dimension to the visit.⁸⁸ Another point that the researchers argued was that the museum visit extends beyond the time spent in the physical museum space, as there are often pre-visit and post-visit phases to museum trips.⁸⁹ The pre-visit phase includes planning for the visit and may or may not include a social element, such as asking friends for their opinions or experiences at the museum or exhibit.⁹⁰ The post-visit phase has the potential to produce the most social elements, because it is in this phase that people share their experiences, whether with a group whose members experienced the visit, or with others in their social circle.⁹¹ Sintas et al. concluded that “the museum experience is always social in that it is invariably shared and that the social dimension is not limited to visits made in the company of others.”⁹² So, sharing a museum experience on social-media is one strategy a visitor may use to share their

⁸⁷ Linda Lotina, "Reviewing Museum Participation in Online Channels in Latvia," *Museum Management and Curatorship* 29, no. 3 (2014): 289.

⁸⁸ Sintas, Álvarez, and Rubiales, "Art Museum Visitors," 253.

⁸⁹ Sintas, Álvarez, and Rubiales, "Art Museum Visitors," 249.

⁹⁰ Sintas, Álvarez, and Rubiales, "Art Museum Visitors," 249.

⁹¹ Sintas, Álvarez, and Rubiales, "Art Museum Visitors," 250.

⁹² Sintas, Álvarez, and Rubiales, "Art Museum Visitors," 255.

experience with their social circle. Additionally, posts on social-media could inspire others to visit the museum. If that is the case, the social aspect of a visitor's post-visit phase could lead to a future visitor's pre-visit phase.

Social-media and Engagement

In 2015, Kylie Budge conducted a case study on Instagram posts made about an exhibition of shoes presented at the Museum of Applied Arts and Sciences in Sydney, Australia; Budge is a Research Manager at this museum.⁹³ While it might be easy to assume that social-media posts from visitors at a museum are unimportant, Budge's findings suggest otherwise. The data collected in this study showed that visitors' Instagram posts "were overwhelmingly focused on the objects on display."⁹⁴ And that "posts that included people were only 9 percent of all images posted and all without exception included objects or exhibition props."⁹⁵ Budge concluded that "Museum exhibition audiences in this case study used Instagram *primarily* to engage with exhibition *content*, with a central focus on the *materiality of objects*."⁹⁶ From this study it appears that visitors posting on Instagram are doing so precisely because they are engaging with the exhibits. Weilenman et al. conducted a similar study in 2012 and concluded that "visitors use social-media to engage with exhibitions in rich and varied ways."⁹⁷ In addition, they found that Instagram users "work to construct their own narratives from their visits" by "recategorizing and reconfiguring the museum environment."⁹⁸

As addressed in Chapter One, the viewer's interests and knowledge are a sort of "starting point" for him or her to engage with an exhibit.⁹⁹ Social-media applications give users freedom in choosing content that they wish to share, so it is logical that they will share the content or aspects of their museum visits in which they are interested. It also seems logical that

⁹³ The exhibition, *Recollect: Shoes*, ran from November 29th, 2014 until July 19th, 2015. More information on this exhibit may be found on the museum's website, maas.museum/event/recollect-shoes/

⁹⁴ Budge, "Objects in Focus," 78.

⁹⁵ Budge, "Objects in Focus," 78.

⁹⁶ Budge, "Objects in Focus," 82.

⁹⁷ Alexandra Weilenmann, Thomas Hillman, and Beata Jungselius, "Instagram at the Museum: Communicating the Museum Experience through Social Photo Sharing," ACM, 2013, 10.

⁹⁸ Weilenmann, Hillman, and Jungselius, "Instagram at the Museum," 2.

⁹⁹ Insulander and Selander, "Designs for Learning," 18.

choosing to post photographs of museum experiences is actually a sign of engagement with the museum and exhibitions that prompted them to share experiences via social-media outlets. Additionally, because all museum visits contain a social element in some form, posting on social-media can be interpreted as a pursuit of the social aspect of the museum visit.

Marketing

Social-media has tremendous marketing potential for museums, especially those that have a difficult time attracting younger audiences. The Pew Research Center found that 86% of young adults in the United States (ages 18 to 29 years) use at least one social-media site. However, while younger audiences are more likely to use social-media, its usage among older Americans is also quite high. Up to 80% of adults ages 30 to 49 years and 64% of adults between the ages of 50 to 64 years use at least one social-media site. While Facebook is the most common social-media site used by Americans of all ages, Instagram comes in second for social-media users in the 18 to 29 age demographic at 59%.¹⁰⁰ What this data reveals is that social-media can be used to target younger audiences, but it certainly does not exclude audiences over the age of thirty.

Researchers from the University of Osijek in Croatia, Iva Buljubašić, Marta Borić, and Ivana Hartmann Tolić, conducted a study on the effectiveness of various forms of promotion for an exhibit at the Museum of Fine Arts in Osijek during the spring of 2015.¹⁰¹ They wanted to compare conventional versus unconventional promotional channels and their effects on museum attendance. The conventional methods to attract visitors included advertisements on television, radio, billboards, and in newspapers; unconventional methods included the museum's social-media network, advertisements on sugar packets,¹⁰² and a video shown at the cinema. The results of the study were taken from questionnaires that were filled out by visitors

¹⁰⁰ "Social Media Fact Sheet." *Pew Research Center*, January 12th, 2017. <http://www.pewinternet.org/fact-sheet/social-media/>.

¹⁰¹ Research was conducted during Julije Knifer's retrospective exhibition "Uncompromising," in 2015. This exhibition opened in March of 2015, but the museum's website does not give a closing date. More information on this exhibition may be found in the museum's exhibition archives here: mlu.hr

¹⁰² The ads on sugar packets were distributed to local cafes in Osijek. See Buljubašić, Borić, and Tolić, "The Impact of Promotion," 123, note 1.

to the exhibit over a six-week period.¹⁰³ Two thirds of the respondents were students, and almost 95% were under the age of 32 years.¹⁰⁴ Because the data pool measured younger individuals, it would be difficult to assess the overall impact of the promotional activities. However, it does offer information on this particular demographic. When asked about the frequency of their social-networking usage, 92% of the people surveyed rated themselves as frequent users of social-media networks; they responded with either a 4 or a 5 on the Likert scale where a 5 represented “always” and a 1 represented “never.”¹⁰⁵ When the participants were asked how they found out about the exhibition, “social-media” was the most common response at 30% and “recommendation” came in at a close second with 28%. What was extremely interesting in the results is that social-media had a greater impact than television, radio, newspaper, and billboards combined. Of the four traditional promotional methods, the most successful was billboards, which made up a little over 11% of responses. Surprisingly, sugar packet advertisements actually beat out the billboard ads by 3.5%.¹⁰⁶ That is certainly a small margin, but it is stunning that such an unconventional method of promotion had better results than any of the traditional methods.

Another notable aspect of social-media marketing is that it is often free. Museums must pay someone to produce the content, but that is true of any promotional material.¹⁰⁷ The delivery of the content, or the channel, is free. While museums can choose to hire full time social-media managers, pay for sponsored posts, or pay to advertise on social-media networks, it is not a requirement for having a presence. Running advertising on traditional promotional channels like television, radio, and billboards, all cost money to rent the air space. If museums want to reach a younger audience, it seems that social-media campaigns are more effective and cost less money. This is especially promising for museums, since the majority are non-profit organizations that rely on external funding. Roberta Garibaldi, a professor of Marketing at the University of Bergamo, points out that “the economic crisis of recent years has significantly

¹⁰³ Buljubašić, Borić, and Tolić, "The Impact of Promotion," 109, 111, 116, 117.

¹⁰⁴ Buljubašić, Borić, and Tolić, "The Impact of Promotion," 116-7.

¹⁰⁵ Buljubašić, Borić, and Tolić, "The Impact of Promotion," 117.

¹⁰⁶ Buljubašić, Borić, and Tolić, "The Impact of Promotion," 117.

¹⁰⁷ Technically this could be outsourced to unpaid interns, but this is not advisable.

affected cultural institutions which, because of cuts in public and private funding, do not have the funds needed to plan communication operations via traditional media.”¹⁰⁸

Garibaldi conducted an analysis of Italian contemporary art museums and their use of Web 2.0 tools in 2012, defined as “all web applications that allow a considerable level of website/user interaction.”¹⁰⁹ This is unlike websites from the 1990s where users could visit the page, but the communication was one-way. Social-media sites and mobile applications are a prime example of Web 2.0; users can communicate with each other on the sites in a bi-directional manner.¹¹⁰ This research was conducted with the “aim of assessing whether, in a situation of scarce funding, these tools may represent an effective way both to promote what museums offer to a wider public and to preserve cultural heritage.”¹¹¹ The museums studied “only had accounts on Facebook, Twitter, Flickr, YouTube, and TripAdvisor.”¹¹² ¹¹³ The results found that only 15% of the museums studied had an account profile on all of the aforementioned sites.¹¹⁴ Garibaldi concluded that the museums studied were not using these tools to their full potential.¹¹⁵ Additionally, she recommended that museums reconsider their approaches to social networks, as these and other Web 2.0 tools “offer cultural institutions the opportunity to strengthen their relationship with potential customers without being limited to traditional promotion channels.”¹¹⁶ Garibaldi also advised that museums should better understand the “peculiarities” of Web 2.0 tools.¹¹⁷ This brings up an important point, because social-networking sites have their own unwritten set of rules that guide the general behavior of

¹⁰⁸ Roberta Garibaldi, “The use of Web 2.0 Tools by Italian Contemporary Art Museums,” *Museum Management and Curatorship* 30, no. 3 (2015): 230.

¹⁰⁹ Garibaldi, “Web 2.0 Tools,” 231.

¹¹⁰ For more information on Web 1.0, 2.0, and 3.0, see Nupur Choudhury, “World Wide Web and Its Journey from Web 1.0 to Web 4.0,” *International Journal of Computer Science and Information Technologies* 5, no. 6 (2014): 8096-100.

¹¹¹ Garibaldi, “Web 2.0 Tools,” 232.

¹¹² Garibaldi, “Web 2.0 Tools,” 233.

¹¹³ It seems relevant to point out that at this time Instagram had not taken off yet; Instagram began to see a steady rise in users in the beginning of 2013. Alex Heath, “Instagram’s user base has doubled in the last 2 years to 700 million,” *Business Insider*, April, 2017. Accessed November 12, 2017. <http://www.businessinsider.com/instagram-number-of-users-700-million-2017-4>.

¹¹⁴ Garibaldi, “Web 2.0 Tools,” 238.

¹¹⁵ Garibaldi, “Web 2.0 Tools,” 240.

¹¹⁶ Garibaldi, “Web 2.0 Tools,” 241.

¹¹⁷ Garibaldi, “Web 2.0 Tools,” 241.

their users. For example, Instagram is primarily a photo sharing platform and therefore quality visual content is the best thing to share. It is fairly unusual to post photographs on Instagram with long captions because captions that are longer than two lines are cut off and hidden behind a link. Twitter, on the other hand, can be used to post multimedia content, but it is not unusual to post text-only updates. Museums should tailor their social-media content based on the platform they are using. If museums do not understand those “rules” properly, they will not be able to use the sites to their best advantage.

Another case study was conducted in 2013 by Joan-Isidre Badell, who was a doctoral student focusing on “tools for museum websites, within the context of Web 2.0 and social-media,” when his study was published.¹¹⁸ Badell’s study focused on the social-media usage of museums in Catalonia; he found that Facebook was the most popular site used by museums, followed by Twitter.¹¹⁹ ¹²⁰ The author found that Twitter generated a higher level of user interaction than Facebook.¹²¹ These findings prompted the author to pose the question, “Would it not be better to have a greater presence on Twitter than on Facebook?”¹²² Badell’s suggestion, as an answer to this question, was that museums should pay closer attention to “the needs of their visitors,” in order to implement a better strategy concerning their social-media usage.¹²³ Just as it is important to understand the “rules” of social-media sites, it is equally important to understand one’s audience. Paying attention to how a museum’s visitors interact on social-media will help museums to sharpen their social-media strategies.

Strategies

Simply having active social-media accounts is not enough for museums to reap the benefits of these tools. Understanding the unwritten “rules” of the various social-media platforms is a first step in harnessing their power. Taking stock of what produces positive

¹¹⁸ Joan-Isidre Badell, "Museums and Social Media: Catalonia as a Case Study," *Museum Management and Curatorship* 30, no. 3 (2015): 261.

¹¹⁹ Badell, "Museums and Social Media," 257.

¹²⁰ Again, it seems pertinent to note that this is before Instagram became popular. See Alex Heath, "Instagram's user base," *Business Insider*.

¹²¹ Badell, "Museums and Social Media," 257.

¹²² Badell, "Museums and Social Media," 257.

¹²³ Badell, "Museums and Social Media," 257.

engagement is another step in figuring out how to create content to which users will connect. Stacy Baker, a graduate student at the University at Buffalo, conducted a study as part of her master's thesis on how science museums were utilizing Twitter and what type of content was the most effective at reaching their audience. Based on the results of her analysis, which was published in *Museum Management and Curatorship*, Baker offered suggestions for museums when considering their marketing strategies in relation to Twitter.¹²⁴

Baker studied the Twitter use of 27 science museums with active Twitter accounts. The museums were separated into categories based on the number of annual visitors: large, medium, and small. Museums with over 3 million annual visitors were considered large, museums with 1-3 million annual visitors were considered medium, and museums with less than 1 million annual visitors were designated as small. There were 7 large museums, and 10 small and medium museums.¹²⁵ Twitter data was collected from these museums and analyzed. The sample was then cut down to 3 museums from each category, chosen at random, for further analysis.¹²⁶ Researchers coded the tweets into categories based on Jenny Kidd's research on the ways that museums utilize social-media.¹²⁷ Categories were defined as "marketing," "inclusive," and "collaborative." After coding tweets, the researchers agreed on the need for a fourth category of "educational" tweets. Tweets labeled as falling into the "marketing" or "educational" categories should be self-explanatory. "Inclusive" tweets were defined, for this study, as interacting with followers or inviting interaction.¹²⁸ Common examples included, "retweeting a user's photo[graph] of an experience at the museum, interacting with the user in a discussion about a particular museum topic, or sharing links to user-created content."¹²⁹ Collaborative tweets were those that enable "people to become co-producers of museum narratives and culture. Examples of strategies that fit within this frame

¹²⁴ Baker, "Identifying Behaviors," 144.

¹²⁵ Baker, "Identifying Behaviors," 147-148.

¹²⁶ The reason for cutting down the sample was due to the fact that analyzing twitter data is labor intensive; Baker believed the sample size was large enough to yield enough data while still being small enough to actually code the results. Baker, "Identifying Behaviors," 148.

¹²⁷ Baker, "Identifying Behaviors," 146. Citing Jenny Kidd, "Enacting Engagement Online: Framing Social Media use for the Museum," *Information Technology & People* 24, no. 1 (2011): 64-77.

¹²⁸ Baker, "Identifying Behaviors," 152.

¹²⁹ Baker, "Identifying Behaviors," 152.

included story-making initiatives and crowd-sourcing.”¹³⁰ Marketing tweets were the most common, making up nearly 60% of those studied. The second most common type of tweet was educational, which made up 26% of those studied. The next most common was inclusive, coming in at almost 14%. Collaborative tweets were nearly nonexistent making up only 1%. Because of this, these types of tweets were dropped from the analysis.¹³¹ The results of the analysis of the museums’ tweets were that educational tweets were more likely to be retweeted or favorited, tweets with links were also more likely to generate engagement, marketing tweets had low levels of interaction, and tweets that used humor had a higher likelihood of being favorited or retweeted.¹³²

Baker found that the number of months on Twitter did not seem to have much of an effect on the number of followers. Having a higher number of annual visitors was a much better predictor (of a higher numbers of Twitter followers.) Interestingly, having a higher number of followers did not correlate to a higher level of engagement on Twitter. Engagement was measured by favorites, retweets, and user mentions. The reason why more followers do not equal higher engagement is because Twitter has a lot of fake spam robot accounts that are not actually real people; one museum’s Twitter followers was made up of almost 30% spam bots. Social-media bots are “...automated accounts capable of posting content or interacting with other users with no direct human involvement.”¹³³ Because of the high number of accounts run by computer programs- not human beings, the number of Twitter followers is not a good source of measurement when calculating influence or reach on Twitter. Having actual interaction, favorites, retweets, and replies, is a much better indicator of Twitter impact.¹³⁴

The takeaway from this research was that museum tweets fall into the marketing category most of the time; however, this category of tweets was not useful at generating user interaction and social engagement. One explanation for this was that marketing tweets are

¹³⁰ Baker, "Identifying Behaviors," 146.

¹³¹ Baker, "Identifying Behaviors," 150.

¹³² Baker, "Identifying Behaviors," 150, 152, 155.

¹³³ Stefan Wojcik et al., "Bots in the Twittersphere," Pew Research Center: Internet, Science & Tech, April 09, 2018, accessed July 19, 2018, <http://www.pewinternet.org/2018/04/09/bots-in-the-twittersphere>

¹³⁴ Baker, "Identifying Behaviors," 150-151.

generally a one-way form of communication, and social-media users “want to interact with museums in more two-way communication methods.”¹³⁵ As Baker explained, “People on Twitter do not want to read advertisements, they want to engage in a discussion or share content they find interesting with others.”¹³⁶ If museums can find ways to incorporate their marketing into tweets that are humorous and/or educational, they have a higher likelihood of generating a positive response and, in turn, being more effective. Additionally, if museums increase the amount of inclusive and educational tweets that they post, instead of relying mainly on marketing tweets, they will create more incentive to continue to follow the museum’s activity on Twitter. As Baker pointed out, overuse of marketing tweets could cause followers to “disengage with the museum and ignore future tweets.”¹³⁷ Museums must consider the wants and needs of their prospective guests, in order to capitalize on the broad reach to which Twitter gives them access; that reach is useless if users are not interested in engaging with the museum’s content.

Instagram is another popular social-media platform for young adults. Nearly 60% of adults ages 18 to 29 use the platform, making it the second most popular social-media network for that age bracket in the United States, after Facebook.¹³⁸ In 2014, the National Gallery of Denmark (hereinafter referred to as SMK¹³⁹) conducted experiments in an effort to maximize its reach on Instagram. In less than two months, the museum was able to increase “its Instagram reach by 2,500 percent.”¹⁴⁰ The strategies that its staff members used to achieve this outcome could be implemented by other museum staff members who are interested in strengthening their own museum’s social-media presence.

¹³⁵ Baker, “Identifying Behaviors,” 145. Citing Lynda Kelly and Susan Groundwater-Smith, “Revisioning the Physical and on-Line Museum: A Partnership with the Coalition of Knowledge Building Schools,” *Journal of Museum Education* 34, no. 1 (2009): 55-68, and Lynda Kelly and A. Russo, “From Communities of Practice to Value Networks: Engaging Museums in Web 2.0.” In *Hot Topics, Public Culture, Museums*, edited by F. Cameron and L. Kelly, 281 – 298. London: Cambridge Scholars.

¹³⁶ Baker, “Identifying Behaviors,” 156.

¹³⁷ Baker, “Identifying Behaviors,” 156.

¹³⁸ “Social Media Fact Sheet.” *Pew Research Center*, 2017.

¹³⁹ SMK stands for “Statens Museum for Kunst.”

¹⁴⁰ Smith, “The Me/Us/Them model.”

The first strategy employed by the digital communication team at SMK was “streamlining” its username and preferred hashtag for visitors posting about the museum and announcing the changes on their Instagram page.¹⁴¹ Having a unique, easy to remember, branded hashtag makes it easier for Instagram users to find and tag posts related to the specific museum on Instagram. Using a hashtag that is too general, such as #Museum, will bring up posts that are museum related but not to a specific place. If a hashtag is too long or complicated, users are less likely to put in the effort to use it. If a preferred hashtag is communicated to users and is used by the official museum page, users are likely to follow suit. This helps to link Instagram posts about the specific museum together.

After streamlining the museum’s Instagram page and hashtags, the SMK team launched “a series of initiatives” to “encourage guest sharing.”¹⁴² The first of these initiatives was “Instawalks,” in which participants were given access to the museum before opening hours and posted pictures of the museum using the #emptysmk hashtag.¹⁴³ Next, the team explicitly encouraged photography within the museum by placing a sign in the lobby that read “please take photos.”¹⁴⁴ Finally, the museum created a space specifically designed for taking photographs inside the building that was tied to a temporary exhibition. The museum staff installed a “selfie mirror” with a small platform that guests could use for taking photographs of themselves; printed under the mirror was the suggested hashtag “#smkselfie.”¹⁴⁵ The mirror spelled “biography” and was “placed in conjunction with an exhibition of works by the artist duo Elmgreen & Dragset focusing on the contemporary conditions for writing one’s own biography”¹⁴⁶ (Fig. 1). Because the SMK launched several initiatives simultaneously, there is no

¹⁴¹ These were “@SMKMUSEUM” and “#SMKMUSEUM,” respectively. Smith, “The Me/Us/Them model.” (pg 5 printed)

¹⁴² Smith, “The Me/Us/Them model.” (pg 6 printed).

¹⁴³ Smith, “The Me/Us/Them model.” (pg 7 printed)

¹⁴⁴ Smith, “The Me/Us/Them model.” (pg 8 printed)

¹⁴⁵ Smith, “The Me/Us/Them model.” (pg 9 printed)

¹⁴⁶ Smith, “The Me/Us/Them model.” (pg 9 printed)

The *Biography* exhibition ran from September 19th, 2014 until January 4th, 2015. More information on this exhibition may be found on the SMK’s website: <http://www.smk.dk/en/visit-the-museum/exhibitions/biography/>.

way to determine their individual effects. However, the overall campaign resulted in a “marked increase in activity.”¹⁴⁷

Between July and August, the total of shared images increased from 147 to 604 (410 percent), and reach increased from 9,083 to 227,605 (2,506 percent). This made Instagram the channel with by far the highest reach in August.

What is particularly interesting here, of course, is that the high reach continues into subsequent months (without specific Instagram events). This suggests, perhaps unsurprisingly, that the effect of social-media initiatives is not isolated but rather snowball-like as activity yields interest and awareness, which again yields activity.¹⁴⁸

The positive results of the SMK initiatives may cause museum staff to presume that encouraging Instagram users to share posts about the museum is more important than maintaining the museum’s own Instagram account. However, this presumption ignores some of the social mechanics of the platform. First, official museum accounts have the ability to post about things that are not available to the public.¹⁴⁹ Examples of this could be behind-the-scenes photographs of conservation work or exhibition hangings. Secondly, museums can use their official profiles to disseminate information about artists or artworks. A museum is usually a trusted source of information, and as noted in the article about science museums on Twitter, educational content is popular on social-media and is more likely to foster engagement. Finally, as the author points out, if a museum has an active account then users are more likely to tag the museum’s account directly. Tagging on Instagram functions the same way as tagging on Facebook. On Facebook, “...users can tag digital photos by adding their friends to the photos with a purpose of identifying people in the photo. Adding tags to photos in return informs the tagged users in form of a message alert and their profile gets linked to the tagged photos.”¹⁵⁰ The impetus for this is might be that the official museum account might repost their post. This kind of content, as mentioned in the Twitter study, would fall under the “inclusive” category of content. The idea here is that the better the official museum account is, the more

¹⁴⁷ Smith, "The Me/Us/Them model." (pg 9 printed)

¹⁴⁸ Smith, "The Me/Us/Them model." (pg 10 printed)

¹⁴⁹ Smith, "The Me/Us/Them model." (pg 10 printed)

¹⁵⁰ Aqdas Malik, Amandeep Dhir, and Marko Nieminen, "Uncovering Facebook Photo Tagging Culture and Practices among Digital Natives," *Global Media Journal* 13, no. 24 (2015): 3.

likely users are to tag that account. The more users who tag the account, the higher the account's visibility, and the more motivation there is for users to share and tag.¹⁵¹ So, encouraging museum visitors to share on social-media has a positive effect on the museum's social-media visibility. If such encouragement is combined with a well maintained official museum account, the effects are likely to snowball.

One thing to consider when utilizing Instagram for museum purposes is that Instagram is an application for sharing images, which makes it a highly visual forum. As Budge pointed out in her study of Instagram posts surrounding the *Recollect: Shoes* exhibition in Australia, "It is important to note that there is a strong aesthetic sensibility in the way Instagram is used and viewed... Therefore, areas of exhibitions with a strong aesthetic appeal may be more inclined to be photographed and shared on Instagram."¹⁵² Another observation on the content of museum-related Instagram posts by visitors was recorded by Weilenmann et al. In their analysis of Instagram posts taken at the Gothenburg Museum of Natural History in Sweden, they found that there were features of the museum that would show up repeatedly. "These are primarily a blue whale and an elephant in the mammal gallery... These animals are highly recognizable as being located in this particular museum, making them representative of, or emblematic symbols of the museum and even of the city of Gothenburg."¹⁵³ In my own informal review of Instagram posts that were geotagged as being from the Detroit Institute of Arts, I found that a disproportionate number of posts featured the *Detroit Industry Murals* (1932-1933) by Diego Rivera (1886-1957).¹⁵⁴ These murals feature workers at Ford automotive plants. Detroit is synonymous with the auto industry; therefore, these murals serve the dual function, in the case of Instagram, of being both visually striking and emblematic of place. "Visually striking" is a subjective term, but these murals are large; they span all four walls of Rivera Court inside the Detroit Institute of Arts. Additionally, according to the Institute, "[i]t is considered the finest

¹⁵¹ Smith, "The Me/Us/Them model." (pg 11 printed)

¹⁵² Budge, "Objects in Focus," 80-81.

¹⁵³ Weilenmann, Hillman, and Jungselius, "Instagram at the Museum," 6.

¹⁵⁴ "Geotagging or geo-referencing is the process of adding geographical identification metadata to various media such as images and videos in websites, blogs, or photo-sharing web-services." Jiebo Luo, Dhiraj Joshi, Jie Yu, and Andrew Gallagher, "Geotagging in Multimedia and Computer vision—a Survey," *Multimedia Tools and Applications* 51, no. 1 (2011): 189.

example of Mexican mural art in the United States, and the artist thought it the best work of his career.”¹⁵⁵ Because these painting are murals, they are immovable; they can only be viewed in-person in Detroit. Their permanent location combined with their subject matter make them emblematic of place.

A museum without a specific feature that might serve as being emblematic of place can find inventive ways to create one. The SMK’s selfie mirror, deployed for a specific exhibit, could serve as one example. Looking at Fig. 1, the mirror is square and also features the hashtag #smkselfie. Instagram posts are traditionally square shaped. Although the application has since updated its features to allow for other aspect ratios, the platform is still associated with square images. Hence, the square frame of the mirror. The hashtag located in the lower right-hand corner is small enough to not impose on the image and can also be easily cropped out of the image if the user chooses to do so. The hashtag serves two functions: it tells visitors that the place is designated for taking photographs to be shared on mobile platforms, and it gives them a suggested hashtag to use if or when they post a photograph. The hashtag can then be used by other users—or the museum—to track images from the same location. When the hashtag is used, it aggregates photographs into a pool of like images. Users may add their submissions to the pool, so that the image may be seen by a larger group of individuals who might search that pool.

As another example, in 2016 I created a marketing plan for a fictional exhibition of Polaroid images at the Andy Warhol museum in Pittsburgh. One suggestion for this exhibit was to create a Polaroid themed photograph frame to encourage visitors to post on social-media (Fig. 2). The hypothetical photograph station consisted of a Polaroid-shaped frame with the Andy Warhol Museum’s typographic branding located in the lower right-hand corner. The wording and font were consistent with the wording and font used on the museum’s website. Additionally, the branding was made to appear as though it has been stamped on the Polaroid frame, mimicking the stamps that Andy Warhol himself used on his Polaroid images (Fig. 3). Signage next to the frame suggested a hashtag with the explicit statement that the museum

¹⁵⁵ "Rivera Court," Detroit Institute of Arts, accessed July 21, 2018, <https://www.dia.org/art/rivera-court>. Diego Rivera, *Detroit Industry Murals*, 1932-1933, frescoes, Detroit, Detroit Institute of Arts.

may share or retweet posts; this was meant to serve as a motivating factor for would-be posters. The signage also encouraged visitors to follow the museum on Twitter and Instagram, informing them of the usernames for official museum accounts. For museum marketing teams looking for ways to incorporate and encourage photography and social-media sharing, the photography stations in this example, the SMK example, and the examples of images taken at the Detroit Institute of Arts and the Gothenburg Museum of Natural History can serve as illustrations. These examples are tailored to the geographic location, the museum and/or the specific exhibit. They are emblematic of place: a specific museum, a specific exhibit, a specific city or region.

Caveats

While social-media is a great resource for museums to disseminate knowledge, engage with visitors, and raise their profile among potential visitors, it can also be a tricky landscape to navigate. There are certain downsides to social-media that cannot be ignored. Because of the two-way communication of social-media and its inherently public nature, problems can arise. Amelia Wong discussed some of the ethical issues that she has encountered as a museum employee of the United States Holocaust Memorial Museum (hereinafter referred to as USHMM) in a case study:

...[O]n almost a daily basis, the museum's videos [posted on YouTube] also receive virulent expressions of anti-Semitism and racism, and/or attacks on staff and Holocaust survivors who appear in the videos. Based on a loose set of criteria (developed with colleagues) that bans vulgarity, derogatory language, outright abuse, Holocaust denial, and off-topic rants, I currently delete many comments in the interest of trying to prevent the spread of misinformation, hate, and inanity, as well as to shape a space for potential dialog that has a modicum of civility.¹⁵⁶

While this may seem specific to the USHMM, which deals almost exclusively in sensitive topics, other museums are not immune to abusive or explicit comments on public social-media posts. Art museums will also inevitably have exhibits that are sensitive or controversial in nature.

¹⁵⁶ Amelia S. Wong, "Ethical Issues of Social Media in Museums: A Case Study," *Museum Management and Curatorship* 26, no. 2 (2011): 104.

Promoting artwork authored by varying minority groups on social-media will open the floor (the comment section) to anyone who wishes to spew hate—racist, sexist, anti-Semitic, or otherwise. This will put museums in a situation that they must be prepared to handle in an ethical manner. Do you simply delete such comments? Do you respond to misinformation? It is tough to know what the correct course of action should be in these situations. In her article, Wong discussed how she and her colleagues grappled with these issues. Selectively deleting comments would give the people in the museum’s YouTube videos “respectful treatment,” but does that impose on free speech? Wong also questions if “by not exposing people to the full spectrum of responses, are we undermining the museum’s aim to provoke critical thinking?”¹⁵⁷ While turning off the comments feature is an option, that course of action prohibits dialogue.¹⁵⁸ Wong posed a lot of questions in her discussion of the USHMM and offered little by the way of answers. At the time of the article, Wong and her colleagues were still devising a social-media strategy for the museum.¹⁵⁹

The strategies ultimately employed by the USHMM may not be appropriate for other museums, depending on the specific aims and subject matter of those museums. However, there are issues that can arise when museums use social-media, and it is important to identify potential problems and prepare strategies for how to handle them. When museums are on social-media, those accounts are handled by individuals or small teams, but those individuals represent the museum. This is different from personal social-media accounts where individuals are accountable only to themselves. If an individual social-media user makes a mistake, he or she is not risking anyone’s reputation but his or her own. Properly trained staff to manage public social-media accounts as well as having policies and protocols in place will save museums and other institutions from falling into dangerous territory that might reflect poorly on the institution as a whole, rather than the individual overseeing the accounts. Additionally, staff members who are properly trained will be more prepared to handle uncomfortable situations that may arise on social-media platforms.

¹⁵⁷ Wong, “Ethical Issues,” 105.

¹⁵⁸ Wong, “Ethical Issues,” 104.

¹⁵⁹ Wong, “Ethical Issues,” 109.

Chapter 3: Museum Technology Now

While researching this thesis, I read a number of articles and studies that were focused on the different ways that museums can or should incorporate technology. I consulted research focused on psychology, learning, visitor studies, and the technical aspects of incorporating technology into a museum setting. Much of this data seemed abstract and theoretical; how audio-guides could be improved, what might influence visitor behavior, or how technology could be applied to engage audiences and increase learning. I felt that it was also important to look at actual technologies that were being used in museums currently. I wanted to road test museum technologies to see what was happening in relation to museum technology versus what could theoretically happen. To do this, I visited the Art Institute of Chicago in Illinois; the Museum of Fine Arts in St. Petersburg, Florida; the Andy Warhol Museum in Pittsburgh, Pennsylvania; and the Cleveland Museum of Art in Ohio.¹⁶⁰ During these visits, I observed and engaged with a range of technologies, including museum mobile applications, digital exhibits, audio/visual galleries, interactive exhibits, and augmented reality. In this chapter, I will report on my findings and observations of what the user experience is like regarding current museum technologies in these museums.¹⁶¹

In February of 2017, I visited the Art Institute of Chicago (hereinafter referred to as AIC).¹⁶² Their extensive collection is spread over four floors, and ranges from ancient Etruscan vases dated to the fifth century BCE, to contemporary video installations that are less than fifteen years old. In preparation for this visit, I downloaded the museum's mobile software application onto my cell phone. The application was loaded with a wide variety of self-guided tours. You could tour by collection, such as Impressionism or American Folk Art, or you could tour by theme. My personal favorite theme was Ferris Bueller's Day Off, which would lead you to a few of the works that Ferris, Sloane, and Cameron visited on their adventure at the Institute in the 1986 movie of the same name. The application also had a wayfinding feature that tracked your location to help guide you on your tour. Unfortunately, this feature did not work for me and I was incredibly frustrated when I could not use it to make my way from

¹⁶⁰ These museums may be found on the web at artic.edu, mfastpete.org, warhol.org, and clevelandart.org, respectively.

¹⁶¹ For a breakdown of mobile application features available in the applications I tested, please see Table 2.

¹⁶² The AIC is located in downtown Chicago and its encyclopedic collection includes roughly 300,000 objects.

painting to painting.¹⁶³ The reason why wayfinding is helpful in an incredibly large museum is two-fold. First, wayfinding helps you navigate spatially in a museum, just like an analog museum map. Second, if the application knows your location within the museum, it makes it much easier to find didactic information on artworks. Instead of searching for an artwork within the application, the application will pull up a scrollable list of artworks that are in the gallery in which you are located. Because the wayfinding feature was not working for me, accessing information within the application was inconvenient. After wasting time trying to get this feature to work, my frustration with the mobile application outweighed any of its benefits; I shut it off and did not use it for the remainder of my visit. As of February 2018, the AIC's Android application is no longer available; it is still available for Apple.

My visit to the AIC was the first time that I had used a museum's mobile application. Even though that particular experience was a little frustrating, I was excited about the possibilities. Since that trip, I have downloaded and used museum mobile applications for The Toledo Museum of Art, The Museum of Fine Art in St. Petersburg Florida, and the ArtLens application for The Cleveland Museum of Art. These applications range in complexity; some offer only basic information that is identical to the museum's wall labels, while others feature augmented reality and videos narrated by curators. In this chapter, I would like to discuss the ways that mobile applications are being used in museums right now as well as other ways that technologies are being implemented.

The Art Institute of Chicago

The AIC's Android application is no longer available; however, the Apple application is still available. According to the Apple store's information on the AIC's mobile application, the application was launched in October of 2016 and was last updated in December of 2017.¹⁶⁴

¹⁶³ It is unclear why the application could not detect my location. It could have been an issue with the application itself, or it could have been user error. I took a seat on a bench and spent about 15 minutes trying to troubleshoot the issue before deciding that my time would be better spent enjoying the museum.

¹⁶⁴ The Art Institute of Chicago. "Art Institute of Chicago App." Apple Store, vers. 1.1.7 (2017) <https://itunes.apple.com/us/app/art-institute-of-chicago-app/id1130366814?mt=8>

Because the Android application has been taken down, there is no information on it in the Google Play store. It was available in February of 2017 but has since been removed.

It is unclear why the Android application was not replaced or fixed. Perhaps the AIC decided to scale back its mobile technology in order to focus on doing it really well before offering it everywhere. This, of course, is just a theory. Currently the only application from the AIC for Android devices is a Digital Member Card. This application allows users “to carry their member cards on their Android device rather than in their wallets or purses.”¹⁶⁵ The application replaces a paper member card and has all of the same benefits. The application creates a barcode that can be scanned for entry to the museum and to access member discounts at the museum’s restaurants and shops.¹⁶⁶

The mobile application available to Apple users is an all-in-one design that features audio-guides, wayfinding, and the digital membership card. The map in the Apple application is interactive and location-aware: you can browse the artworks in the galleries from wherever you are.¹⁶⁷ This feature could be used to plan your visit before you go or be consulted while in the museum to assist in deciding where you would like to go next. This is in addition to the traditional use of a museum map to help orient and guide you, while you are in the space. The application also features an audio-guide that functions like a traditional audio-guide but uses your cell phone or tablet in place of a traditional hand-held device. Users simply type in “[...] the three-digit number listed on the artwork label to access audio content.”¹⁶⁸ Finally, the application has preset tours that take users to a variety of works throughout the museum. A great feature of the audio clips on these tours is that they do not sound like traditional audio-guide snippets of a nameless person reading a scripted description. The AIC appears to have taken a cue from podcasts, giving the audio clips on its tours a higher production value that includes music and sound effects- or as they describe it: “sound design that accentuates the

¹⁶⁵ The Art Institute of Chicago. “Digital Member Card.” Google Play Store, vers. 1.3 (2016)
<https://play.google.com/store/apps/details?id=edu.artic.digitalmembercard>

¹⁶⁶ The Art Institute of Chicago, “Digital Member Card.”

¹⁶⁷ The Art Institute of Chicago, “*The New Mobile Experience*,” Artic.edu, <http://extras.artic.edu/new-mobile/#video>

¹⁶⁸ The Art Institute of Chicago, “*The New Mobile Experience*.”

narrative.”¹⁶⁹ Narrators introduce themselves and speak in a more casual, conversational tone that feels spontaneous rather than scripted. The result is audio clips that feel like a conversation or an interview, rather than monotonous reading of facts.

Through the magic of technology, visitors on these mobile application tours can have the feeling that they are being given personal tours by curators and staff who have the most insight into the works. This is something that is not practical for museums to do in person, every day, to any visitor. Even though my experience with the AIC’s application was not a great one, I hope that they work the kinks out and eventually offer the application to all mobile platforms. I would gladly go back to the museum and give the mobile application a second chance.

Museum of Fine Arts, St. Petersburg

The next museum mobile application that I tested was MFA Viewpoint, which is an application designed for the Museum of Fine Arts in St. Petersburg, Florida.¹⁷⁰ I visited this museum and tested the application with my husband, Jeff, in May of 2017. I found it useful to get feedback and perspective from Jeff because he is not a person with an art history background, and he has much less experience with museums than I do. Ideally, he would be able to reflect on the experiences of the casual museum-goer in relation to museum technology.

MFA Viewpoint has four main sections: *Explore*, *Portfolio*, *Visit*, and *Calendar*. The *Calendar* section is a list of events and programs. Users can scroll through and see upcoming events, times and costs, and they can even purchase tickets. The *Visit* section has information on the museum’s hours, admission prices, docent tours, and contact information. The latter has clickable links that will open other applications on users’ phones. For example, if you select the museum’s phone number in the application it opens the cellphone’s calling feature with the museum’s phone number already entered. Users then only need to click the send button to call

¹⁶⁹ The Art Institute of Chicago, “*The New Mobile Experience*.”

¹⁷⁰ HD Interactive Inc, “MFA Viewpoint,” Google Play Store, vers. 1.1.9 (2017).
<https://play.google.com/store/apps/details?id=com.hdinteractive.mfaviewpoint>

the museum directly. The same is true for the museum's email and web addresses. Clicking on these links will open the user's email application or web browser with the pertinent information already filled out.

While the *Visit* and *Calendar* sections of the application offer practical tools for preparing for a visit to the museum, the *Portfolio* and *Explore* sections are useful while visitors are at the museum itself. In the *Portfolio* section, users can create sketches, journal entries, and poetry. The sketchbook is very similar to MS Paint (Fig. 4). To create a sketch, users can choose colors and the size of their brush then "sketch" using the touch screen on their mobile device. When finished, they can save their masterpiece to their phone or submit it to the application's administrators.¹⁷¹ Users can also scroll through sketches submitted by other users that have been approved by administrators. Journal entries are text documents where visitors can write about their experience at the museum. Like the sketches, users can save their entries or submit them to the administrators, or scroll entries by other users. The poetry section is a digital version of refrigerator magnet poetry (Fig. 5). Preselected words are available in alphabetic order, so users can drag and drop them to create a poem. As with the other features, finished products can be saved to the user's device and/or submitted to the administrators and approved submissions can be viewed in the application. The MFA describes these activities as a way for visitors to "share ideas, drawings and verse and create a community of art-inspired conversation."¹⁷² These features within application create a platform for museum-goers to not only engage with the art, but to engage with others as well.

The *Explore* section of the application has three sections: MFA Collection, Collection Highlights, and Custom Tours. Collection Highlights and Custom Tours both include preset tours of the collection. These tours are likely designed to be self-guided by visitors to the museum; however, application users can view the art digitally and listen to audio clips anywhere. The Collection Highlights are divided into two tours: one of the north wing and one of the south wing. Custom tours are created around a theme and include a kids' tour and a tour of works

¹⁷¹ It is unclear who exactly the administrators are; the approval process is most likely in place to filter out explicit or offensive content.

¹⁷² HD Interactive Inc, "MFA Viewpoint."

that feature headwear. The “Topper Tour” was created as “a companion to the exhibition of *Dorothy Height’s Hats*,”¹⁷³ and features paintings and sculptures that include hats or headwear including an African mask and a Greek amphora with warriors wearing Corinthian helmets. By selecting one of these tours, users are taken to a map of the museum that shows the works and path of the tour (Fig. 6). Then, they are given a list of the stops with images, clicking on these will open up a page for the artwork. From there, users can read the gallery label or listen to the audio clip (Fig. 7). All of the audio clips in the children’s tour are read by children.

The MFA Collection feature in the *Explore* section is essentially an audio-guide for the museum. Opening this section of the application, users are taken to an interactive map of the museum. From there, users can select the gallery that they are in and choose an artwork from that gallery. By selecting the artwork, they can read the gallery label or listen to an audio clip. Audio clips are almost always an audio version of the gallery label, read without additional information. Users can also scroll below the artwork and see sketches, journals, or poems created by other users, inspired by that work. Users can create and submit their own entries. A final feature available under individual works is the ability to post the artwork to Facebook. The Facebook icon opens the Facebook application and a post, including an image of the artwork, is uploaded and ready to edit for sharing on the platform.

When I used the MFA Viewpoint application during a visit to the museum in May of 2017, I recorded some of my thoughts about the experience. The usability of the application was good; it felt intuitive and clear. The application ran smoothly and was not glitchy or slow. I had hoped that the map feature would include wayfinding, or the ability to identify the user’s location within the map, but it did not. This was a disappointment, but it turned out to be less of an inconvenience than I imagined. Because the museum is mid-sized and on a single floor, it was not difficult to assess my location on the map. The galleries were labeled in the museum and on the application’s map, making it easy to find information on the art in the gallery from

¹⁷³ HD Interactive Inc. “MFA Viewpoint.”

Dorothy Height’s Hats was a temporary exhibition that ran from April 29th, 2017 to September 4th, 2017. This tour has since been removed from the Viewpoint application. More information about this exhibition may be found on the museum’s website: <http://mfastpete.org/exh/dorothy-heights-hats/>

where I was located. As for the audio clips, I was disappointed that they did not contain more information than the wall labels. I am accustomed to audio-guides that give deeper insight into a work. My guest (spouse), on the other hand, really enjoyed the audio feature. He felt that it was easier to listen to the information on the artwork while looking at it, rather than reading the information and viewing the art separately. This, of course, makes sense. It is much easier to synthesize information about a technique or theme with the visual information in the art if you are able to do those things simultaneously. Neither of us used the sketch, poem, or journal features, and it appeared as though there were not many submissions under each artwork. Perhaps it was a newer feature and had not been utilized very much. While these features were not very interesting to us, they could be useful or interesting to younger visitors. Or, perhaps it would have been more informative to see others' reactions to the art, if more submissions had been available to view.

One final technological feature at the Museum of Fine Arts in St. Petersburg was a digital display of photographs that could be considered controversial. The museum installed a pedestal with photographs displayed on a looped digital slideshow (Fig. 8). The photographs were from a series by Jacob Holdt (1947-present) titled *American Pictures* (1971-1976). A panel next to the display provided contextual information on the series, as well as a warning that the "video includes images that may not be suitable for children."¹⁷⁴ I have only seen photographs displayed this way at one other museum: the United States Holocaust Memorial Museum in Washington D.C. The advantages to this method of display are that it ensures that children do not accidentally see something that their parents might find objectionable; moreover, it gave viewers a warning and allowed them to choose if they wished to view sensitive content. The disadvantage of this display was that the photographs did not have the same impact as actual, correctly sized prints. Viewers could not view the exhibition as a collection of images, and photographs were only shown for a few seconds at a time before moving on to the next image. If viewers wanted to investigate an image further, they would have had to wait for the whole series to loop around again. This is not how viewers are accustomed to seeing art in a museum,

¹⁷⁴ Museum label for Jacob Holdt, *American Pictures*, St. Petersburg, Museum of Fine Art, 24 May 2017.

and I found the experience to be impractical. However, curators must weigh the advantages and disadvantages and decide what works best for their museums and their audiences.

The Andy Warhol Museum

I visited the Andy Warhol Museum (herein after referred to as the Warhol) in Pittsburgh in January of 2018. The Warhol did not have a mobile application, but it did have a couple of interesting interactive technological features. First it had an interactive Commodore Amiga 1000 personal computer from the 1980s. Using the Amiga computer, users could explore digital artworks that Andy Warhol (1928-1987) created in the 1980s with graphic software on an Amiga (Fig. 9). These images were discovered in 2014 and were “new, computer-generated Warhol images, locked away on a floppy disk for nearly 30 years. Made on an Amiga computer in 1985, the images were unlocked by the members of Carnegie Mellon University Computer Club...”¹⁷⁵ A sign next to the Amiga encouraged visitors to explore the images on the computer and to “Please be patient – the system is designed to mirror the interface and processing speed of the original 1985 Amiga”¹⁷⁶ (Fig. 10). The delayed reaction of the slower processing on this computer was noticeable and the artworks were pixelated. The pixelation of the digital images seemed rudimentary in comparison to the high resolution digital artworks of the present. The images, however, were not unlike other works by Warhol (Fig. 9). The interactive Amiga display was part of a larger exhibit of Warhol’s Amiga artifacts, including floppy discs used for storage, graphic design programs, and an Amiga magazine with Warhol on the cover (Figs. 11-12).

The museum also had a “Film and Video Gallery,” where visitors could sit at one of twelve touch screen monitors equipped with headphones and browse through a large collection of Warhol audio/video content (Figs. 13-15). This included screen tests, full length movies, and episodes of Warhol’s talk show *Andy Warhol’s Fifteen Minutes*. Because Warhol had a wide range of film media, a film and video gallery where users could browse the

¹⁷⁵ Michael Woodson and McKenzie Graham, "Andy Warhol's digital images: the master of pop art continues to make his mark as his forgotten images come to light," *The Artist's Magazine*, October 2014, 6. (accessed February 22, 2018). <http://link.galegroup.com.libproxy.umflint.edu/apps/doc/A380747983/BIC1?u=umuser&id=ceed724a>.

¹⁷⁶ Museum label for Andy Warhol, *Interactive Amiga 1000*, Pittsburgh, The Andy Warhol Museum, January 27, 2018.

collection on their own makes sense. There were other exhibits in the museum that had videos playing, but they were relevant to a specific theme or period in Warhol's career. When I visited the Warhol about 10 years ago, it had one screening room that played a video on a loop that was switched out periodically. The advantages to having a gallery dedicated to audio and visual content is that users can browse and view the content that interests them. It provides much more access to Warhol's collection and it is done in such a way that is not intrusive to other visitors. The gallery was in a dedicated room with doors that close, while the lighting was dark to mimic the ambiance of a movie theater. Each station was equipped with headphones so that users could watch videos without disturbing others. Users had control over content with which they might choose to interact, and they could pause, fast forward, and rewind. None of these features are available to traditional screenings of video content in museums.

The film and video gallery at the Warhol was a museum feature that I had never experienced before and an ingenious use of technology. This feature worked very well for the Warhol museum, because it is a single artist museum with an extensive collection of film and video. It is hard to say if this type of gallery would have the same impact at other museums. Artists who work in digital media might not want their work displayed in the same manner that gives viewers so much control over the viewing experience.

Cleveland Museum of Art

I visited the Cleveland Museum of Art (hereinafter referred to as CMA) in January of 2018 to review its mobile application as well as the museum's interactive ArtLens gallery that had a variety of digital activities. The museum's mobile application, also named ArtLens, works in conjunction with the ArtLens gallery that includes the ArtLens wall, studio, and exhibition. When entering the museum, the ArtLens gallery was to the immediate left of the information desk, while the art galleries were on the other side of a large atrium (Fig. 16). The positioning of the ArtLens suite next to the only entrance, separate from the galleries, made it a convenient stop either before or after visiting the galleries.

ArtLens Gallery: Wall

Almost all of the activities in the ArtLens suite worked well as end-of-visit activities. The only feature that I wish I had used pre-visit was the ArtLens wall (Figs. 17-18). The ArtLens touch screen wall spanned 40 feet and was large enough that ten or more people could experience it simultaneously.¹⁷⁷ It featured scrolling images of every artwork displayed at the museum, or “between 4,200 and 4,500 artworks at any given time.”¹⁷⁸ Users could select artwork that interested them for more information, such as its location in the museum, artist, date, or medium. From a selection, users could then browse similar works by medium, era, or subject. The wall could also connect with a user’s device via Bluetooth, allowing users to save their favorite works to the ArtLens application. While I was browsing the ArtLens wall, I found a painting that I had missed during my visit to the galleries. I saved the painting to my favorites in the ArtLens application and, armed with its location, dragged my spouse back through the galleries to find it. Because the ArtLens wall displayed all of the objects currently on view, it would have worked better as a pre-visit activity. Users could look for objects that would be of most interest to them, save them to their devices, and make sure that they see them. It provided a way to access the entire collection at once and whittle it down to specific objects of interest. Furthermore, it was less intimidating than walking through a 3-story museum and trying to digest everything that was on view; navigating a large space can feel overwhelming but having the ability to scroll through objects made narrowing choices easier.

ArtLens Application

The ArtLens application has a search bar and four main sections: *Galleries*, *Tours*, *You*, and *Museum*. The search bar allows users to search for objects that are currently on view; users are directed to the museum’s website if they wish to search the entire collection.¹⁷⁹ One downside to the search is that it only returns items that have the search term in the title or

¹⁷⁷ The Cleveland Museum of Art, “ArtLens Wall,” *ClevelandArt.org*, <http://www.clevelandart.org/artlens-gallery/artlens-wall>

¹⁷⁸ The Cleveland Museum of Art, “ArtLens Wall.”

¹⁷⁹ The Cleveland Museum of Art, “ArtLens,” Google Play Store, vers. 3.0.83 (2018). <https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>

name of the artist. For example, searching for “sculpture” return only two works: a sculpture with the word “sculpture” in the title, and a photograph with the word “sculpture” in the title. By selecting a work in the search results, users are taken to a page with a photograph of the work, wall label information, the object’s location, and artworks located nearby. If there is multimedia content available for an object, it will be on the object’s page as well.

The *Galleries* section is a location-aware interactive map (Figs. 19). The museum offers galleries on 3 levels, so users must select which floor they are on. By selecting the “find me” button next to the map, the user’s location is detected and then shown on the map. This feature proved to be incredibly useful for navigating such a large museum. It was easy to become disoriented, so opening the map and having a pinpoint of your location within that map was a fast and easy way to reorient oneself. The *Galleries* page also has a list of galleries in the museum. If you wanted to find a specific type of art, it is a convenient resource. For example, if you open the galleries list and click on “Dutch Painting,” the application enlarges the Dutch Painting gallery on the map. From here, it is easy to zoom out and find your position relative to your destination. Additionally, you can browse some of the paintings available in that gallery on the application. The last feature in the *Galleries* section of the application is an augmented reality scanner. In the *Galleries* section, a camera lens aperture icon may be found. By selecting this icon, the device’s camera opens and can scan artwork in the galleries. Objects with augmented reality content are identified by an aperture icon next to their label (Fig. 20). With the camera showing the object on the screen, interpretive information is overlaid onto the image. The features are then clickable, giving users additional information.

The benefits of augmented reality in this application are that it can serve as a diagram. If a specific feature of an object is relevant to the interpretive information, it can be highlighted on the screen and then explained via the clickable text. For the painting, *The Miracle of Saint James the Greater* (1726) by Noël Nicolas Coypel (690-1734),¹⁸⁰ Saint James is identified in the augmented reality overlay on the image. By selecting the text on their smartphone screen, users are given more information on who he was (Figs. 21-22). As seen in figure 20, this

¹⁸⁰ Noël Nicolas Coypel, *The Miracle of Saint James the Greater*, 1726, oil on canvas, 50 15/16 x 42 5/16 in., Cleveland, The Cleveland Museum of Art.

painting also had the ArtLens headphones icon next to its label. This icon lets users know that there is multimedia content available for this object. For this example, there are three videos available for view in the application, all of which are audio narration over static images. On occasion, the image might change to a close-up view of a particular feature, or, in the case of three-dimensional objects, to another angle. In this way, the videos function much like an audio-guide with visual elements that correlate to the features that the narrator is discussing. Another beneficial feature of the videos is that they identify the narrator. In the videos for *The Miracle of Saint James the Greater*, the narrator is John Seydl, who is Junior Curator of European Paintings and Sculpture 1500-1800.¹⁸¹ The videos are short, under two minutes in length, and provide information about the painting and the artist. Another effective element of the videos is that the narration is unscripted and conversational. Much like the AIC's audio clips, these videos feel like a personal tour given by museum curators- they are casual, conversational, and insightful.

The *Tours* section of the Application features curator and visitor-created tours. They are broken down into four categories: featured, multimedia, themed, and visitor created. One helpful aspect of the tours is that they list the number of stops and offer an approximate time length for completion. After selecting a tour, users are taken to a screen that has a brief description of the tour and a map of the tour stops. The map gives the room number of the stop and includes an image of the object on that stop. By clicking the image, users are given information on that artwork. By selecting "next," the map moves to the next object and its gallery. This feature functions well and is intuitive to use. In the *Tours* section of the application, users can also create their own tour using artworks that they have bookmarked, or favorited, in the ArtLens application. Users simply select artworks from their favorites and give their tour a title and description. When they are finished, the tour is available in the application for others to use. Users could potentially create a tour of objects that they wish to see before visiting the museum and then use the tour feature to navigate quickly to everything on their "must-see" list. There were 75 user-created tours available in the application in August of 2018.

¹⁸¹ Cleveland Museum of Art, "ArtLens."

The *You* section of the application lists all artworks and tours that the user has favorited. Favoriting an artwork is easy, intuitive, and functions similarly as the “like” button on Facebook and other social-media sites.¹⁸² Artwork pages in the application have a heart icon next to the title that can be marked to “favorite.” Once clicked, the heart turns red to indicate its favorited status. Objects can be favorited in the application, or on the ArtLens wall when the user’s device is connected via Bluetooth. Favorite works can be easily revisited later. This feature was useful to me because I forgot to bring headphones to the museum and was not comfortable playing the interpretive videos that were available while in the galleries. The favorite function allowed me to revisit these artworks and watch their accompanying videos later when it would not be a disturbance to others.

The final section of the ArtLens application is the *Museum* section. This section gives practical visitor information, such as museum hours, special events, and special exhibitions. This section also has information on where to find restrooms, elevators, and exits. Lastly, this section of the application has a “help” feature that can assist users with enabling permissions on their phone that make the application work correctly, such as, location, Bluetooth, and saving photographs. It also checks to make sure that the device is connected to the museum’s Wi-Fi, enabling the application to work quickly and effectively. If users are still having trouble, they are directed to on-site technicians in the ArtLens gallery for further assistance.

ArtLens Gallery: Exhibition and Studio

The ArtLens Gallery includes the ArtLens Wall, Exhibition, and Studio. The Exhibition “features a selection of artwork from across the museum’s collection intertwined with interactives that respond to body movement, facial recognition, and gaze tracking without touching a screen.”¹⁸³ This area had stations set up with various activities, such as changing the facial expression in an artwork and mimicking “the pose of a character in an artwork.”¹⁸⁴ These

¹⁸² Twitter originally used the term “favorite,” but the platform switched to “like” in 2015. Aki Kumar, “Hearts on Twitter,” Twitter, November 3, 2015, accessed August 07, 2018, https://blog.twitter.com/official/en_us/a/2015/hearts-on-twitter.html.

¹⁸³ Cleveland Museum of Art, *ArtLens Gallery: Create, Engage, Connect*, (Cleveland: Cleveland Museum of Art, 2018.)

¹⁸⁴ The Cleveland Museum of Art, “ArtLens Exhibition,” *ClevelandArt.org*, <http://www.clevelandart.org/artlens-gallery/artlens-exhibition>

activities may be designed to help visitors fully understand how meaning and emotion are conveyed in art. Another station in the ArtLens exhibition could track visitors' eye movements. Visitors are encouraged to look at an image for set period while their eye movements are tracked. Next, the display shows how their eyes moved around the artwork. This activity helps visitors to understand "how an artist's compositional choices influence how art is viewed."¹⁸⁵

The ArtLens Studio has stations where visitors can create art digitally. Stations included a "Pottery Wheel," "Collage Maker," and "Portrait Maker." The Pottery Wheel station uses movement tracking to digitally show how hand movements shape pottery on a potter's wheel (Fig. 23). The Collage Maker station employs touch-screen technology to allow visitors to create collages digitally (Fig. 24). The Portrait Maker station takes photographs of visitors who can then digitally overlay it in various styles of media, such as oil or watercolor. Masterpieces can be saved and uploaded to a dedicated Tumblr page.¹⁸⁶

The ArtLens Gallery is described by the CMA as an "intergenerational suite of experiences designed to help you look closer, dive deeper, and strengthen your experience with the museum's collection."¹⁸⁷ It is interesting that the word "intergenerational" was used; during my visit to the gallery, most of the people interacting with the stations were children with parents or grandparents. I did not observe adults by themselves, except for a small group of high school to college-age young adults. It felt like a beneficial area for educating and entertaining younger visitors. The ArtLens gallery was a collaborative project between the "curatorial, digital innovation and technology services, education and academic affairs, and design departments at the Cleveland Museum of Art."¹⁸⁸ Additionally, "museum educators were instrumental in curating the space and its related experiences."¹⁸⁹ The influence of museum educators is evident in this space. Every activity is designed to help support visitors' understanding of art and artmaking, making the activities educational as well as entertaining.

¹⁸⁵ The Cleveland Museum of Art, "ArtLens Exhibition."

¹⁸⁶ Tumblr.com is a multimedia social-media blogging platform. The dedicated ArtLens Tumblr page can be found at <https://creategallery.tumblr.com/>

¹⁸⁷ Cleveland Museum of Art, *ArtLens Gallery: Create, Engage, Connect*.

¹⁸⁸ The Cleveland Museum of Art, "ArtLens Exhibition."

¹⁸⁹ The Cleveland Museum of Art, "ArtLens Exhibition."

Technology, in this case, is not used simply because it exists. It is wielded as a tool to engage the audience and assist with comprehension and analysis.

The ArtLens gallery and mobile application have won numerous awards, including five Museum and the Web Awards in the categories of Digital Exhibition, Mobile, Groundbreaking, and Exhibition Media or Experience.¹⁹⁰ The Best of the Web Awards, also known as the GLAMi's, were created to "recognize and celebrate the most innovative projects in the cultural heritage sector."¹⁹¹ While the existence of such awards could be interpreted as a demonstration of how the museum field is changing, Museums and the Web was founded and giving out awards in 1997.¹⁹² Some of these awards sound a bit dated, such as Best Website, but others would not be out of place in 2018, such as Best Interactive Exhibit.¹⁹³ The ways that the CMA and other museums have incorporated digital technologies are certainly innovative, but the use of digital technologies in the context of museums is not new.

¹⁹⁰ An up to date list of awards for the ArtLens gallery and mobile application can be found here: The Cleveland Museum of Art, "Awards/Collaborators," *ClevelandArt.org*, <https://clevelandart.org/artlens-gallery/collaborators>

¹⁹¹ "GLAMies and Best of the Web," Museums and the Web, accessed August 06, 2018, <https://www.museumsandtheweb.com/best-of-the-web/>.

¹⁹² "About," Museums and the Web, accessed August 06, 2018, <https://www.museumsandtheweb.com/welcome-to-museumsandtheweb-com/>.

¹⁹³ "Museums and the Web 1997: Best Museum Web Contest," Museums and the Web, accessed August 06, 2018, <https://www.museumsandtheweb.com/mw97/mw97best.htm>.

Chapter 4: Recommendations for Museum Mobile Application Features

Thirty years ago, it would have been uncommon for a museum to have a website. A website would not have been the best use of a museum's resources because the average American did not have access to the internet- less than .1% of the U.S. population accessed the internet in 1990.¹⁹⁴ As internet access and usage has climbed, the need for a web presence has become more apparent. In 2018, the percentage of Americans using the internet has climbed to just under 75%.¹⁹⁵ And, unsurprisingly, not a single museum mentioned in this thesis is without a website. The Apple App Store launched in 2008 with over 500 applications available.¹⁹⁶ As smartphone usage has increased in the last 10 years, so has the number and variety of applications available.¹⁹⁷ As internet usage increased, so did the logical need for websites. As smartphone and mobile applications become ubiquitous, I predict that museum mobile applications will become more widely used and will be a practical addition to museum digital content. In this chapter, I will discuss some of the positive aspects of museums applications and some features for museums to consider that add value for users, provide aid to educational and group visits, and can assist with offsetting the costs of application development.

There are a variety of ways that museums can incorporate technology, from large scale interactive exhibits, to iPad stands to solicit visitor feedback. The costs of these technological additions can range from manageable to prohibitively expensive. The most useful technological component for the average museum to utilize is the museum mobile application. An application gives the museum a range of options as far as features that it could incorporate; additional features can be added later based on need, resources, feedback, etc. There are multiple companies that create mobile applications for museums at varying price points.¹⁹⁸ The

¹⁹⁴ Julia Murphy and Max Roser, "Internet," Our World in Data, 2018, accessed August 04, 2018, <https://ourworldindata.org/internet#growth-of-the-internet>.

¹⁹⁵ Murphy and Roser, "Internet."

¹⁹⁶ "Apple's App Store Launches with More than 500 Apps," AppleInsider, July 10, 2008, accessed August 04, 2018, http://appleinsider.com/articles/08/07/10/apples_app_store_launches_with_more_than_500_apps.

¹⁹⁷ Smartphone ownership doubled in the United States between 2011 and 2018, going from 35-75%. See "Mobile Fact Sheet," Pew Research Center: Internet, Science & Tech, February 05, 2018, accessed August 04, 2018, <http://www.pewinternet.org/fact-sheet/mobile/>.

The Apple App Store currently has 2 million applications available and the Google Play Store has nearly double with 3.8 million. See "App Stores: Number of Apps in Leading App Stores 2018," Statista, May 2018, accessed August 04, 2018, <https://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/>.

¹⁹⁸ This article gives an overview of companies that create and host mobile applications for museums and other cultural heritage sites. This article also gives information on costs and features that offered by each company.

advantage of a museum mobile application is that it does not require hardware, as pointed out by Gido Hakvoort, Eugene Ch'ng, and Russell Beale, researchers from the University of Birmingham in the United Kingdom:

One of the greatest challenges for museums is to make the technology unobtrusive for their visitors and also to keep a low 'technological footprint'. Well designed Smartphones are perhaps the first technology to meet these two expectations: they get carried in by visitors, and they are taken away when they leave, and are personal items with which visitors are familiar – they know how to use it.¹⁹⁹

Museum staff do not have to worry about supplying or providing technical support and maintenance for the hardware. This cuts down significantly on the cost. Additionally, museums do not have to concern themselves with devices getting lost, stolen, or damaged. When technology advances, museums are not stuck with the financial burden of replacing obsolete hardware. Applications can be simple or complex based on the museum's needs and budget, and the software can always be updated. Mobile applications can also supplement income by soliciting donations, driving traffic, and promoting retail areas within the museum.

According to the Pew Research Center, more than three quarters of adults in the United States own a smartphone and more than ninety percent of young adults (ages 18-29) own a smartphone.²⁰⁰ This means that mobile applications will be available to large sections of museum audiences. However, older Americans, Black Americans, Americans with less education, and poorer Americans are less likely to own a smartphone.²⁰¹ Because of this, museums must consider ways in which they can mitigate against privileged access to mobile content. An easy solution is to have devices available for visitors to check out during their visit. This, of course, raises the cost of implementing mobile applications. However, the cost is much less severe than having dedicated hardware that is only available through the museum. Most visitors will have access to a smartphone if they wish to use mobile content. Additionally, some

Jeffery Guin, "Mobile Tour Platforms for Museums and Cultural Sites," *Voices of the Past*, June 03, 2017, accessed June 10, 2018, <http://voicesofthepast.org/2017/02/15/review-mobile-tour-platforms-museums-cultural-sites/>.

¹⁹⁹ Gido Hakvoort, Eugene Ch'ng, and Russell Beale, "The Museum Environment: A Complex Community of Objects, People and Devices," *International Journal of Heritage in the Digital Era* 1, no. 1 (2012): 1.

²⁰⁰ Lee Rainie and Andrew Perrin, "10 Facts about Smartphones as the iPhone turns 10." *Pew Research Center*, June 28th, 2017. <http://www.pewresearch.org/fact-tank/2017/06/28/10-facts-about-smartphones>

²⁰¹ Rainie and Perrin, "10 Facts."

demographics, such as older Americans, might be less interested in mobile content and forego using it altogether, regardless of access.²⁰²

Features for Users

For a mobile application to be successful, it must provide features that are useful and enjoyable to its users. If an application does not provide some form of value to the user, why would anyone use it? Some features that museums should consider when developing a mobile application are: audio-guides, personalization, gamification, and wayfinding. Wayfinding and audio-guides within a mobile application are just technologically advanced features of tools that museums already use, such as traditional audio-guides and maps. Museum administrators already know the benefits of audio-guides. They allow users to hear information about art works while they look at the art itself. “Heads up” features are important for visual arts museums because they are not seen as a distraction from the works themselves.²⁰³ Wayfinding is a simple technological advancement from paper museum maps. It aids visitors with navigation in real time. There is evidence to suggest that having good information and directions aids museum visitors in having a positive museum experience, whereas lack of information is detrimental. In a study of museum visitor behavior, Christina Goulding, a researcher from Wolverhampton Business School in the United Kingdom, found that visitors must feel comfortable to intellectually engage and make the most of their visit.²⁰⁴ Because wayfinding is a feature that assists users in orienting themselves within the museum, it could be argued that wayfinding is an important feature that leads to higher quality visitor engagement. Maps in a museum’s application can range from basic to complex. As discussed in the previous chapter, the map in the mobile application for the Museum of Fine Art in St. Petersburg, Florida, was fairly basic. Rooms could be individually selected, but the map did not find users’

²⁰² Older Americans tend to be less comfortable with technology and might be less interested in utilizing it for a museum visit. Margee Hume, “To Technovate or Not to Technovate? Examining the Inter-relationship of Consumer Technology, Museum Service Quality, Museum Value, and Repurchase Intent,” *Journal of Nonprofit & Public Sector Marketing* 27, no. 2 (2015): 160. Citing S. E. Koester, D. Bearman, and B. Wright, “Interactive Multimedia in American Museums,” *Archives & Museum Informatics*, no. 16 (1993).

²⁰³ An audio-guide is a “heads-up” display; users can listen to the audio and view art simultaneously. In contrast, a “heads down” display describes how users must look down at a device for information.

²⁰⁴ Christina Goulding, “The Museum Environment and the Visitor Experience,” *European Journal of Marketing* 34, no. 3/4 (2000): 273.

locations within the map. This map worked well for a mid-sized, one-story museum in which it is difficult to get lost. In contrast, the map feature in the CMA's ArtLens application could locate a user's position within the map, which was incredibly helpful when one considers the size of the museum: nearly 600,000 square feet in total with 130,000 square feet of gallery space spread over three floors.²⁰⁵

One feature that is quite common on many popular mobile applications is the ability to make personalized suggestions. Pinterest, YouTube, Spotify, Pandora, TripAdvisor, and Netflix all give users personalized recommendations based on the things that they like. This feature could easily translate to an art-museum setting. Recommendations could be based on media, region, subject matter, style, etc. Museums generally group art based on time period, but artworks featuring similar styles or subject matter could exist all over the museum. Having a feature where users could rate artworks that they like could then generate a list of artworks to recommend. When users are in proximity to an artwork on the recommendation list, a notification could pop up and alert the user. The ArtLens application and wall use suggestions, although they are not based on users' "favorites." The wall allows users to browse artworks that share the same medium, time period, or region, or medium, but artworks featuring similar styles or subject matter could exist all over the museum. When users are in proximity to to an artwork on the recommendation list, a notification could pop up and alert the user. Having a feature that allows users to rate artworks that they like could generate lists of artworks to recommend. The ArtLens application shows users artworks that are near the user's location or near a selected artwork being viewed in the application. The application also shows visitor favorites that are nearby; these are based on the number of times nearby artworks have been favorited by other users. These give suggestions based on overall popularity within the application, but not personalized based on an individual's favoriting activity. However, because the ArtLens wall can connect to users' devices via Bluetooth, visitors can create their own personalized tours made from "favorites" that they have selected.

²⁰⁵ Kelley Notaro. "Cleveland Museum of Art Concludes Capital Campaign," *The Cleveland Museum of Art*, Oct. 24, 2016, <http://www.clevelandart.org/about/press/media-kit/cleveland-museum-art-concludes-capital-campaign>

A prototype of a mobile technology that offers personalized recommendations was developed for the National Gallery of Australia by Richard Yu-Chang Li and Alan Wee-Chung Liew at Griffith University in Queensland, Australia. The mobile application serves as an audio-guide, provides wayfinding, and offers recommendations based on short quizzes. The researchers' basis for this prototype is that personalization boosts value and wayfinding helps visitors find what they want to see more quickly.²⁰⁶

Most visitors spend a very limited amount of time on object appreciation due to the large number of objects in a museum, and not being able to find the objects of interest easily. Thus, personalization could help to match a visitor to objects that are of interest to him/her. Personalization means detecting the interest of [a] visitor through intelligent analysis of his/her visiting behaviour. The recommendation system in our prototype therefore acts as a personal tour guide that attempts to recommend objects and art works based on the individual's interest."²⁰⁷

Fernando Vera, J. Alfredo Sánchez, and Ofelia Cervantes, from the Laboratory of Interactive and Cooperative Technologies at the Universidad de las Américas Puebla, Puebla, Mexico, also argued for the benefits of personalization in museum technology on the basis that a personal experience is more likely to "evoke emotions" and that "an event has to matter to the person experiencing it in order to cause some emotions. Benefits of emotional interaction are deeper, longer-lasting learning and higher engagement of users."²⁰⁸ So if the museum experience is personalized, this can lead to a more personal and engaging experience. It might also reduce the time spent with objects that are of less interest to users. Wayfinding can assist users to prioritize works that they want to see and cut down on time spent trying to figure out where they are and navigating to where they want to go. These mobile features can thus contribute to

²⁰⁶ "However, with the huge amounts of information available, many researchers advocate that information needs to be personalized to boost its value." Richard Yu-Chang Li and Alan Wee-Chung Liew, "An Interactive User Interface Prototype Design for Enhancing On-site Museum and Art Gallery Experience through Digital Technology," *Museum Management and Curatorship* 30 no. 3 (2015): 215. Citing David Huynh, Stefano Mazzocchi, and David Karger, "Piggy Bank: Experience the Semantic Web inside Your Web Browser," *Web Semantics: Science, Services and Agents on the World Wide Web* 5, no. 1 (2007): 16 – 27.

²⁰⁷ Li and Liew, "An Interactive User Interface," 224.

²⁰⁸ Fernando Vera, J. Alfredo Sánchez, and Ofelia Cervantes, "Enhancing User Experience in Points of Interest with Augmented Reality," *International Journal of Computer Theory and Engineering* 8, no. 6 (2016): 451. Citing B. Parkinson, "Emotions are Social," *British Journal of Psychology* 87, no. 4 (1996): 663-683.

more time in the museum focused on engaging with artwork, boosting the value of the museum experience.

Another aspect of technology design mentioned by Vera, Sánchez, and Cervantes is gamification. Gamification is where “game mechanics [are applied] in a way that adds an element of fun to otherwise dull and repetitive activities.”²⁰⁹ An example of gamification can be found in the mobile application Untappd,²¹⁰ which is a mobile application that allows users to rate beers. Users can check in to bars and restaurants and tag the beers that they are drinking. They can rate and leave comments about the beers and even share photographs of what they are drinking. There is a social element, where users can add friends to see their activities on the application and interact with them. The rating system, not unlike applications such as Yelp, allow users to see others’ ratings of beers which can then assist them in deciding what to drink. The gamification elements come in the form of badges. Badges are given when users have checked in as drinking a certain number of beers. For example, the first time a user checks in with a beer he or she will earn a badge. Badges are awarded for all different types of beers, such as American, Ciders, high alcohol content, and so on. Once a badge is unlocked it can be leveled up, and users can see the badges that their friends have unlocked and vice versa.

The concept of “winning” badges and “leveling up” gives the user an incentive to use the application. Other incentives are information, in the form of reviews, and social interaction. From the developer’s standpoint, it does not cost anything to give out badges. The “winnings” are essentially imaginary. To translate this to a museum application, users could check in at various art works and earn badges or level up. An example might be checking in at a museum five times or checking in at five different sculptures. A museum application could give out a badge for literally anything. The impetus for doing so is to incentivize the users to use the application. Game mechanics can be applied to a museum application to generate user interest.

²⁰⁹ Vera, Sánchez, and Cervantes, “Enhancing User Experience,” 451. Citing E. Schonfeld, “SCVNGR’s Secret Game Mechanics Playdeck,” *TechCrunch*, August 2010.

For a more in-depth exploration of gamification, see Maura Bouça, “Mobile Communication, Gamification and Ludification,” In *Proceeding of the 16th International Academic MindTrek Conference*, Tampere, Finland, October 2012, 295-301.

²¹⁰ Untappd, Inc. “Untappd.” Google Play Store, Vers. 3.2.2. (2018).
<https://play.google.com/store/apps/details?id=com.untappdapp&hl=en>

An application cannot benefit the museum unless people want to use it. Other “gamification elements” suggested by Vera et al. include: complete missions, earn points, and exchange points for rewards. Rewards could include discounts at the museum store or café.²¹¹

I understand how game elements might seem frivolous for a museum application. The difference between a museum mobile application and other applications, such as Untappd, is that a museum application has a variety of other uses; the sole point is not to earn badges. Wayfinding and audio-guides are two important features. Personalization elements that help visitors connect to areas of the museum that are interesting to them is another feature that helps users make the most of the time they have to spend inside a museum. These features are not frivolous. Adding in game mechanics are certainly not necessary but might offer additional value to the user. Additionally, features such as earning points that can be exchanged for a discount could drive sales in retail outlets within the museum. This helps to support the museum through sales.²¹²

Education and Groups

In their article, Daniela Bauer and Palmyre Pierroux discuss a study that they conducted in Norway, where they explored the interpretive gaps between curators and adolescents. The study revolved around an exhibit of Edvard Munch’s (1863-1944) work in the National Gallery of Norway. Researchers interviewed the curator about the “themes and aims” of the exhibition and about the exhibition’s arrangement.²¹³ The adolescent data was collected from high-school students ages 15-19 who visited the museum for field trips, sixteen young people in total. The students visited the exhibition as they would on a trip with friends and participated in card-sorting activities afterwards. The visits were recorded with a microphone and a video recorder.²¹⁴ After viewing the exhibit, students sat at a table for some additional activities using cards with reproductions of the paintings on view in the gallery. These activities included

²¹¹ Vera, Sánchez, and Cervantes, “Enhancing User Experience,” 455.

²¹² Consumer rewards programs are effective, when they are researched and correctly implemented. Dheeraj Sharma and Varsha Verma, “Psychological and Economic Considerations of Rewards Programs,” *Journal of Retailing and Consumer Services* 21, no. 6 (2014): 924, doi:10.1016/j.jretconser.2014.08.010.

²¹³ Daniela Bauer and Palmyre Pierroux, “Expert and Adolescent Interpretive Approaches in a National Art Museum,” *Museum Management and Curatorship* 29, no. 3 (2014): 264.

²¹⁴ Bauer and Pierroux, “Expert and Adolescent,” 264.

mapping where the paintings were in the gallery, arranging the cards in “an order that seems most meaningful,”²¹⁵ and sorting the cards into piles “according to perceived similarities, categorising each pile using one to three keywords.”²¹⁶

The results of the study showed that there was a disconnect between “the curator’s intentions behind the overall arrangement” and the young visitors’ interpretations.²¹⁷ The researchers found that “an important gap was identified between expert and visitors: laymen do not ‘follow the story’ because they are not aware it exists.”²¹⁸ Bauer and Pierroux suggest that this study supports the argument for giving visitors explicit insight into how curators make decisions when hanging an exhibit.²¹⁹ An easy way to do this would be a “behind the scenes” feature in a museum’s mobile application. This feature could have videos and resources for visitors who would like to know more about how a curator designed an exhibit and what guided their curatorial choices. These features could help visitors to understand the significance of placement and the juxtapositions of artworks. It would give contextual information for the lay person, and also in-depth interpretive resources for visitors who are more familiar with art and art history. The casual visitor who is not interested in this information can enjoy the gallery as-is, but the information is available for those who are interested in a more in-depth reading of the exhibit. When curators design an exhibit, they are trying to communicate something. If that message is not being received by the viewers because they do not understand a curator’s intentions, then it serves no purpose. By having a video or diagram available in the mobile application, museum visitors will be able to understand the curatorial choices and hopefully gain a deeper understanding of the exhibit.

In chapter one, I discussed how shared listening and displays have been studied for people who are visiting a museum as a group. Given the positive results of the shared listening feature, this component is an advisable option for audio-guides in mobile applications. The beneficial design of the shared listening function is that it is optional. It does not negatively

²¹⁵ Bauer and Pierroux, "Expert and Adolescent," 264.

²¹⁶ Bauer and Pierroux, "Expert and Adolescent," 264.

²¹⁷ Bauer and Pierroux, "Expert and Adolescent," 275.

²¹⁸ Bauer and Pierroux, "Expert and Adolescent," 275.

²¹⁹ Bauer and Pierroux, "Expert and Adolescent," 275.

affect visitors who wish to enjoy the museum by themselves, but it can help “facilitate social interaction” between visitors enjoying the museum together.²²⁰ The downside to traditional audio-guides is that they can “impede visitor interaction.”²²¹ Additionally, the shared listening element of an audio-guide can be adapted in multiple ways to suit different visiting strategies.²²² Another great aspect of the shared listening design is that users retain control over their device. In the shared display study, researchers found that participants did not like sharing a device because they had to relinquish control, even though the lack of control led to a better group experience.²²³ In summary, a shared listening option for audio-guides includes all of the benefits of traditional audio-guides, with the added benefits of facilitating social interaction between groups of visitors, and multi-way adoption for different visiting strategies. Solitary visitors are not negatively impacted; furthermore, it allows paired listeners to hear the same audio, retaining the feeling of sharing the activity, without being intrusive to other visitors by adding to noise pollution in galleries due to audio being played through-the-air.²²⁴

Shared displays, which were also discussed in chapter one, are another feature to be considered for museum mobile applications. The disadvantages of using a projector as a shared display were visual clutter and noise pollution. Disadvantages of the iPad were “heads down” display, and noise pollution.²²⁵ The advantages of a shared display were group collaboration and social interaction.²²⁶ A shared listening feature solves a lot of these problems but does not address families or school groups whose members want or need to complete an activity together. A solution for this might be using shared listening in combination with activity prompts. Activity prompts could be designed specifically for school trips, such as the m-learning curriculum discussed in chapter one. Or, activity prompts could be designed for families and sorted into age-appropriate categories. Examples could be selecting a favorite artwork and explaining the reason for making that choice, answering exhibit-related trivia questions,

²²⁰ Aoki et al., "Sotto Voce," 431.

²²¹ Aoki et al., "Sotto Voce," 431.

²²² Grinter et al., "Revisiting the Visit."

²²³ Joel Lanir et al., "Shared Mobile Displays," 647.

²²⁴ Joel Lanir et al., "Shared Mobile Displays," 637.

²²⁵ “Heads down” display is describing how users must look down at a device for information. In contrast, an audio-guide is a “heads-up” display; users can listen to the audio and view art simultaneously.

²²⁶ Joel Lanir et al., "Shared Mobile Displays," 637, 647-8.

watching a short video about a specific art movement and finding examples of that work within the museum. These activities give families a way to enjoy the museum together, while also engaging in thought-provoking and learning activities as a group. In this approach, users can enjoy the benefits of a shared display, such as group collaboration, without the negative side effects of noise pollution or “heads down” viewing in the museum. Having prompts available in the different galleries give families a way to share the experience, but to also engage with each other. This is meant to be a fun and entertaining, but engaging learning experience that families can do together.

Offsetting Costs

One downside of mobile applications for the museums that offer them is that they are typically free for users.²²⁷ Every museum application and technological feature that I tested for the previous chapter was free of charge. Visitors do not want to pay to use a mobile application but creating them requires a financial investment from the museum. Museums must find ways to offset the costs of creating a mobile application, so it follows that they must provide some form of value for the museum to make that investment worthwhile. There are several ways to do this directly. This can be done with surveys and data tracking, social-media integration, and donation features.

In a discussion about the cost of implementing mobile applications, it seems pertinent to discuss content choice. It is logical for museum staff to focus their time and funding on creating digital content for a museum’s permanent collection. Creating mobile digital content for temporary exhibitions that will only be available at the museum for a limited period of time reduces the return on investment. From the available research, it appears that current museum mobile applications focus mainly on permanent collections. However, it should be noted that it is not unheard of to offer mobile content for temporary exhibitions.²²⁸ Additionally, having

²²⁷ See Table 1.

²²⁸ Table 1 shows that two of the largest twenty-five museums in the United States have, in fact, created mobile applications specifically for temporary exhibitions.

basic digital content for temporary exhibitions, such as audio-guides, is a reasonable middle ground.

One easy way to provide some promotional features for a museum within an application is to have an integrated social-media sharing button. The MFA application for the Museum of Fine Art in St. Petersburg has a button for sharing on Facebook. When viewing an artwork in the application, users can click the “share button” and post artworks to their Facebook page. The share button opens the user’s Facebook application and uploads an image of the artwork to a blank Facebook post, so users can then write a description and share their post among their friends. As discussed in Chapter 2, social-media is an effective technique to spread word-of-mouth promotion. I would also suggest diversifying the share button so that users can post to their social-media channels of choice, such as Instagram, Snapchat, or Pinterest. Having more channels available increases the avenues for sharing, which should positively impact the reach of “share” buttons.

Another method to offset the costs of museum applications is to collect user data from the application, with the users’ permission. In their article, “Visualizing Museum Visitors’ Behavior: Where do they go and what do they do there?” Lanir et al., from the University of Haifa in Israel, used radio frequency beacons and developed a location-aware mobile guide that tracked visitors’ movements within a museum; users also filled out a questionnaire, which allowed researchers “to gather complete log data of these visitors.”²²⁹ From this information, these researchers were able to give museum personnel an overview of visitors’ paths through the museum, exhibits’ “attraction power,” and “staying power”- such as knowing the number of visitors to an exhibit and the time spent at those exhibits.²³⁰ They were also able to show museum administrators how many times multimedia presentations in the mobile guide were viewed, and the distribution of museum visitors over time.²³¹ Having this type of data-tracking in a museum’s mobile application gives museum administrators quantitative data regarding

²²⁹ This article has information on the technological aspects of tracking visitor behavior as well as analyzing and applying the data. Joel Lanir et al., “Museum Visitors’ Behavior,” 318.

²³⁰ Lanir et al., “Museum Visitors’ Behavior,” 319-322.

²³¹ Lanir et al., “Museum Visitors’ Behavior,” 321-322.

visitor behavior. This could assist in understanding visitor engagement, exhibit popularity, and high-traffic times and areas within the museum. As pointed out by one museum director in Lanir et al.'s study, knowing exactly when high-traffic times occur can assist museums in making practical decisions.²³² "[A museum director] stated that there are certain days in which the museum is open late, and other days on which they consider opening late. However, opening more hours has financial repercussions. It is important for her to know whether this policy is worthwhile."²³³ Finally, having quantitative data about visitor activities can also be used when museums are applying for grants. This data could indicate how many are using the application, how much educational content is being delivered via the application, and so forth. It could be cited as evidence of the application's impact. Additionally, if the application is collecting data this can cut down on the staff labor used to collect data, which helps to decrease museum costs.

Another feature that can be used to collect data on the application itself is the rating systems that are included in the Apple App Store and the GooglePlay Store. These rating systems are designed for users to help them decide if they wish to download an application but could be used by museum staff to find common problems with the application. For example, if many user reviews complain about the size of the application or the time required to download, then museum staff can find ways to mitigate those issues. The ratings systems can draw attention to problems with the application that might otherwise go unnoticed.

One final way to offset costs in a museum application is to ask for donations. The Toledo Museum of Arts' application, TMAApp, has a "Make a Donation" button on its homepage. Clicking the button opens a webpage within the application so that users can fill out a donation amount and credit card information. But a donation page can be much simpler than this. Retrieving a credit card to enter information on a mobile device is not the most convenient way to make a payment on-the-go. Integrating the application with payment services, such as PayPal, Venmo, Samsung Pay, or Apple Pay, would allow users to make a donation without

²³² This person is identified as the museum director of the Tower of David museum in table 1. Lanir et al., "Museum Visitors' Behavior," 323.

²³³ Lanir et al., "Museum Visitors' Behavior," 324.

payment. With payment services, users only need to sign into their account and select a donation amount, making it more efficient.

Throughout the research in this thesis, successful implementation of technology has been coupled with collaboration. The research herein is multidisciplinary because when considering the application of technology in museums the perspectives from different fields is key to being successful. Knowledge of visitor studies, curatorial input, and computer science expertise all have a role to play in ensuring that technology is being designed usefully. For museum staff wishing to strategize incorporating digital technologies into their programming, it would be to their benefit to consult all stakeholders and make it a collaborative process. The technology itself must be designed from a software and programming perspective, but graphics and visual elements should be designed by graphic designers, content should be created and discussed with curatorial, education, and communications staff, and so on. When designing for fieldtrips and school groups, educational goals and input from teachers should be considered. One of the best ways to offset costs might be in the collaborative process of brainstorming and designing technological features. Considering input from various departments could catch problems before they become too large or too expensive to fix. Furthermore, consulting all stakeholders will ensure that the technology is meeting the needs of the people and groups for which it is being designed.

The rise of internet adoption in the United States and other developed countries has increased the need for museums to have a web-presence, to the point that a website has become standard. With the increase of smartphone adoption and the proliferation of mobile applications, it is logical for museums to utilize these channels for distributing digital content. For museums interested in investing in a mobile application, there are a wide range of practical features that add value for both visitors and the museums. Mobile applications may be employed to increase visitor engagement and learning while also benefiting the museums through data collection and analysis, promotion, and fundraising. As technology advances, so does the ways that it may be adapted and utilized. Mobile applications are simply the next evolution of museum tools that have existed in the past, delivered through a channel that Americans are increasingly becoming accustomed to using.

Conclusion

Roger Bruce's 1996 article predicted that digital technologies would alter the landscape of the cultural heritage sector but would not destroy it; museums would adapt to the new landscape and find ways to navigate it and hopefully avoid the pitfalls of implementing technologies for technology's sake. Since that article has been published, the internet and other digital technologies have advanced and evolved. The ways that people and organizations utilize these technologies has also evolved. One aim of this thesis has been to explore some of the ways that technology can be applied in the context of museums for various aims and outcomes. Technology can be used to foster engagement and social-media can be used for engagement, promotion, and supporting the social aspects of museum visits. Another aim has been to investigate the technologies actively being employed in museums currently, and to provide recommendations for museums looking to distribute content via mobile applications. The research has shown that Bruce's assertion that technology provides new tools for old tasks remains true today.

New technology provides new channels for communication and advanced tools for traditional tasks. Chapter 1 explored how mobile devices could be used for increasing engagement, group visits, fieldtrips, and educational activities, while also presenting evidence that negative perceptions of mobile devices may be unfounded. Chapter 2 illustrated how social-media could be employed as an effective marketing channel and how it may help some visitors to experience the social dimension of a museum trip. Furthermore, it demonstrated how social-media may be used to engage with museum exhibits. Chapter 3 described some technologies currently being utilized by museums including mobile applications, digital and interactive exhibits, and augmented reality. Chapter 4 looked at useful features for museum mobile applications that benefit both visitors and museums, including visitor engagement and learning, data collection and analysis, and promotion and fundraising. All of these facets of digital technology usage are simply twenty-first century channels and tools for longstanding objectives. Marketing and promotion, engaging audiences, and disseminating educational

information are not new concepts for museums; using social-media, mobile applications, and touch-screen digital exhibitions are.

Figures and Tables



Fig. 1. A selfie taken in the Biography mirror at the National Gallery of Denmark.

Michael Williams, "Being arty," January 6, 2015, *Instagram*,
<https://www.instagram.com/p/xg5cE6lJOB/?tagged=smkselfie>.



Fig. 2 A PowerPoint slide showing an example of a branded photographic opportunity at a museum for social-media sharing.

Kerry Bellinger, "The Warhol: Polaroid Exhibition," (Marketing Fundraising and Planned Giving, University of Michigan Flint, Flint, Michigan, December 2016.)



Fig. 3 A Polaroid photograph with Andy Warhol's stamp in the lower right corner.

Andy Warhol, *Mick Jagger, Study for 'Love You Live' Album Cover*, 1977, unique Polaroid print, 4 1/4 x 3 3/8 in., private collection.

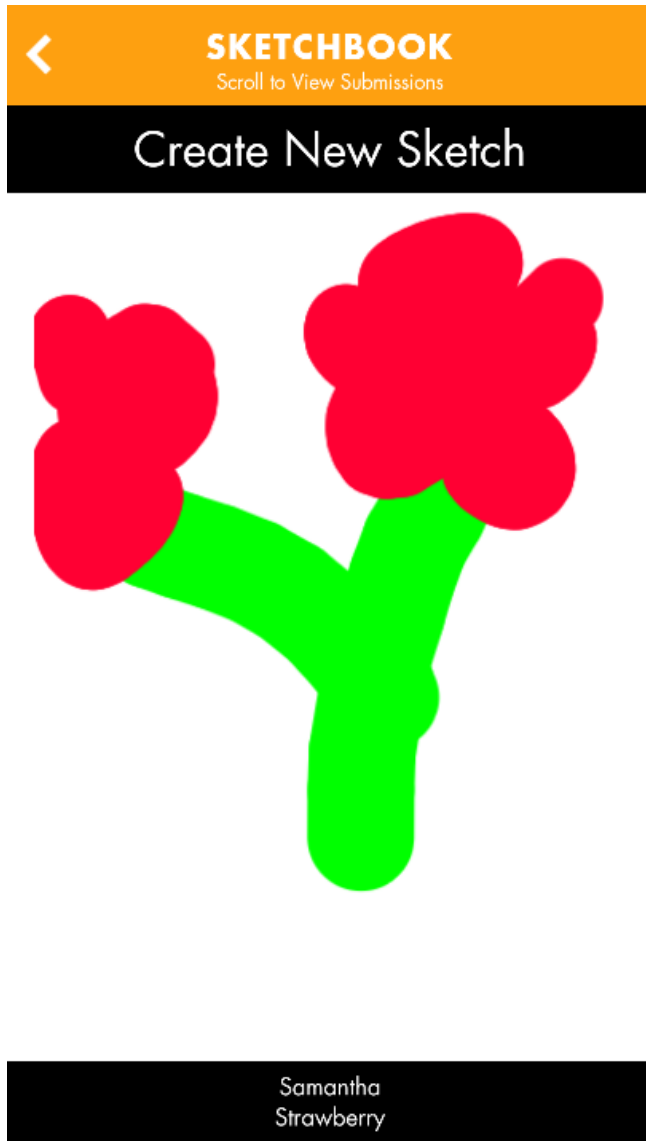


Fig. 4 A screenshot of the sketchbook section of the MFA Viewpoint application.

(Screenshot captured on February 22, 2018.)

HD Interactive Inc, "MFA Viewpoint," Google Play Store, vers. 1.1.9 (2017).

<https://play.google.com/store/apps/details?id=com.hdinteractive.mfaviewpoint>

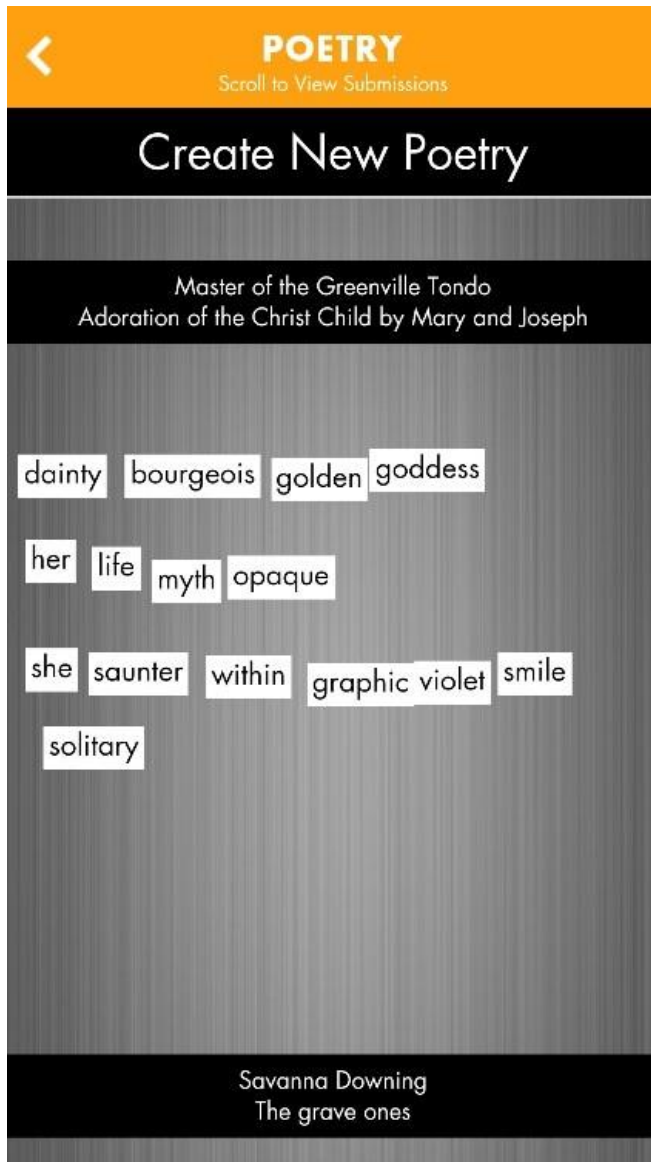


Fig. 5 A screenshot of the poetry section of the MFA Viewpoint application.

(Screenshot captured on February 22, 2018.)

HD Interactive Inc, "MFA Viewpoint," Google Play Store, vers. 1.1.9 (2017).

<https://play.google.com/store/apps/details?id=com.hdinteractive.mfaviewpoint>

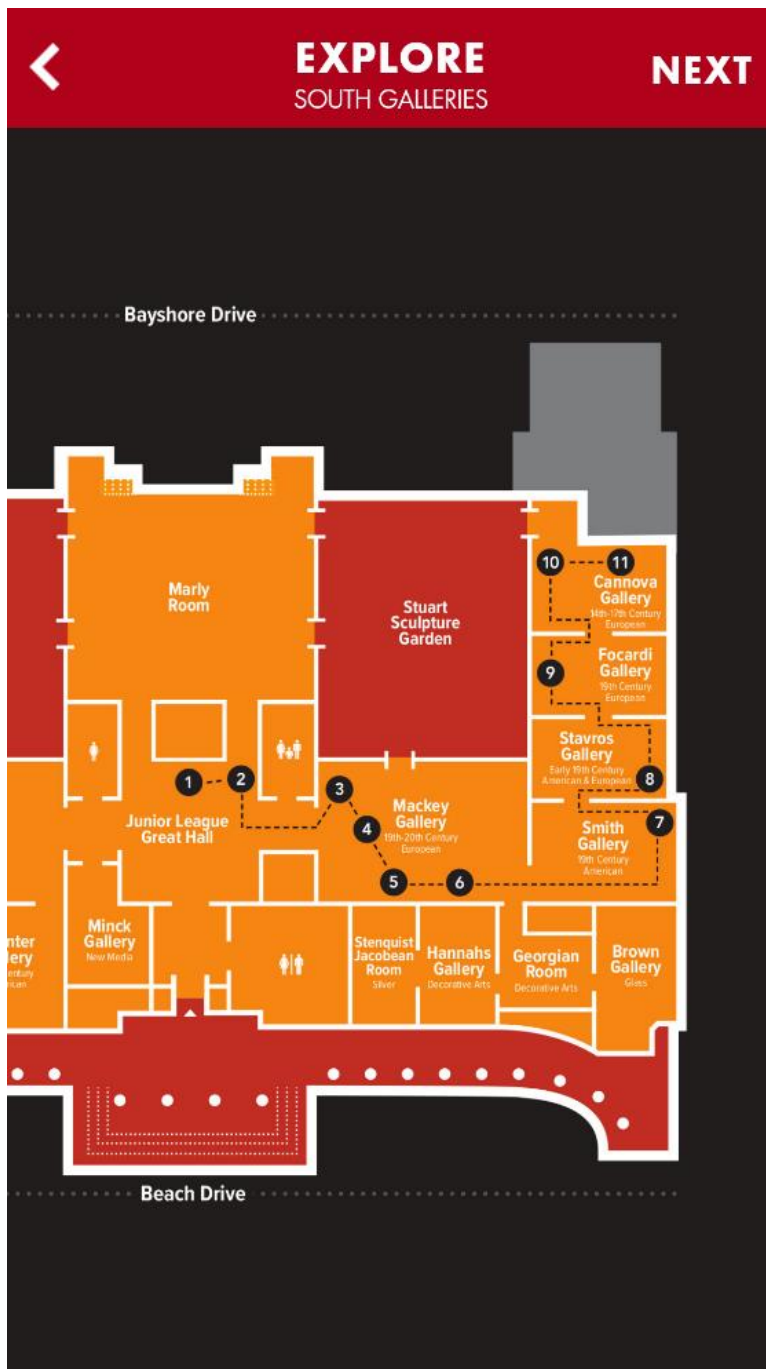


Fig. 6 A screenshot of the explore section of the MFA Viewpoint application.

(Screenshot captured on February 22, 2018.)

HD Interactive Inc, "MFA Viewpoint," Google Play Store, vers. 1.1.9 (2017).
<https://play.google.com/store/apps/details?id=com.hdinteractive.mfaviewpoint>

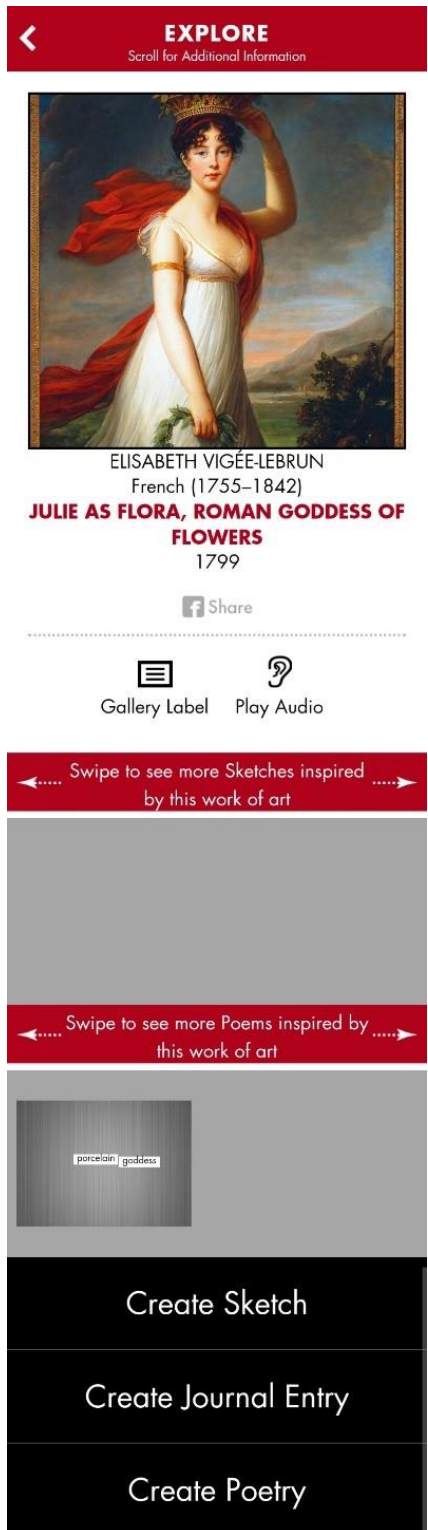


Fig. 7 A screenshot of the MFA Viewpoint application information for the painting *Julie as Flora, Roman Goddess of Flowers* (1799) by Elisabeth Vigée-Lebrun (1755-1842).

(Screenshot captured on February 22, 2018.)

HD Interactive Inc, "MFA Viewpoint," Google Play Store, vers. 1.1.9 (2017).

<https://play.google.com/store/apps/details?id=com.hdintera.mfaviewpoint>

Élisabeth Vigée Le Brun, *Julie as Flora, Roman Goddess of Flowers*, 1799, oil on canvas, 51 in. x 38 1/2 in., St. Petersburg, Florida, The Museum of Fine Arts.



Fig. 8 Photograph of the digital display of *American Pictures* by Jacob Holdt. Inside the Museum of Fine Arts, St. Petersburg, Florida.

(Photograph taken on May 24, 2017.)



Fig. 9 A photograph of the Interactive Amiga exhibit with a recovered digital artwork by Andy Warhol, on display at the Andy Warhol Museum, Pittsburgh, PA. (Photo taken on January 27, 2018.)



Fig. 10 A photograph of the museum text for the Interactive Amiga exhibit on display at the Andy Warhol Museum, Pittsburgh, PA. (Photo taken on January 27, 2018.)

Museum text, *Interactive Amiga 1000*, the Andy Warhol Museum, Pittsburgh, January 27, 2018.

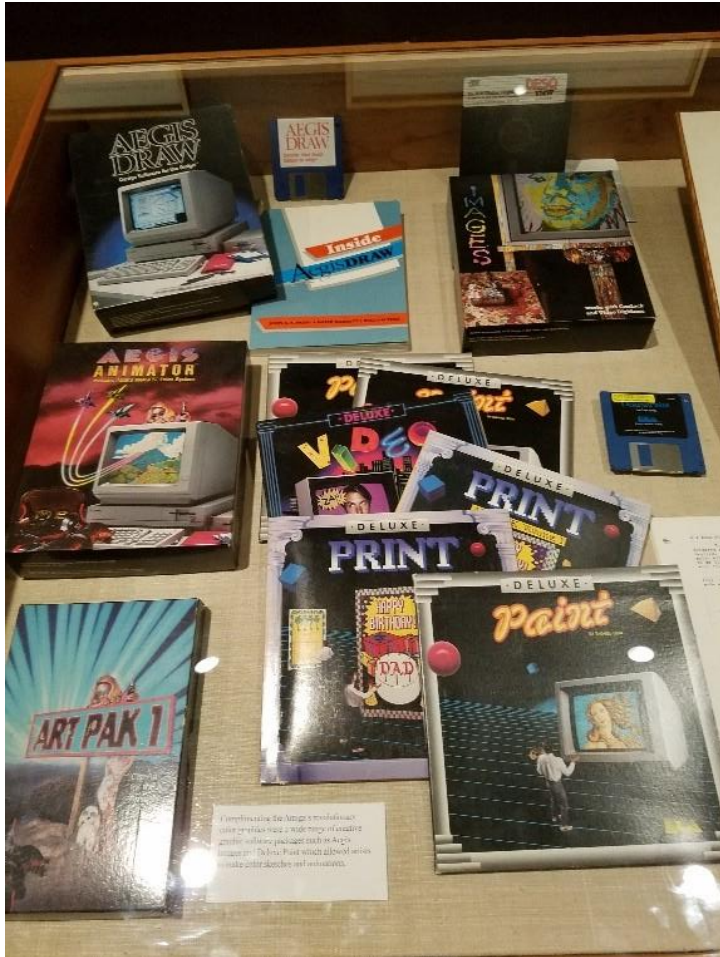


Fig. 11 A photograph of early graphic software, a part of the Amiga exhibit on display at the Andy Warhol Museum, Pittsburgh, PA. (Photo taken on January 27, 2018.)

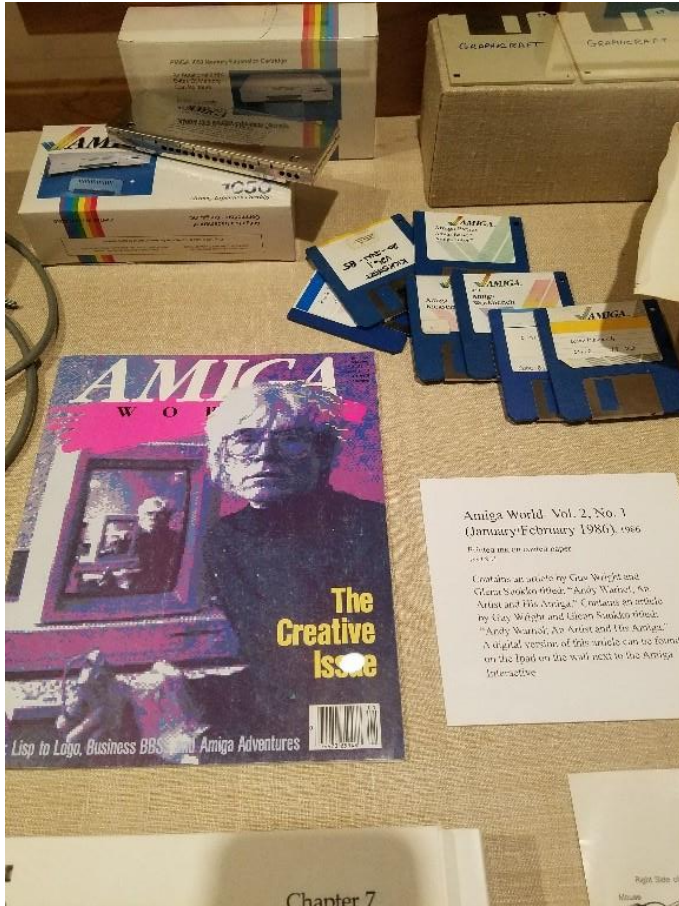


Fig. 12 A photograph of an *Amiga World* magazine and floppy disks, a part of the Amiga exhibit on display at the Andy Warhol Museum, Pittsburgh, PA. (Photo taken on January 27, 2018.)

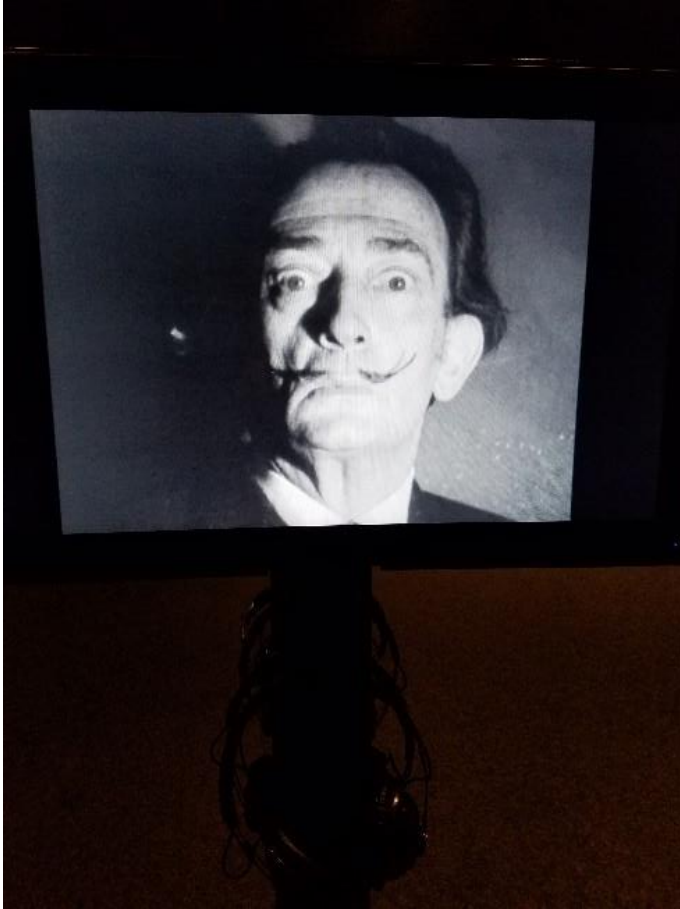


Fig. 13 A photograph of Salvador Dalí's (1904-1989) screentest being viewed at the Film and Video Gallery at the Andy Warhol Museum, Pittsburgh, PA. (Photo taken on January 27, 2018.)

Andy Warhol, *Screen Test: Salvador Dalí*, 1966, The Andy Warhol Museum, Pittsburgh.



Fig. 14 A photograph of a visitor in the Film and Video Gallery at the Andy Warhol Museum, Pittsburgh, PA.
(Photo taken on January 27, 2018.)



Fig. 15 A photograph of the Film and Video Gallery at the Andy Warhol Museum, Pittsburgh, PA. (Photo taken on January 27, 2018.)



Fig. 16 A screenshot of the Gallery section of the ArtLens application. The ArtLens Wall and Gallery are labeled in blue towards the bottom of the image. The museum galleries are located across a large atrium, towards the top of the image. (Screenshot captured on January 26, 2018.)

The Cleveland Museum of Art, "ArtLens," Google Play Store, vers. 3.0.83 (2018).
<https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>
 dtdht

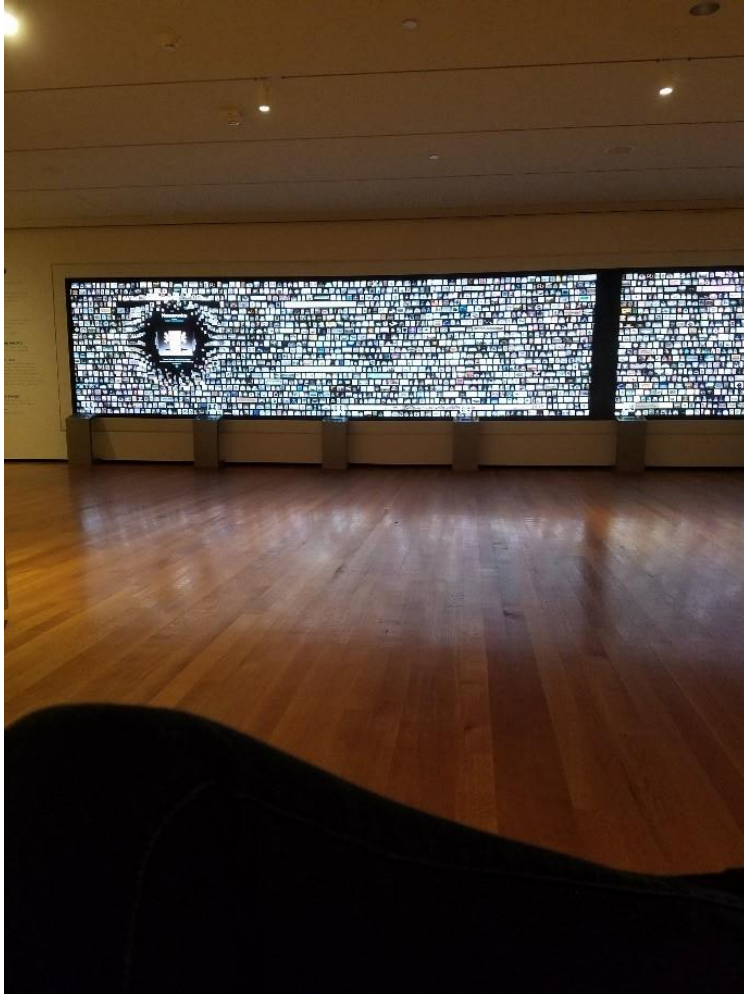


Fig. 17 A photograph of the 40-foot ArtLens Wall, at the Cleveland Museum of Art, Cleveland, Ohio.
(Photograph taken on January 26, 2018.)



Fig. 18 A photograph of a visitor interacting with the 40-foot ArtLens Wall, at the Cleveland Museum of Art, Cleveland, Ohio. (Photograph taken on January 26, 2018.)

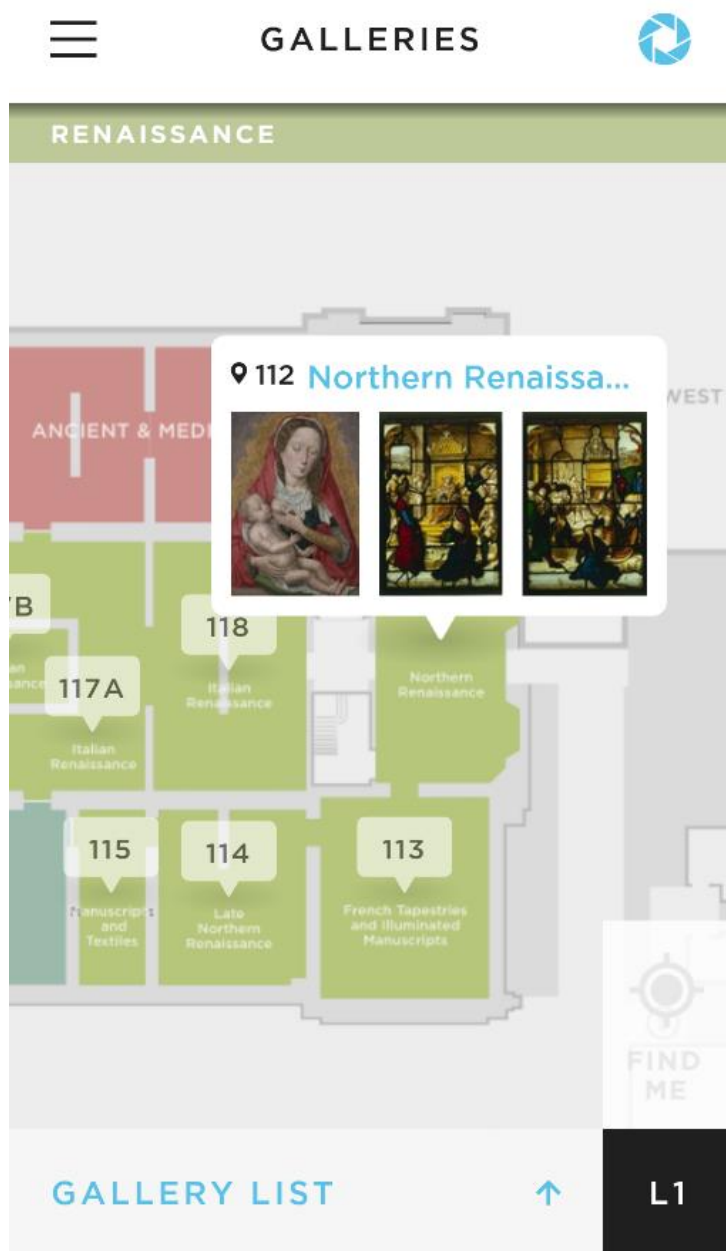


Fig. 19 A screenshot of the Map section of the ArtLens application. (Screenshot captured on January 26, 2018.)

The Cleveland Museum of Art, "ArtLens," Google Play Store, vers. 3.0.83 (2018).
<https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>
dtdht

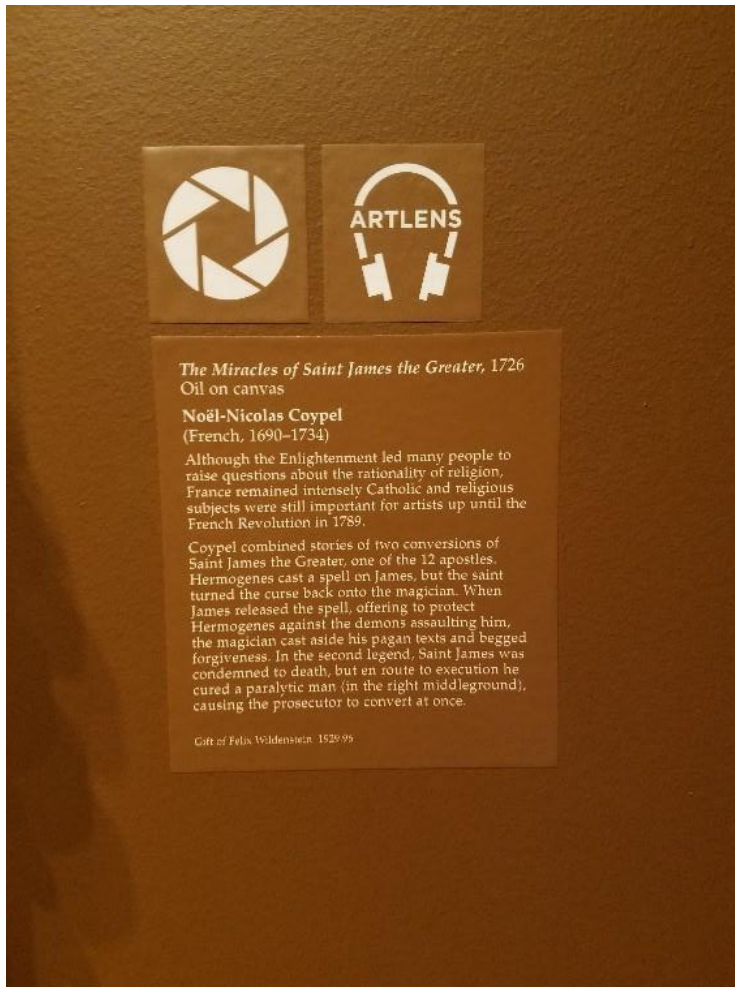


Fig. 20 A photograph of the Aperature and ArtLens icons above the museum text for the painting *The Miracle of Saint James the Greater* by Noël-Nicolas Coypel on display at the Cleveland Museum of Art, Cleveland, Ohio. (Photo taken on January 26, 2018.)

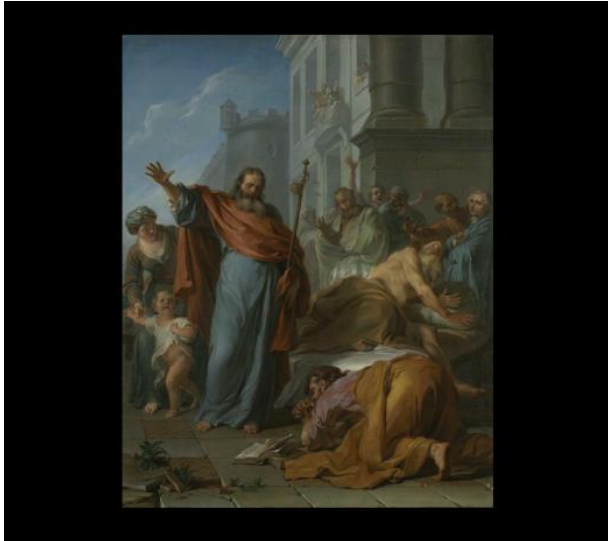
Wall text, *The Miracle of Saint James the Greater*, Cleveland Museum of Art, Cleveland, January 26, 2018.



Fig. 21 A screenshot of the augmented reality content in the ArtLens application overlaid on the painting *The Miracle of Saint James the Greater* by Noël-Nicolas Coypel on display at the Cleveland Museum of Art, Cleveland, Ohio. The circles and accompanying text can be selected for additional information. (Screenshot captured on January 26, 2018.)

The Cleveland Museum of Art, "ArtLens," Google Play Store, vers. 3.0.83 (2018).
<https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>
dtdht

Noël Nicolas Coypel, *The Miracle of Saint James the Greater*, 1726, oil on canvas, 50 15/16 x 42 5/16 in., Cleveland, The Cleveland Museum of Art.



Saint James the Greater

Saint James the Greater is one of the twelve apostles, and one of the first followers of Jesus. He is also said to be the first of the apostles to be martyred for his faith when King Herod Agrippa had him executed.

Fig. 22 A screenshot of the augmented reality content in the ArtLens application overlaid on the painting *The Miracle of Saint James the Greater* by Noël-Nicolas Coypel on display at the Cleveland Museum of Art, Cleveland, Ohio. This content is available by selecting the text “Saint James the Greater,” which is visible in Fig. 21. (Screenshot captured on January 26, 2018.)

The Cleveland Museum of Art, “ArtLens,” Google Play Store, vers. 3.0.83 (2018).
<https://play.google.com/store/apps/details?id=org.clevelandart.artlens&hl=en>
dtdht

Noël Nicolas Coypel, *The Miracle of Saint James the Greater*, 1726, oil on canvas, 50 15/16 x 42 5/16 in., Cleveland, The Cleveland Museum of Art.



Fig. 23 A photograph of a visitor interacting with the interactive digital pottery wheel in the ArtLens Gallery at the Cleveland Museum of Art, Cleveland, Ohio. (Photograph taken on January 26, 2018.)



Fig. 24 A photograph of a visitor interacting with the digital collage maker in the ArtLens Gallery at the Cleveland Museum of Art, Cleveland, Ohio. (Photograph taken on January 26, 2018.)

Columns A-C taken directly from WorldAtlas.com			Application Available?			
Rank	Museum Name	Location	Android	Apple	Price	Web Address
1	Metropolitan Museum of Art	New York, New York	Yes	Yes	Free	metmuseum.org
2	Art Institute of Chicago	Chicago, Illinois	Yes	Yes	Free	artic.edu
3	National Gallery of Art	Washington, D.C.	Yes	Yes	Free	nga.gov
4	Massachusetts Museum of Contemporary Art	North Adams, Massachusetts	Yes	Yes	Free	massmoca.org
5	Museum of Fine Arts	Boston, Massachusetts	No	No	N/A	mfa.org
6	Minneapolis Institute of Art	Minneapolis, Minnesota	No	Yes	Free	artsmia.org
7	San Francisco Museum of Modern Art	San Francisco, California	Yes	Yes	Free	sfmoma.org
8	Denver Art Museum	Denver, Colorado	No	No	N/A	denverartmuseum.org
9	Philadelphia Museum of Art	Philadelphia, Pennsylvania	No	No	N/A	philamuseum.org
10	Dia:Beacon	Beacon, New York	No	No	N/A	diaart.org
11	Dallas Museum of Art	Dallas, Texas	Yes	Yes	Free	dma.org
12	Detroit Institute of Arts	Detroit, Michigan	No	No	N/A	dia.org
13	Indianapolis Museum of Art	Indianapolis, Indiana	No	No	N/A	discovernewfields.org
14	Brooklyn Museum	New York, New York	Yes	Yes	Free	brooklynmuseum.org
15	Virginia Museum of Fine Arts	Richmond, Virginia	Yes*	Yes*	Free	vmfa.museum
16	Cleveland Museum of Art	Cleveland, Ohio	Yes	Yes	Free	clevelandart.org
17	Houston Museum of Fine Arts	Houston, Texas	No	No	N/A	mfah.org
18	Milwaukee Art Museum	Milwaukee, Wisconsin	No	Yes	Free	mam.org
19	Museum of Modern Art	New York, New York	No	Yes	Free	moma.org
20	Portland Art Museum	Portland, Oregon	No	No	N/A	portlandartmuseum.org
21	Carnegie Museum of Art	Pittsburgh, Pennsylvania	No	Yes	Free	cmoa.org
22	Saint Louis Art Museum	St. Louis, Missouri	No	Yes	Free	slam.org
23	Smithsonian American Art Museum	Washington, D.C.	Yes**	Yes**	Free	americanart.si.edu/
24	Toledo Museum of Art	Toledo, Ohio	Yes	Yes	Free	toledomuseum.org
25	de Young Museum	San Francisco, California	Yes	Yes	Free	deyoung.famsf.org
		Totals	12/25	17/25	100% Free	

*It appears as though this museum creates dedicated apps for temporary exhibits. Some of these are still available in the Google Play Store and the iTunes Store; however, the exhibits are no longer at the museum.

**The Smithsonian had a virtual reality app for a temporary exhibition that ended in 2016.

Table 1 This table shows the 25 largest museums in the United States, if they have a mobile application available for Android and/or Apple devices, and the cost of the applications for users. The table shows that 48% of these museums have Android applications and 68% have Apple applications. Note that these applications are all free to download. This data was collected in June 2018.

Faith Chelangat, "The Largest Art Museums in the United States," WorldAtlas, August 14, 2017, accessed June 09, 2018, <https://www.worldatlas.com/articles/the-largest-art-museums-in-the-united-states.ht>

Museum Mobile Application Features

	Museum of Fine Art, St. Petersburg, FL	Cleveland Museum of Art, OH	Art Institute of Chicago, IL*
Map	Yes	Yes	Yes
Location Aware Map	No	Yes	Yes
Tours	Yes	Yes	Yes
Custom Tours	No	Yes	?
Events Information	Yes	Yes	?
Museum Hours	Yes	Yes	Yes
Museum Contact Information	Yes	No	Yes
Social-Media Sharing	Yes	Yes	?
Donation Feature	No	No	?
Audio-guide	Yes	Yes	Yes
Additional Interpretive Content	No	Yes (Videos)	?
Other	Sketch, Poem, Journal	Save favorites	?

* The Art Institute of Chicago no longer offers a mobile application for Android devices, information on available features for the iPhone application was pulled from the museum's website in August of 2018.

Table 2 This table gives a breakdown of available features on the mobile applications that I tested for this thesis.

Appendix

Appendix 1 A questionnaire for investigating museum visitors' reactions to museum mobile applications. This survey could be utilized in future research exploring how visitors respond to mobile applications in museums.

- 1) What did you like about the mobile application?
- 2) Did the application work well for you?
- 3) Did you have any errors with the application?
- 4) Did you find the application easy to use? If not, why?
- 5) Did you use the application for your entire visit? Why or why not?
- 6) Which features did you use the most?
- 7) Were there any features that you did not use?
- 8) Are there any features or improvements that you would like to see in this application?

9) Did this application improve your museum visit?

10) Would you use this application again?

11) Would you be interested in using a similar application at other museums?

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