

# Museum Visitor Engagement Through Resonant, Rich and Interactive Experiences

A thesis submitted to the School of Design, Carnegie Mellon University,  
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## Abstract

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Museums are vast resources, but much of their information is inaccessible to visitors. Typical labels for artifacts provide few details, making it difficult for non-expert visitors to learn about an artifact, and to find its relevance to other artifacts or to themselves. Although museums have developed interpretive aids such as brochures and audio guides, these are limited and do not offer visitors the possibility to explore artifacts both broadly and deeply as they go through an exhibition. Visitors often have questions that go unanswered or pass through an exhibition without being engaged. As visitors all have their own personal interests and preferences, it would be difficult to offer a usable version of any current interpretive aid that includes all of the information, stories, and related content that each visitor would like. Personal mobile devices provide a platform for interactivity and access to an unlimited amount of information, presentation of rich media, and flexibility for customized experiences both inside the museum and beyond.

To bridge the gap between museum collection information and visitor engagement, I propose a framework for increasing engagement through resonant, rich, and interactive experiences mediated by a personal mobile guide, and present a case study and functional prototype mobile guide for the Hall of Architecture at the Carnegie Museum of Art.

For Todd.



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# 1 Introduction

Learning is not restricted to classrooms or school curricula; people learn new things every day when they read books, look things up online, go on hikes, or try to fix their cars. People may also seek out places like museums, nature centers, gardens, or zoos in order to be exposed to new ideas and to have new experiences. These places are dedicated to engaging and educating visitors; unfortunately, there are few people who truly use these institutions to the greatest potential. Many people visit an institution only once, or very infrequently, and those visits could be more engaging and informative. Visitors are missing out on the true breadth and depth of information, and the rich experiences, that these places can offer.

This is not merely a missed opportunity; many institutions realize that in order to prosper, they must change. They can no longer satisfy themselves with merely preserving and displaying important collections, confident that the public will continue to find value in repeat visits [4]. There are some in the museum community who have called for a new dedication to excellence, asserting that museums too often focus on merely surviving, when they should be innovative and work to exceed the expectations of visitors [25]. Striving for excellence is a requirement for museums if they are to compete for the public's attention in the face of content and activities like the increasingly-impressive and accessible content online and on television.

The difficulty in engaging visitors is that, although museums are extensive resources, much of their information is inaccessible to visitors. Typical labels for artifacts provide few details, making it difficult for non-expert visitors to learn about an artifact, or to find its relevance to other artifacts or to themselves. Visitors have questions that go unanswered or they pass through an exhibition without being engaged. Visitors can fully engage with museum content through resonant, rich, and interactive experiences.

- *Resonance occurs when someone senses a connection between himself and an object or event—it brings up memories of events, thoughts or feelings or ties to personal interests.* While visitors can choose exhibitions that they relate to, many possible connections are not readily visible to visitors. An interpretive system can present more options for visitors, like different ways to view collections, themed tour options, or recommendations based on works that the visitor has already seen, resulting in many more opportunities for visitors to find connections to artifacts.
- *Rich information goes beyond a listing of facts to provide further details or related information that can help visitors to find resonance, and to become more engaged.* Some examples of rich information that an interpretive system can provide to users include videos of artifact restoration, interviews with curators, period music clips, and reconfigurable maps of connections between artifacts. Having a variety of information, and ways to interact with that information, introduces a sense of freedom and potential that will spark the curiosity of visitors and lead them to consider not only

whether they like or dislike an artifact, but also its connections to other artifacts or knowledge domains and, particularly, how it relates to themselves.

- *Interactive information enables visitors to make choices and to explore exhibitions and related content on their own, as far as they would like to go.* Providing visitors more control in how they choose to learn about the exhibitions and individual works may help them to discover their own connections to the exhibitions. Interactive information frameworks may provide flexibility, customization, and incidental exploration. These behaviors are important in transforming passive museum visitors into active information seekers and engaged visitors.

Museums offer many interpretive aids to engage and inform visitors, such as wall labels, docent tours, audio guides, and brochures, but these aids are inherently limited. A brochure may be very well designed, but it will always be static. Traditional audio guides may contain interesting stories, but content is presented serially and users cannot request more information. Docent tours have a personal touch and visitors can have their questions answered on the spot, but they are restrictive (because visitors will only view and get information about a predetermined set of artifacts) and limited (because they rely on volunteer resources).

Museums are in need of a new way to share their content. Some institutions like children's museums or science centers have many physical exhibits and signs that provide information and allow visitors to experiment in order to understand new concepts. Physical and especially interactive, exhibits involving multiple senses are generally accepted as very engaging, educational, and memorable. However, those institutions whose focus has traditionally been on presenting and preserving objects (such as specimens or artworks), rather than on directly educating visitors, face a challenge because such exhibits and activities may not fit within their culture or exhibition space.

Mobile guides (offered on smartphones, PDAs, or other small electronic devices) are a natural means of creating resonant, rich, and interactive experiences, and require only minimal changes to the exhibition space. Unlike other interpretive aids, mobile guides can access an unlimited amount of information via the Internet and can contain many learning options that are tailored to individuals or to categories of visitors. Mobile guides can tap into the depth of museum-curated digital content or link across the Internet to external sources. While there are an increasing number of mobile guides, many are still limited, merely offering another means of accessing pre-existing audio guide content, and do not live up to the potential of their advanced technology.

This thesis proposes a system that increases engagement through a resonant, rich, and interactive experience that takes advantage of the new possibilities afforded by personal mobile devices. The system is based on models of visitor goals and attitudes, successes and failures of current mobile guides, interviews with key stakeholders (museum staff and visitors), and user testing, in addition to known design principles. As a case study, this thesis develops a mobile guide that successfully engages visitors at an art museum, one of the most difficult types of museums for visitor engagement, because of the required trade-off between providing interpretive content and maintaining an uncluttered atmosphere.



## 2 Frameworks for Understanding Visitors

Traditionally, museum professionals have used demographic data to understand their visitors. This data typically includes information such as race, age, income, and level of education. While this data is easy for visitors to provide, it has been shown through years of visitor research that it is not predictive of visitor behavior or experience [7]. Visitor models can help museums find new ways to offer resonant experiences—experiences that encourage curiosity and help visitors find meaning in the collections. People often create or discover meaning by finding connections between something they are currently experiencing and something from their past, with their other interests, or with their aspirations. While museums cannot have a deep understanding of all of their visitors in order to create experiences that best resonate with them, visitor models can be an efficient way to improve upon current strategies, which are often one-size-fits-all, and to evaluate proposed solutions in terms of meeting and exceeding visitors’ expectations.

### 2.1 Falk’s Visitor Model

Renowned museum researcher John H. Falk describes different types of visitors based on their visit goals, which relate to their sense of personal identity. These visitor types include: Explorers, Facilitators, Experience Seekers, Professionals/Hobbyists, and Rechargers. These categories cut across demographics, and a person may go to a museum or other learning institution as an Explorer one day and as a Facilitator the next. A visitor may also embody a combination of categories during a visit.



Figure 2.1: Falk’s visitor categories

### **Experience Seekers**

Experience Seekers want to see the “most important” exhibitions and to “make memories;” they are often tourists. These visitors may be on a tight schedule, so they want high-level information about the museum collection rather than long stories and details. They may also be especially interested in maps or navigational help as it is likely their first visit to a particular institution. Experience Seekers may also be locals attracted by a new “blockbuster” exhibition—perhaps a traveling exhibition that has been to many renowned museums.

### **Explorers**

Explorers are curious and seek to learn new information, and understand new concepts, during their visit. In order to satisfy their curiosity, Explorers read wall labels and brochures, and may attend museum lectures or search for books specializing in topics that they find particularly interesting during their visit. They may come alone, or separate from their group. They are often repeat visitors and want to explore on their own, without following prescriptive tours or audio guides. Falk suggests that Explorers might use a guide if it were flexible and allowed them freedom of choice [7]. In terms of their identity needs, Explorers are seeking to confirm themselves as curious people who value education. They want to feel intrigued and challenged.

### **Facilitators**

Facilitators go to learning institutions with others such as friends, relatives, or children. Their primary goal is to ensure that the other people in their group have a good time and accomplish their own goals at the museum. Parents are often Facilitators and seek to confirm themselves as good parents who help their children learn. Other Facilitators seek to confirm themselves as good friends or family members. If visit companions are not particularly interested in the exhibitions, the museum may simply serve as a “backdrop” for socializing and building relationships.

### **Rechargers**

Rechargers want to relax in a peaceful atmosphere and are not especially interested in the exhibitions themselves and are unlikely to use interpretive aids.

### **Professionals/Hobbyists**

Professionals or Hobbyists often come to the museum with a specific interest or to see a particular exhibition. They think of themselves as the “real visitors,” unlike the mere “tourists” and want to confirm themselves as sophisticated [7]. They are unlikely to read wall labels or use other interpretive aids as they are already very knowledgeable. They may, however, attend lectures or workshops, and enjoy talking to experts and learning behind-the-scenes information about the museum.

Falk, in collaboration with Lynn Dierking, also developed the Contextual Model of Learning [8], which shows how visitor experience is affected by factors other than identity, such as personal context (prior knowledge, experiences, and interests), socio-cultural

## Dallas Museum of Art Visitor Model

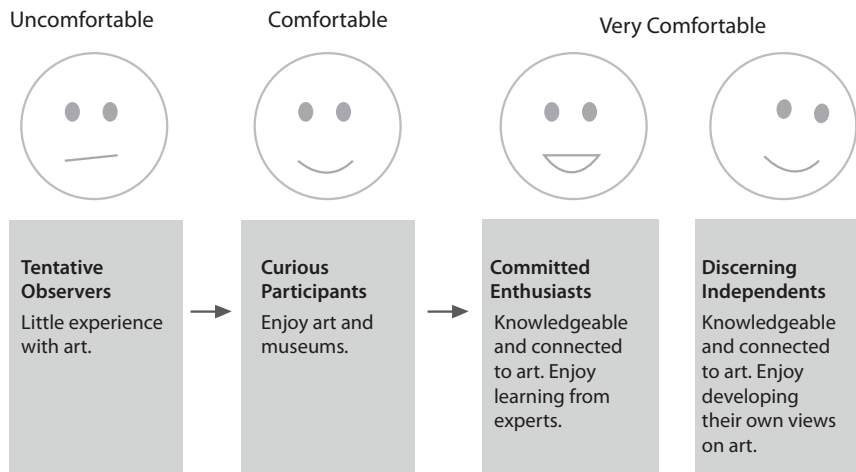


Figure 2.2: The Dallas Museum of Art’s visitor types and their comfort with art.

context (current companions, others at the venue, and cultural background) and physical context (advance organizers, architecture and exhibit design).

## 2.2 Other Visitor Models

In addition to Falk’s foundational work, there are more-recent studies completed over the last ten years that propose other models of visitor types, centering on the idea that personal information—like previous experience, goals and identity—are more meaningful than demographic data in terms of predicting visitor behavior and desires. These models offer other perspectives on visitors that can help to shape interpretive aids.

### The Dallas Museum of Art’s Visitor Model

Researchers at the Dallas Museum of Art (DMA), in conjunction with research consultancy Randi Korn and Associates, developed a visitor model based on the level of comfort or “personal connection” that different visitors have with art. They identify four types of visitors: Tentative Observers, Curious Participants, Discerning Independents, and Committed Enthusiasts [11]. While Committed Enthusiasts and Discerning Independents are both knowledgeable, confident and emotionally connected to art, the Committed Enthusiasts are those visitors who are interested in hearing explanations of artwork while Discerning Independents are more interested in developing their own views.

Randi Korn and Associates used the same approach to visitor categorization at the Sports Legends Museum at Camden Yards [15]. While the categories that they found there (Middle-Road Fans, TV Enthusiasts, Active Enthusiasts, and Indifferent Companions) are different from those found at the DMA, this example illustrates that analyzing visitors from a non-demographic view can be applied to different types of museums.

As an example of how a visitor model can be put to use, in 2005 the Dallas Museum of Art created a new system for developing visitor programs based on their research. The DMA calls this new system The Arts Network and has used visitor categories to develop

“channels” that organize and target their offerings in the same way that many television channels are targeted (e.g. HGTV focuses on home and garden interests and ESPN focuses on sports interests). More information about their visitor studies and the implementation of their framework can be found in their publications *Dallas Museum of Art Presents The Arts Network* [11] and *Ignite the Power of Art: Advancing Visitor Engagement in Museums* [23].

By analyzing visitors, museums can generally find a small number of categories into which visitors fit for the purposes of designing exhibits or communications to appeal to a range of visitors. These categories can cover such distinctions as identity-related goals (as does that Falk model), attitude toward the subject matter (as does the DMA model) or other distinctions that are of interest to a particular museum.

## 3 Mobile Museum Guides

Museum audio guides, the precursors to mobile guides, originated in the 1950s as the standard method for delivering content beyond wall labels. They began as personal receivers for short-wave radio broadcasts—visitors could “tune-in” and listen to a recorded audio program that was already in progress. Visitors did not have any choice over what to listen to or when to listen to it [29].

In the early 1990s random access capability was introduced and visitors could access audio clips by keying in numeric codes placed by artworks [10]. Visitors had more control—they could choose to only listen to information about works in which they were interested. Today, most museums with audio guides use systems that have changed little since the introduction of random access. Visitors typically go to a designated area after purchasing museum admission and then pay to rent an audio guide player. They can usually select a language option and then use the guide as described above.

### 3.1 Benefits of Mobile Guides

Mobile guides offer new capabilities and conveniences to address the limitations of audio guides. They can be accessed on visitors’ own devices and can provide a richer experience: more information, more personalized information, and multimedia information (text, pictures, videos). Current mobile guides capitalize on these capabilities to varying degrees.

- *Unlimited Content* Although it is important to consider connection speeds, mobile guides that have access to the Internet can provide an unlimited amount of information to visitors and can provide multimedia content in a number of formats. This allows museums to present visitors with many options for engaging with their collections, and allows visitors to explore beyond basic facts about works in as much breadth or depth as they choose.
- *Exploration Options* Digital, interactive guides can also offer a choice between guided tours or on-demand information (See Figure 8.1). While audio guides have evolved into on-demand systems, some visitors may still prefer the more structured approach of an organized tour. Mobile guides can offer both, including many distinct tours and the ability to switch between on-demand viewing and following a tour.
- *Purchase/Decision Timing* Guides developed for visitors’ own devices (with Internet access) can provide a new flexibility for visitors. Currently, visitors have to decide at the beginning of their visit to get an audio guide, before they have seen the exhibitions. They may not think that they will want a guide, or they might not realize that the museum has a guide if it is not brought to their attention. By developing guides

for these new devices, and specifically for the devices that a visitor may own and carry with them, visitors can decide to opt-in to the guide at any time. If a visitor has a smartphone, as he reads a label or looks at a sign in a gallery, he can learn about the guide and quickly install it or access it through a Web browser.

- *Reading and Listening Options* A reading- or text-based option allows for easy browsing (can quickly see what information is included) and makes users appear more approachable than if they were wearing headphones (good for group visits).

## 3.2 Business Model

Audio or mobile guides are not relied upon for revenue, which largely comes from donors and ticket sales (if admission is not free). Guide systems are implemented as part of a strategy for increasing visitor engagement, contributing to the education of the public and increasing a museum's popularity and reputation. However, if a museum is popular and the community recognizes it as a valuable resource (perhaps partially due to a guide), that will help the museum to secure funding.

## 3.3 Native Versus Web Applications

Current guides for mobile devices are either native applications (made to be installed on a specific type of device) or Web applications (viewed through a Web browser). Many of the current smartphone guides are native iPhone applications—made for Apple's iOS which, unfortunately, leaves out the majority of smartphone users. In order to reach other users, additional applications would have to be developed specifically for other smartphone operating systems. While Web applications cannot make use of some operating system-specific features, such as integrating directly with the camera, they provide access to anyone with an Internet-enabled device and avoid the cost and time associated with developing multiple versions of an application for different devices.

## 3.4 Current Guides

Because of the new possibilities afforded by offering guides on consumer devices, museums and guide design firms are both interested and currently engaged in exploring these platforms. Many large or forward-thinking museums are using mobile guides, and many smaller, less-well-funded or more-conservative museums may follow in the future as the guides are further explored and tested. Computer science researchers are also interested in visitor experience and mobile guides because of the large data sets of works and related information, and the challenge of exploring that information at the museum.

Current guides are created either by design firms or in-house at museums. In the past, museums often relied heavily on design firms to create and manage their audio guides, but museums are increasingly handling their guides in-house [5]. Museums that do use design firms generally have more control over content than they did in the past and may rely on the design firm primarily for the user interface (UI) design and programming.

### What is the Future of Mobile Museum Guides?

#### Guide Design Companies

There will be opportunities for custom UIs as well as frameworks that many institutions can use.

Shift focus from custom hardware to developing for common devices that visitors may bring to the museum.

#### Museum Staff

Create a database of the museum collection.

Develop guide content in-house.

Guides must be fun, educational, and adaptable to many different visitor interests.

Minimize costs while making content available to as many people as possible.

#### Researchers

Recommendation algorithms, computer vision, and sensors have the possibility to enhance guides.

Guides should be context aware and fit seamlessly into the visit experience.

Figure 3.1: Different perspectives on future museum guides.

## UI Frameworks

Some design firms have created flexible, generic UIs that can be used for many different institutions. Two such systems are Antenna Audio's Pentimento system [2] and Acoustiguide's Smartour [1]. Museums can use these frameworks to organize and display their content. The frameworks generally support multiple ways for visitors to access content:

- Themes
- Browsable images of works by gallery
- Numeric keypad
- Interactive map
- Text search
- Tours

Smartour also includes features such as a registration form through which visitors can sign up for museum notifications, and social networking options so that visitors can tell others about their visit.

These frameworks can save time when creating a guide. However, although the standard features may capture most of what museums currently expect, they do not approach the full potential of a mobile guide.

## Custom Guides

Most guides are custom-made for a museum or a specific exhibition. Many share common features such as basic logistical information (like hours and tickets prices), tours, and audio or video commentary. Some guides also include an interactive map, showing locations of artworks on a chosen tour.

**Innovative features:**

- Including non-museum content such as relevant YouTube videos
- Posting visitor comments
- Allowing visitors easy access to guide material outside of the museum
- Encouraging visitors to participate in curation

**Examples of museums with custom guides:**

- The Brooklyn Museum
- The Cooper-Hewitt
- The Louvre
- The Mattress Factory
- SFMOMA

There are many guide examples (see Appendix A) and some have incorporated features that have been recognized by museum professionals as engaging for visitors (see Section 4.1), but there is significant room for innovation and refinement of features and user interface, and some areas of interest to museum professionals and visitors (such as games, recommendations, and easy direct access to specific works) have not been fully or satisfactorily explored in current systems. These areas will be explored in the system that this thesis proposes.

### 3.5 Recommendation Systems

Museum professionals and computer science researchers are looking to see how museum guides can go beyond the current state and reach new levels of engagement and ease-of-use. A major interest is in recommendation systems; there are many options covering a range of implementations and values for engagement. A fast and simple way to provide personalization is through a fixed list of profiles (e.g. “Explorer” or “Student”) from which visitors can choose at the beginning of their visit. Researchers Tan and Oinonen conducted a study to learn about visitors’ profiling preferences [30] and found that participants prefer to have some direct control over their experience and are not satisfied with choosing a profile. Alternatively, visitors can be profiled based on which items they view with a guide or which they rate highly, using an automated system based on machine learning (like Pandora or Netflix). However, it is not clear how that can support first-time or infrequent visitors as the system would not have sufficient time or data to make educated recommendations. A simpler option that gives control to users is offering a list of themes or related works from which visitors can choose.



### 3.6 Object Selection

Several research groups have developed and tested mobile museum guides, often with a focus on how new technologies can enhance visitor experience. An overarching trend is context awareness, with a focus on object recognition.

Currently, users of mobile guides usually enter numerical codes provided on wall labels into a guide system in order to access information. This method is reliable, but text entry can be tedious or difficult. Aside from addressing usability concerns, new object selection methods could also be playful.

One new approach to object selection uses sensors and user gestures. In *Towards Interactive Museum: Mapping Cultural Contexts to Historical Objects*, Park et al. present a wearable system through which users can point to an object to select it using a “ring-type 3D pointing device” equipped with a sensor and an accelerometer [14]. After selecting an object, users can make a defined gesture to see information about that object on a viewing device that is worn on the wrist. This work illustrates an innovative type of interaction, but unfortunately, it may not be feasible in the near future (The majority of the paper discusses the difficulties of object-selection.).

Another approach to object selection uses computer vision. Bay et al. created a system that includes a tablet PC with an attached webcam [3]. Users can take a photo of an object, and the system will try to determine which object it is and then display corresponding information. The system also makes use of location information obtained through a wireless networking system installed in the space. While the authors state that the system is “robust,” it does require a database of museum holdings with several images for each object that vary in angle, as well as a location-sensing system. Due to those constraints, such a system seems difficult to maintain as exhibitions rotate in and out of museums and also potentially expensive and difficult to install.

Although these alternative means of object recognition may not be ready for commercial use, they illustrate possibilities to consider for the future. Meanwhile, some museums have used RFID or QR codes to aid in object selection, which are robust, economical, and easy to implement (see Section 4.1 and Appendix A).

### 3.7 Conclusions

Mobile guides have evolved from simple audio tracks with few options to multimedia touch-screen devices with large data stores and customization options. Many professionals in the museum community are excited about the possibilities provided by these new guides and are actively exploring them. However, many guides are still fairly limited, merely offering another means of accessing pre-existing audio guide content and not living up to their potential. The system developed in this thesis will address these deficiencies and take full advantage of the platform to meet and exceed visitor expectations.



## 4 Understanding Visitors and Museum Staff

A museum visitor's experience is influenced by everyone from exhibit designers to city government, but the primary stakeholders to consider when creating interpretive systems are the museum staff and the visitors themselves (See Figure 4.1). The term "museum staff" is intentionally broad as there are numerous roles that vary widely depending on the size, subject matter, and collection of a particular museum. Among the staff, two groups emerge as primary leaders and decision-makers: curators and educators. Curators generally research artifacts, choose exhibition content and write interpretive text. Educators take information about an exhibition and determine how best to present it to visitors in order to maximize their engagement and learning. Educators also organize activities and events for visitors that are aimed at enriching their understanding of the collections, such as lectures or classes. A successful mobile guide (or any other interpretive system) will help museum staff and visitors to achieve their goals. In order to understand their general goals it is important to develop an understanding of any specific museum and visitor base involved in a particular project. There is great variety among museums and visitor bases, so it is not safe to assume that general information or models cover all of the necessary considerations.

### 4.1 Art Museum Professionals

Museum professionals interviewed for this thesis were all enthusiastic about improving visitor experience but came from institutions with varying types of artwork, available content and desired visitor experience. All were interested in providing content to visitors in addition to what can be included on wall labels, in brochures or in audio guides; suggestions included artist interviews, videos explaining the art-making process, historical context, and recommendations about which works to view. Some were concerned that visitors had questions, but did not ask staff for information; possible explanations include that visitors are intimidated, worry about bothering staff, think that the staff is not knowledgeable enough, or worry about revealing their own lack of knowledge or understanding.

#### Varying Exhibition Goals

Overall, the museum staff were enthusiastic about giving options to visitors and letting them explore, although some were concerned about visitors "wandering" in exhibitions and not reaching the learning goals that staff had defined. Museum staff goals vary by exhibition as well as by institution—in some cases the goal is for visitors to make their own meaning and in others there are specific concepts or information that staff would like visitors to learn.

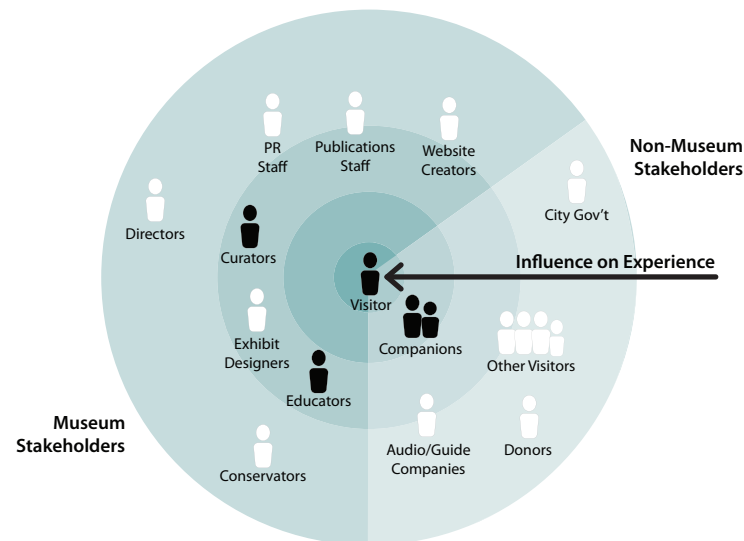


Figure 4.1: Key stakeholders in visitor experience.

### Supportive or Distracting?

Despite museum staff enthusiasm for the possibilities of mobile guides, some did raise the question of whether a guide would distract from the artwork and become its own activity. One person gave the example of the Cooper-Hewitt's guide [12], which showed long videos that detracted from the exhibit. Koven J. Smith, of the Metropolitan Museum of Art, said that he felt frustrated with the long videos and would rather watch excerpts with the option to watch the videos at a later time [27]. A reviewer for the *New York Times* felt that the Cooper-Hewitt's guide worked very well in its context, but admitted that such a guide "could be a fatal distraction from the art on view [28]." While any interpretive aid could potentially distract from artwork, the advanced functionality and multimedia possibilities of the latest mobile guides make them particularly prone to this problem. However, well-structured content of an appropriate length can support visitors and avoid becoming a distraction. Additionally, mobile guides allow visitors to save or bookmark content for later viewing (if they are using their own device) and if they are using the museum's device then the museum can email content links to visitors or provide an easy way to find the content on their websites.

### Guide Platforms

In addition to traditional audio guides, the interviewed museum staff have tried lending MP3 players, guide by cellular phone (providing numbers by artworks that visitors can call for more information), and traditional audio guides. All systems were limited to audio, the MP3 players quickly broke and the guide by cellular phone came with an expensive contract for the museum. The Mattress Factory (an installation-art museum) currently uses an inexpensive system for smartphone users. They have QR codes by their artworks that



Figure 4.2: Kiosk at the Carnegie Museum of Art

visitors can scan in order to view additional content such as online videos of the art installation process or artist interviews. So far they have found that the visitors who have tried the system have liked it and enjoyed the additional content.

### Supporting Socializing

Beyond mobile guides, these institutions improve visitor experience through art-making courses, reading groups, lectures, scavenger hunts and cocktail parties. They are also active on social networking systems such as Facebook and Twitter, and they maintain blogs. While these programs usually occur, or are accessed, outside of a typical visit, they contain aspects that can inform a successful mobile guide. Many of these programs share a social aspect in that they are either group activities or they promote dialog between visitors, or between visitors and museum staff. This social aspect is something in which many museums are interested [5]. A docent at the Carnegie Museum of Art (CMoA) illustrated the museum's focus on dialog when she said of the docent tour program, "We have discussion, rather than a touring philosophy [20]." A mobile guide can include features that support this focus on social connections and discussion through social media integration, and through intriguing content that sparks in-person conversations.

### Supporting Curiosity

Art museums in particular have a reputation as being imposing and elitist and, as well-known visitor experience strategist Nina Simon says, they do not have the same "vibe" as science museums, where visitors are encouraged to feel like anyone can be a scientist [26].

In many art museums the focus is on great artworks and artists rather than on experimentation and the art-making process. There may be ways to incorporate more information about process in a mobile guide, as has been done with some museum kiosks. At the CMoA they do have a few kiosks demonstrating process, and some include physical examples of work that visitors can touch. In addition, they also had a live weaving demonstration during a 2009 exhibition on tapestries [19]. While process information and video demonstrations on screen are still limited in interactivity and may not engage or excite visitors at the same level as a full, physical exhibit, it may be an efficient way to satisfy the curiosity of many visitors and perhaps inspire them to learn more about, and experiment with, the process on their own or attend museum art-making activities.

### **Key Findings from Museum Professionals**

- The system should be relatively cheap, robust, and easy to pilot-test.
- Context is key. Although there is a lot of information that museums want to share, that information has to be shared strategically to support a positive learning experience.
- Museums want to engage visitors in a dialog.
- Every exhibition is different, so a guide must be flexible.
- Visitors should have options and be encouraged to explore.

## **4.2 Visitor Case Study: University Students**

This project will focus on improving the visit experience of university students. Although most museums are moving away from focusing on demographics (see Chapter 2), university students are especially interesting because many of the universities in Pittsburgh (Carnegie Mellon University, Chatham University, and the University of Pittsburgh) provide free admission to the Carnegie Museum of Art (the subject of this thesis' case study), and many university students have flexible schedules and live near the museum. At Carnegie Mellon University, which is the closest university to the museum, approximately 75% of undergraduates live on campus [31]. These conditions show that local university students do have access to the museum and any lack of visitorship can more readily be attributed to disinterest rather than the scheduling, traveling, and financial concerns that many people from the general population cite as reasons why they have not visited or do not often visit a museum. If the visit experience for university students can be improved, then there should be an increase in interest and visitorship among them.

### **Traditional Audio Guides**

Several students mentioned problems that they had with audio guides. They said things like "I don't want to spend that much time at every painting," and the last audio guide that I used, "was almost too much...It was kind of dull and rambling." Some also said that they do not like audio guides because they are too restrictive. Overall it seems that guides that offer more freedom of choice, and the power to preview or get an overview of the information they contain, would improve visitor satisfaction.





Figure 4.3: Participants during a think aloud visit to the Carnegie Museum of Art.

### Desired Information

During think aloud visits to the Carnegie Museum of Art (See Figure 4.3 and Appendix B), students asked a variety of questions about the artworks, such as how, when, and why they were made, as well as questions about the artists and the historical context for older works. It is clear that visitors have varying interests and that it would be difficult to answer all of their questions. Traditional audio guides try to anticipate the most common questions and relate the most interesting stories, but a well-organized screen-based guide enables visitors to decide which information they find the most compelling and to easily make selections that are not available on audio-only guides.

### Deciding Which Works to See

Some students mentioned that they had a hard time deciding which works to see or where to go next. While it seems that some guides can be overly prescriptive, there is an opportunity to provide recommendations that the user can use or ignore as he chooses. As mentioned previously (See section 3.5), there are many ways to provide recommendations. Overly-abstract and simple profiling, such as having users choose from three categories of visitors may not lead to good recommendations and may suggest that the museum does not understand their visitors as individuals. Systems relying on machine learning can take too long to learn enough about visitors' interests based on how they use the system and may end up frustrating users. Themed tours, from which users can select based on their interests, may be a good solution and has been used in guides such as the Louvre's Mon Guide [6] and in print format by the Art Institute of Chicago [21].

### **Key Findings from Student Visitors**

- Have many and varied unanswered questions about the exhibitions.
- Think that audio guides are restrictive and lack structure.
- Think that museums can do more to support subject-matter novices.
- Feel they do not have time to visit museums.
- Tend to visit in groups.

## **4.3 Personas and Visitor Types**

These personas reflect characteristics found in both Falk's and the Dallas Museum of Art's visitor types, and are used to illustrate how visitors with differing backgrounds and goals might use a new mobile guide system. For full scenarios of use, see Appendix B.

### **Rick Reynolds - Tentative Observer, Facilitator**

Rick is a graduate student from West Virginia in the third year of an Economics Ph.D. program. He has been to a few museums while on vacation, but felt ambivalent about them.

Rick decides to take his girlfriend Anna to an art museum because she has only ever been to the small art museum in her hometown and is enthusiastic about seeing a more impressive collection. Since he has had more experience, Rick feels responsible for showing her around and making sure that she has a good time.

### **Nicole Davis - Curious Participant, Experience Seeker**

Nicole is a freshman from Atlanta who lives on campus. She is majoring in professional writing, and is ambitious but naturally easy-going. She spends her free time hanging out with friends and reading novels, but she also loves to travel and has a long list of countries to visit. Even though Pittsburgh is not a large city, she is still excited to see all of the sights.

It is Friday and Nicole has just turned in a difficult project. She is ready to take a break from school and wants to make some headway on her list of places to go in Pittsburgh, so she heads to the art museum.

### **Cassie Reed - Curious Participant, Explorer**

Cassie is a sophomore from Erie, PA who lives in the CMU dorms and is majoring in biochemistry; she is hard-working and focused on her studies. Although she has not had any time for take electives outside of her major or join student clubs, she would like to be more well-rounded and feel like she is not only a "science person."

During mid-semester break when everyone has the day off from classes, Cassie and her friend Katherine decide to go to the art museum because they have never been there and it is just a short walk from campus.



**Megan Lewis - Committed Enthusiast, Explorer**

Megan is a junior from San Francisco who lives in the CMU dorms. Majoring in anthropology, she loves learning about other cultures and studying their traditional artwork.

Megan visited the art museum during her freshman year, but has not returned since then because she never has free time. When her friend Amanda comes to visit during her spring break, Megan says that she will show her around Pittsburgh. They decide to check out some of the local museums and start at the art museum.

**Martin Gray - Discerning Independent, Aspiring Professional**

Martin is a senior from Pittsburgh studying art history. He enjoys the growing local arts scene, but plans to move to New York to earn his Ph.D. in art history at Columbia. Some day he would like to be either a professor or a curator; he is not sure which.

Martin is taking a class on the history of American furniture design and has to choose a topic for his final research paper. He heads over to the Carnegie Museum of Art to see their furniture collection—maybe he will be inspired and come up with a topic.



# 5 Findings & Design Criteria

## 5.1 Key Findings

These key findings are distilled from the literature review, and from interviews with museum staff and university students.

### Literature Review

- Museums are competing with many other education and entertainment options.
- Museums are building databases of their works and related information.
- Museums do not have the space for physical, interactive displays, or feel that such displays would be too distracting from the exhibitions.
- Museum staff are interested in experimenting with mobile guides.
- There are different types of visitors and different visit goals.
- Visitors tend to view work with which they are comfortable.

### Museum Staff

- Are often on a budget and short-handed.
- Want to ensure that interpretive information enhances learning and does not distract from the exhibitions.
- Want to give options to visitors and encourage them to explore.
- Use different interpretive strategies depending on the exhibition content—each exhibition has a unique story to tell.

### Visitors

- Think that museums can do more to support subject-matter novices.
- Feel they do not have time to visit museums.
- Think that traditional audio guides can be verbose and limiting.
- Have questions about artworks that are not answered by currently available information.
- Tend to visit in groups.

## **5.2 Design Criteria**

### **Learning**

- Must provide more pathways to learning through connections with visitors' interests.
- Should support subject-matter novices.
- Should provide more information than is currently accessible to visitors.

### **Experience**

- Must support goals of different visitor types.
- Should support and spark conversations.
- Should extend the visit experience outside of the museum.
- Should enable visitors to share their experiences and promote the museum to friends.
- Could create a long-term connection to the museum.
- Could encourage participation in museum events.

### **User Interface**

- Must be intuitive for first-time users to avoid frustration and distraction from the exhibition.
- Should use familiar UI design patterns.
- Should encourage exploration.

### **Implementation**

- Must use robust technology that is easy to maintain.
- Should be easily pilot-tested so that museums can evaluate the system before making a large investment.

## 6 Initial Concepts

In order to better understand visitors and what they want and expect from museums, this thesis has reviewed literature on visitor research (see Chapter 2) and interviews of visitors and museum staff (see Chapter 4). Main findings include that there are several different types of identity-related goals with which visitors come to museums, and that visitors have many unanswered questions about the collections and are interested in more relatable, contextual information. Museum staff want visitors to feel engaged and to appreciate the exhibitions but are constrained by practical concerns (finances and time), and want to make sure that any changes made to the museum enhance the collections rather than becoming a distraction.

The following concepts enable resonant, rich, and interactive experiences to drive engagement. For simplicity, basic features that have been well-explored and -received in other guides, such as museum hours, rates, floor plan, events, standard tours of collection highlights (including length options for visitors short on time), ways to browse works in the current gallery, and curator comments, have been excluded. It is assumed that such features will be added to any guide before deployment. These features lay the foundation for the types of concepts that will be explored here; if a visitor is lost or lacks basic information, then the possibility for engagement is slight. Museums and their interpretive aids, such as guides, need to meet the current expectations of visitors for basic information and then pleasantly surprise them with additional offerings.

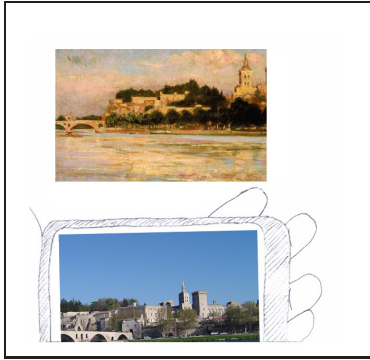


Figure 6.1: Location

### Location

This concept shows the approximate geographic location of a work's subject matter, and photographs of that location. Related images, such as other local historical sites or landscape images, may be included.

The images will help visitors to make connections between works and other interests or past experiences (like books or movies that the visitor has seen), places that they would like to visit, or places that they have visited, among other possibilities. If the location influenced the work then it might also help a visitor to imagine what the artist was feeling or thinking. As one visitor recalled during an interview, seeing the countryside where Van Gogh painted his *Starry Night* brought that painting to life and made her feel that she understood the painting. Providing these images as hooks into visitors' experiences and interests allows them to find aspects of the work that resonate with them and thus allow them to become more reflective and engaged.

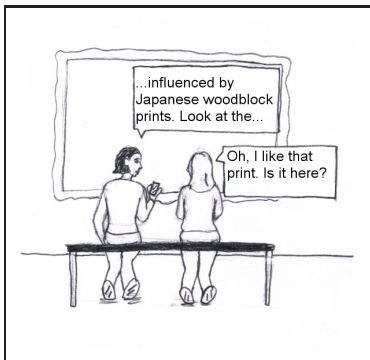


Figure 6.2: Related Works

### Related Works

This feature shows works with interesting connections to viewed works, in order to help visitors structure their visit in a meaningful way by revealing relationships between works and exhibitions. Works may be related in a number of ways, such as by one work's influence on another, time period, medium, artist, artist ethnicity, or geographic location. Related works can be presented in list format or shown as highlighted items on a floorplan of the museum.

Research participants said that they did not know what to see next or how to best move through an exhibition; this feature provides structure, but allows more choices than linear, scripted tours. The Related Works feature can also show works that are in the museum's collections but not currently on view, or even works that are in other museums; these works would help visitors to analyze the work that they are currently viewing.



Figure 6.3: Contrasting Works

### Contrasting Works

Visitors may be more likely to view types of art that they already like, rather than challenging themselves [7]. This feature suggests other works in order to encourage reflection and exploration. Visitors can choose to immediately visit the contrasting work, or they might continue their current path but view the suggested work on their phone and perhaps stop at the work if they happen by it during their visit. Works may contrast in terms of style, time period or subject matter. As an example, when viewing a realistic landscape painting, this feature can recommend an impressionist or modern landscape. The contrasting work should have some connection to the current work so as not to create a disjointed experience, and so that visitors can understand the nature and importance of the contrast. This feature would work best in a museum whose collection is large and has a great variety in style and subject matter.



Figure 6.4: Musical Background

### Musical Background

This feature provides period-specific background music that changes as a visitor moves through an exhibition, setting the tone and historical context. Music can have a strong effect on experience—it is used in places such as stores, restaurants and movies to influence listeners. A musical background can shape museum visitor experience by quickly giving visitors a sense of the tone and style of the time period. The music may also tie into visitors' memories of concerts, recordings or movies that they have experienced. This concept may work best in areas where there is a distinct contrast of time periods or cultural styles. It is also important to consider whether the exhibitions involve the work of living artists, who might object to a juxtaposition of their work with a piece of music.

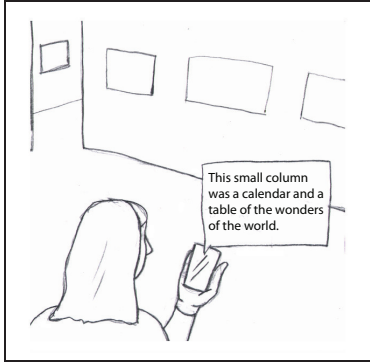


Figure 6.5: Match Game

## Themes

When creating an exhibition, museum staff must choose only one way to group and arrange works. Themed information and games provide a way to show visitors many others ways of combining and connecting works, within an exhibition or throughout the museum. Alternate views of the collections increase the likelihood that a visitor will find a view that resonates with him.

Themes can be introduced through games. Some museums have created elaborate gaming events [16] and some have themed tours [6] [21], but the interactive aspect of games has yet to be applied to tours. In this concept, visitors are given a visual clue and must search for a work. Players are actively involved in searching for artworks and interpreting clues, and will also learn about the works and see other works that they may not have otherwise noticed.



Figure 6.6: Track Your Visit

## Track Your Visit

This feature allows visitors to save specific works or to track all of the works that they access in the guide so that they can follow up them, allowing them to continue learning after their visit is over.

## 6.1 Relation to Visitor Models

The guide features support all of Falk's visitor types. Explorers can satisfy their curiosity by learning in-depth information and Facilitators can entertain or educate their companions. The easy access to intriguing and varied information also encourages Experience Seekers to delve more deeply into the exhibitions, and Hobbyists/Professionals to explore and enjoy works beyond the specific pieces or exhibitions that they came to study. Rechargers generally do not have an interest in interpretive aids, but the guide can provide valuable content that might lead them to transition to another visitor type.



## Interpretive Environment

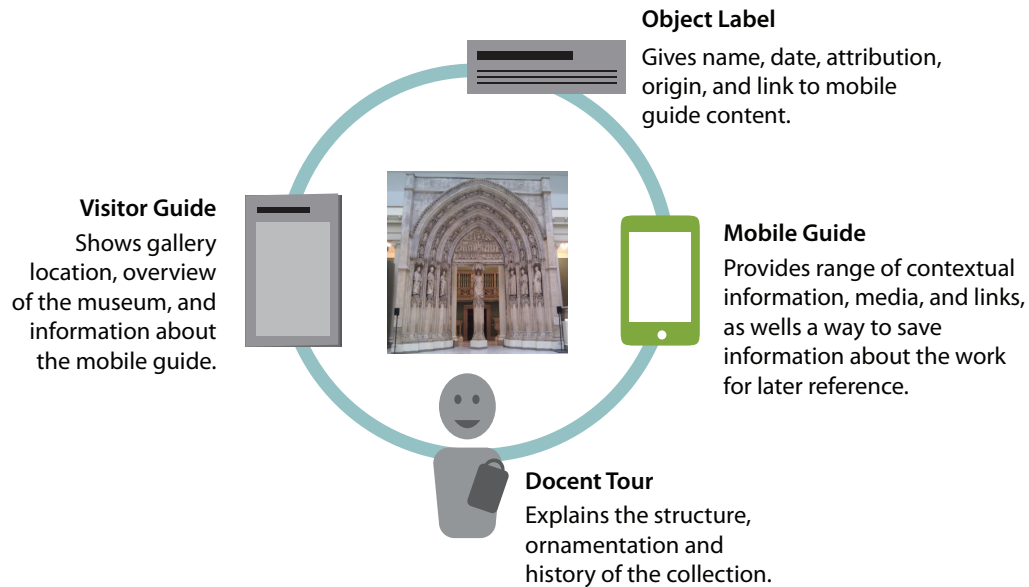


Figure 6.7: Interpretive aid system for an artwork

## 6.2 Relation to Other Interpretive Aids

The guide system will be used within the larger interpretive system of the museum and should integrate with that system so that each component is enhanced by the others. The system components are variable but will often include physical brochures and maps, wall labels, wayfinding signage, and information sheets or binders. These components should include information about how to access the mobile guide and what type of content it offers. The guide proposed in this thesis uses QR codes to access content about specific galleries or artworks, so other interpretive aids should include such codes that visitors can scan to access the guide (see Appendix D).

Mobile guides are not meant to replace the rest of the interpretive system because not all visitors have appropriate devices (and the devices would be expensive for the museum to lend out), mobile guides are not ideal for all interpretive content or strategies (such as complex information displays or long film screenings), and because visitors may prefer one part of the system over another. In addition, these other interpretive aids are necessary to promote, and provide information about, the guide.

## 6.3 Enhancing the Basic Features of Current Mobile Guides

Some of the basic features common in many current mobile guides can be enhanced to reflect visitor experience research and the criteria outlined in this thesis. In particular, curator comments can include content such as interviews with other experts, staff or visitors, and images or videos of the art-making or restoration process. Including viewpoints other than those of curators is another idea that is gaining popularity in visitor experience discussions; it combats an elitist and exclusive perception of museums that may discourage visitors from

visiting often or becoming involved with museum programs.

# 7 Case Study: The Carnegie Museum of Art

The context for this case study is a permanent exhibition at the Carnegie Museum of Art (CMoA) called the Hall of Architecture. This exhibition displays many full-sized casts of architectural and sculptural works, primarily from Western Europe. The collection was created with the goal of educating the people of Pittsburgh and encouraging them to study and understand great works that would be difficult to see in person.

Although a mobile guide can include information about several exhibitions or an entire museum, this case study restricts itself to a single exhibition for reasons of practicality, and also as an illustration of how a museum might pilot-test such a system. It can take considerable time and resources to aggregate content for a guide, so beginning with one exhibition and expanding over time is a pragmatic approach. Museums may also feel that some exhibitions are already very engaging and that there are only certain exhibitions in need of a supplemental guide.

## Considerations for the Hall of Architecture

The Hall of Architecture holds many challenges for designers of interpretive aids, as well as some advantages that should be considered when developing guide features.

## Challenges of the Collection and Space

- *The cast collection is large, with great variety in the size and shape of the works.* While the collection is displayed in a large room created specifically for the collection, the large size of some casts (the largest is approximately 40 feet tall and 78 feet wide) makes it difficult to display each piece to its full advantage. Small pieces are generally hung on the perimeter walls, often in many rows reaching to a height where it is difficult for visitors to appreciate them in any detail. Some of the large casts do not have sufficient space in front of them for visitors to view them in their entirety.
- *There is a lack of space for interpretive information near each piece.* While there is an open space in the middle of the gallery, there is little space between the casts to present information in situ. Pieces are generally placed close together and, in some cases, as with the small pieces on the walls, they share a common label with numbers to identify the specific works.
- *There are no clear pathways through the exhibition or distinct sections.* Visitors may be uncertain of where to begin viewing the casts, or if there is any timeline or narrative guiding their organization. There is only a small sign by one of the three



Figure 7.1: View of the Hall of Architecture.



Figure 7.2: Small works hung in the Hall of Architecture.

entrances giving an overview of the collection and indicating why the works were selected and what visitors might learn.

- *The casts are difficult to move.* Although the casts could be moved, it would be at a considerable expense of time and money.

Given these spatial challenges, a mobile guide is a good fit—it can provide unlimited information and support visitors without the need for additional space or for rearranging the collection. Successful concepts for guide features should address the Hall of Architecture challenges in addition to the design criteria outlined in Chapter 5.

### **Advantages of the Collection and the CMoA**

- *The Carnegie Museum of Art is physically connected to the Carnegie Museum of Natural History (CMNH).* A guide for any part of the CMoA or the CMNH can reference exhibitions in the other museum, helping to expose visitors from one museum to the other. Visitors interested in natural history but not in art might be persuaded—through guide content—to see an art exhibition (and vice-versa). The content in one museum might also help a visitor to connect with a work in another if there are exhibitions with related content, such as the Egyptian column in the Hall of Architecture and the Egyptian mummy in the CMNH.
- *The size and shape of works is varied, many works are three-dimensional, and there are multiple pathways.* This variety can be intriguing and suggestive of exploration, and could be integral to a mystery game or scavenger hunt.

## **7.1 Prototyping**

This thesis' working prototype for the Hall of Architecture includes several features for evaluation with potential users. Note that not all of the concepts discussed in Chapter 6 for general museums are included. The Musical Background concept was not included as it is not well-suited to the exhibition due to the early time periods involved. The Contrasting Works feature was not incorporated because the particular exhibition does not suggest clear contrasts to make with other exhibitions or between works within the exhibition. The remaining concepts work well for the Hall of Architecture, and expansion of those concepts, lead to a prototype that tests well with museum visitors (see Chapter 8).



## Guide Features

Concepts included as features in the guide prototype include:

### Location

This instantiation of the Location concept includes a map of the site where the original work (as opposed to the cast) was created. Some works represented in the cast collection have been moved from their original sites, but many have not, such as the cathedral entrances. Also included are photographs of the original work (which may look dramatically different in color or texture), interior views if the cast is of a building, and recent photographs showing how the work is displayed or used today. Recent photographs bring these works into the present day and make them appear more relevant to visitors. Seeing people in the photos interacting with the works can help to spark stories about what they are doing or can help a visitor imagine going to that location. If visitors are motivated to learn more about an area or to travel to view original works, then the guide and the exhibition will have fulfilled an important goal of engaging visitors and motivating them to continue their learning outside of the museum.

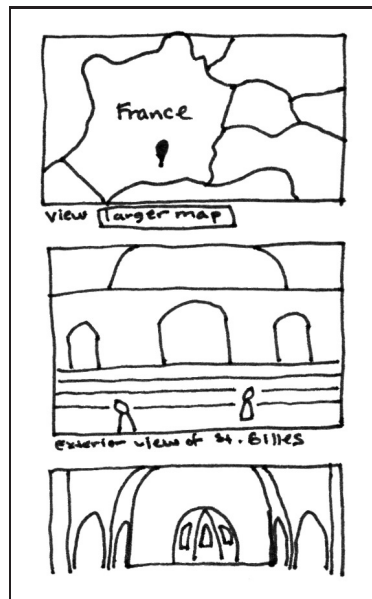


Figure 7.3: Location

### Related Works

Related Works for this exhibition shows works in other media that are from the same time period as the cast that a visitor is reading about, providing other ways for visitors to orient themselves in time. A visitor unfamiliar with architecture may have a better sense of the time period in reference to painting or sculpture. When available, works on display in the museum are shown so that visitors can follow up with these other works. A useful side-effect of this feature is that if the museum staff wants to increase interest in a particular exhibition that is being overlooked, this feature can help drive more visitors to that exhibition.



Figure 7.4: Related Works

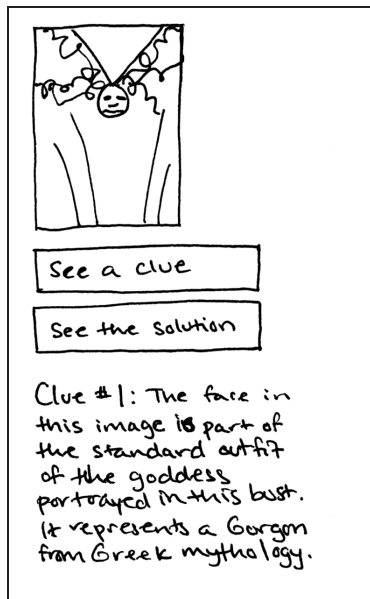


Figure 7.5: Match Game

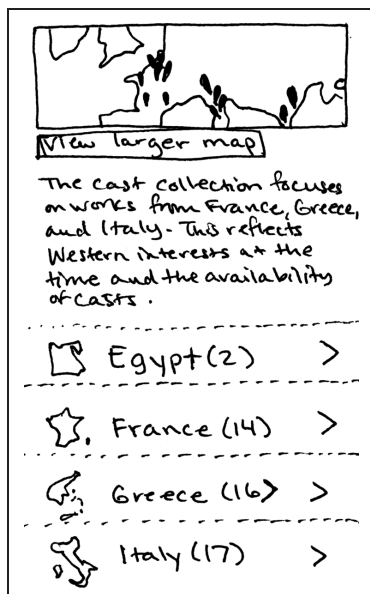


Figure 7.6: Geography

### Match Game

This instantiation of the Themes concept is a searching game that asks players to look at a detail from a work and find the work in the gallery. There are clues provided that offer information about the style, history, geography, or construction of the work. The works chosen for the game are part of a theme (geography and travel) and lead visitors around the different areas of the exhibition. The searching nature of the game prompts players to look around the exhibition more carefully than they might otherwise, highlights the variety of the collection and may also make art novices feel more comfortable in the museum [4].

### Geography

The Geography feature is another instantiation of the Themes concept and shows an overview of the countries from which the casts originate and also includes interactive maps of the casts' locations. Architecture novices might not have significant experience differentiating styles, but most people have experience with maps and geography. Geography is also important to this exhibition because part of Andrew Carnegie's vision for the collection was to "bring the world" to Pittsburgh since most people did not have the means to travel. Additionally, the geography view quickly illustrates to visitors that while the collection is meant to show great architectural work, it only covers a narrow piece of the world, excluding whole continents from which there must certainly be important architectural works (this may simply be due to practical concerns). The listing and map of cast origin could spark deep questions for visitors about ethnocentricity or, more simply, inspire them to travel or imagine the countries represented.

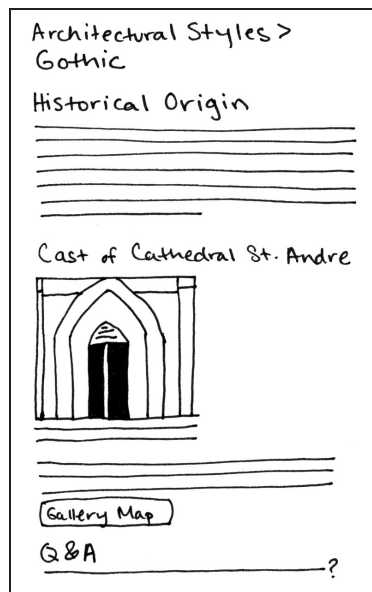


Figure 7.7: Architectural Styles

### Architectural Styles

In this instantiation of the Themes concept, users can view the exhibition in terms of architectural style. Visitors can view information about a single style or view the styles in sequence by time period. Without the guide, a visitor might notice some differences between styles, but there is no route or structure to guide their observations. This feature includes a prime example from each style, question and answer style information (which prompts visitors to look at and notice details in the works) and local examples of the style (which will help them to make connections with past experiences and encourage them to continue learning outside of the museum).

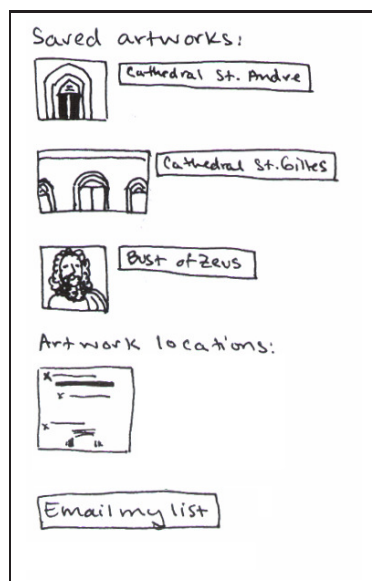


Figure 7.8: Track Your Visit

### Track Your Visit

This feature allows users to either save specific works or save all of the works that they access with the guide. The works and supporting content can be accessed through the guide or a desktop webpage on the museum website. Currently, when a user likes an artwork, he tries to remember the title to look it up later or takes a photo of the work. This feature makes it easy for users follow up with works that they like, and review what they learned and felt during their visit. By continuing the museum experience at home, users can learn more in-depth information, developing more personal connections with the work and also more fully appreciate the rich service provided by the museum.



**Implementation Considerations**

- Some of the preceding features require the collection of photographs related to the artworks, such as those of the artwork's original location. Using professional photographs would increase costs for the museum, but free sources such as Creative Commons might provide appropriate content. In either case, one should be careful to choose photographs that will intrigue and inspire visitors.



## 8 Prototype Mobile Guide System

The final mobile guide system for the Carnegie Museum of Art's Hall of Architecture is based on the preceding literature review (Chapter 2), user research (Chapter 4), and user feedback (Chapter 7), as well as feedback from the university community and staff at the Carnegie Museum of Art. This chapter gives a detailed overview of the system, how it supports visitor engagement, and how it integrates with the museum.

### 8.1 Supporting the Visit Cycle: Planning, Exploring, and Reviewing

The final system supports planning, exploring and reviewing a visit. Upon arriving at a museum, visitors can learn about the guide from paper museum guides, admissions staff, and signs (see Appendix D). They are directed via QR code to plan their visit in the online guide by browsing galleries and tour options. Later at home, visitors can look over and learn more about artworks that they saved during their visit or browse through works that they missed. The guide information would be available as part of the museum's desktop website, as well as on the mobile site, so that visitors can use their home computers. Beyond continuing to learn about the museum and perhaps being motivated to return, the guide also encourages lifelong and leisure learning in general.

The exploring phase of the guide is generally, although not exclusively, used during a visit. Visitors can view information about galleries and specific works, take tours, share their favorite works (through social media), or take part in activities such as games. It supports different levels of guidance for visitors (Figure 8.1), enabling them to directly access information about specific works, get suggestions for other works to see, or follow a tour depending on their preferences.

### 8.2 Resonant, Rich, and Interactive Experiences in the Guide

The goal of the guide is to move visitors from uncomfortable novices or comfortable experts to a middle ground of exploration for maximum engagement and learning through resonant, rich, and interactive experience.

#### **Resonant**

*Resonance occurs when someone senses a connection between himself and an object or event—it brings up memories of events, thoughts or feelings or ties to personal interests.* The guide provides several features aimed at connecting with visitors. Every visitor is unique, but providing several types of content increases the chances of any particular guide

### Exploration Options



Figure 8.1: Visitors can choose their level of guidance by directly accessing works, by seeing recommended works, or by taking a self-guided tour.

user finding content to which they relate. The guide for the Hall of Architecture includes well-organized content on a range of topics, including architectural style, Greek mythology, geography, history and ties to popular culture and travel.

### Rich

*Rich information goes beyond a listing of facts to provide further details or related information that can help visitors to find resonance, and to become more engaged.* The guide includes links to outside sources such as Wikipedia (which, in turn, links to other sources) in order to provide a depth of information and a variety of related content. This relieves the museum of the impractical task of collecting and curating a vast amount of information and also brings other voices and authorities into the museum space, relating the museum to other sources with which visitors are already familiar. The inclusion of popular information sources such as Wikipedia and Google (Google Maps are used in the guide) tells visitors that their past experiences and knowledge of those sources are relevant and useful, which may encourage visitors to explore further on their own.

### Interactive

*Interactive information enables visitors to make choices and to explore exhibitions and related content on their own, as far as they would like to go.* Guide users can choose their level of guidance (as described above), select which topics to learn more about, follow links to outside sources on the Internet and continue to learn more about a topic, save artworks to review later, or share artworks with friends online. Users can also play a game in which they search for an artwork based on an image of a detail and optional clues. The game—as opposed to a tour or direct access to content—is another way to experience the exhibition; users can choose the experience that they find most engaging.

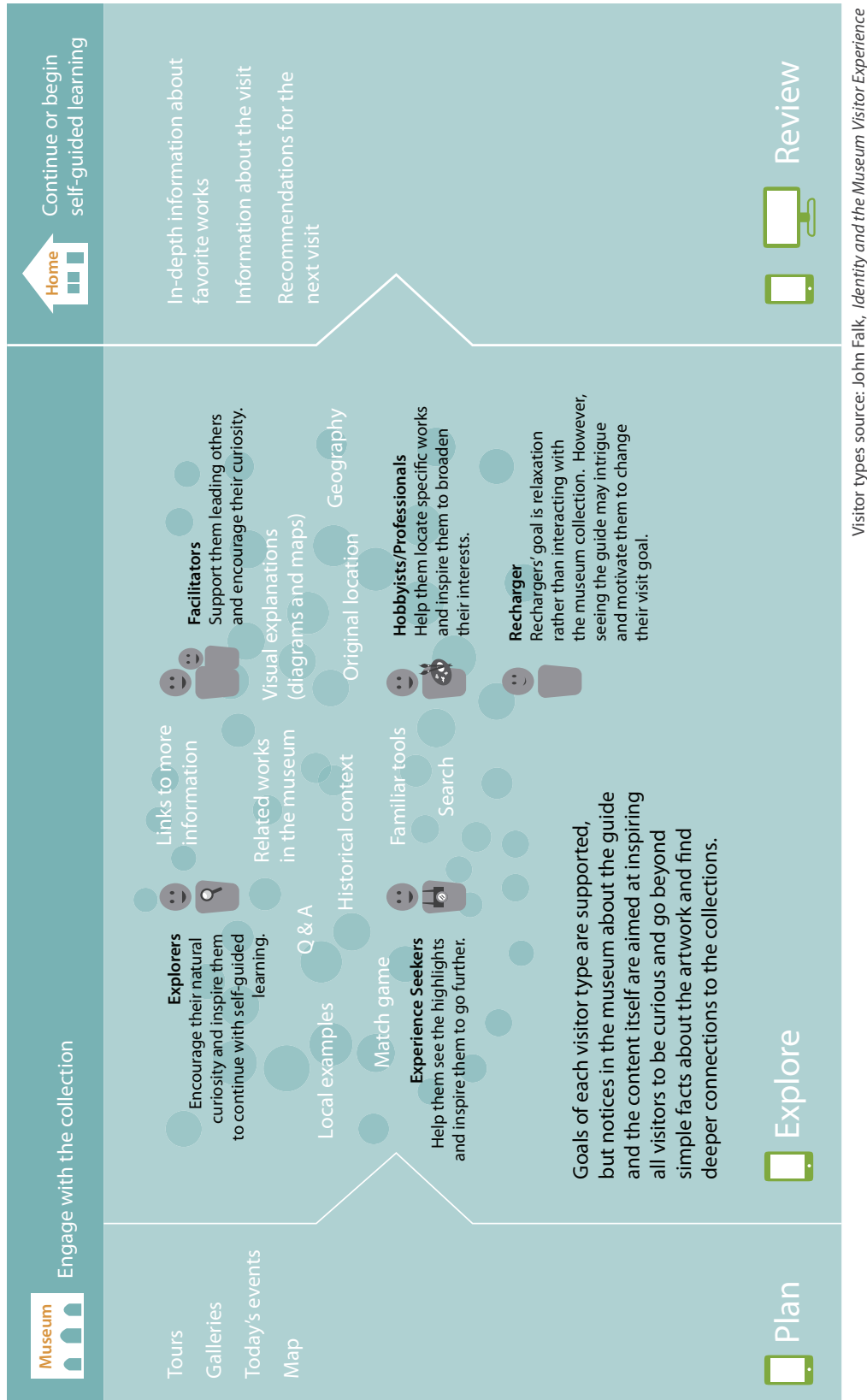


Figure 8.2: The guide helps visitors to plan their visit, explore the museum and later review their visit and continue their learning at home. It can also motivate repeat visits.

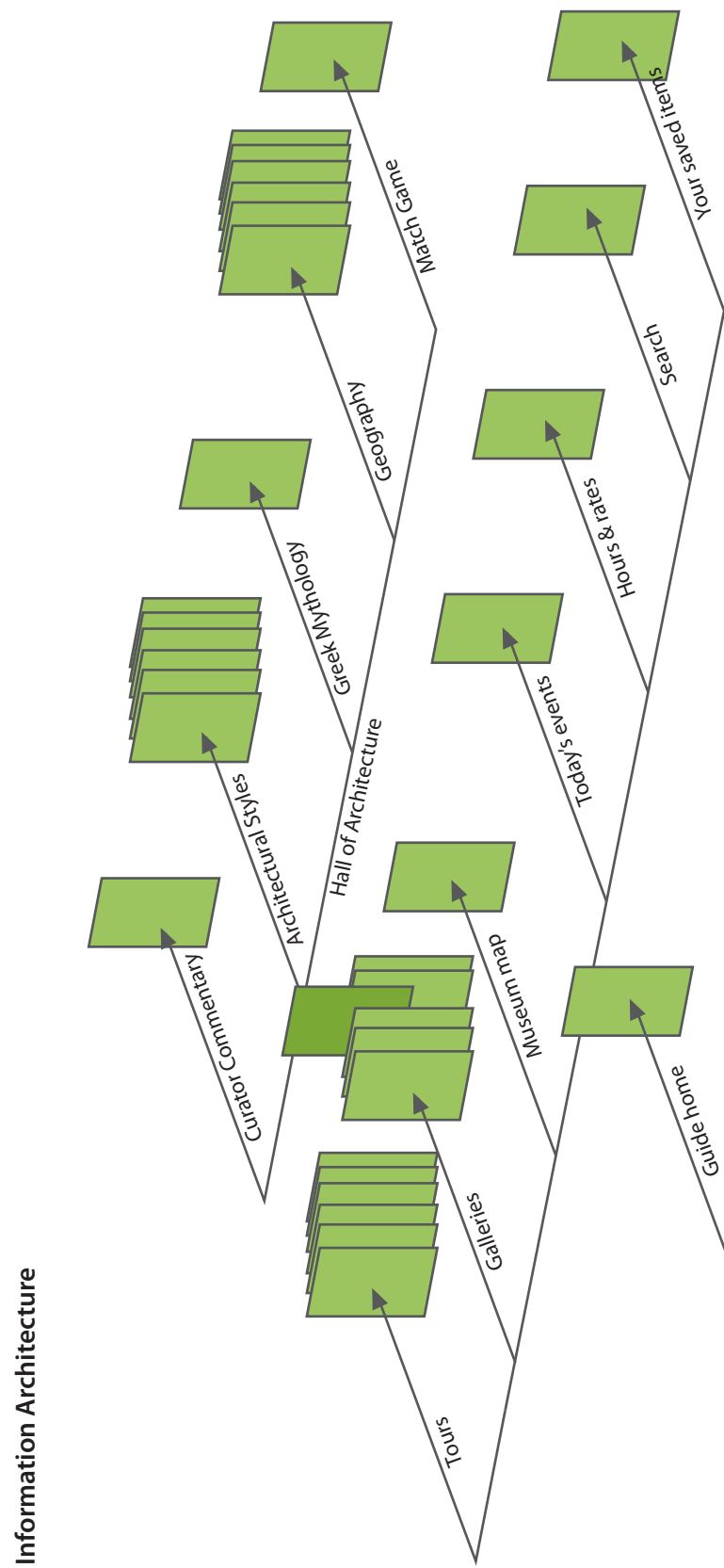


Figure 8.3: Information architecture

### Match Game Flow

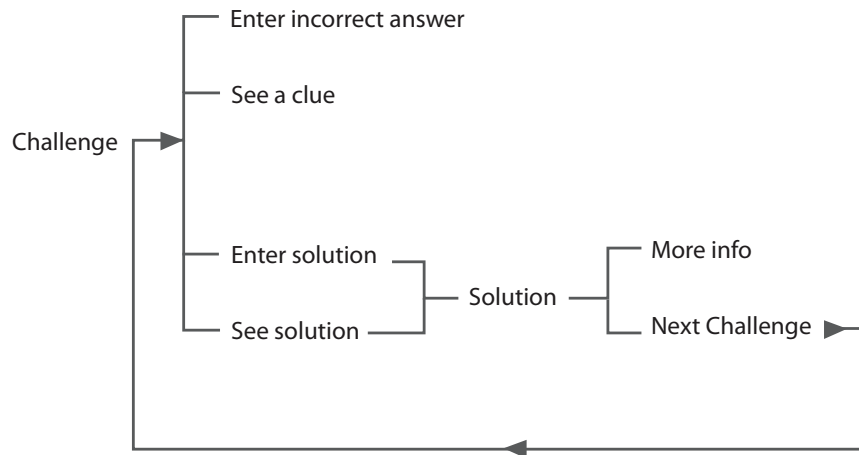


Figure 8.4: Match Game flow

## 8.3 Supporting Many Types of Visitors

The guide supports each of Falk's and the Dallas Museum of Art's visitor types as previously described, although some may use the guide more than others. In particular, Hobbyists/Professionals and Rechargers may use the guide less than other visitor types, because they have fewer felt needs for information. However, a visitor does not have to remain one visitor type during his entire visit. A visitor may enter a museum simply wishing to take in the atmosphere as a Recharger but then be motivated to become an Explorer or Experience Seeker when an exhibition attracts him or he sees signs for a new museum guide that offers intriguing content.

### Experience Seekers

Experience Seekers can use the guide to get the high-level information that they are interested in, such as a museum map, the day's events and tours of the collection highlights.

### Explorers

Explorers are generally curious and motivated to learn. The guide can help them to learn more deeply about a specific work and continue learning by viewing related works. They may also play the game or take self-guided tours, depending on their particular interests and comfort with the collection that they are viewing.

### Facilitators

Facilitators can ensure a good visit for their companions by locating intriguing stories and information relevant to companions, suggesting a tour, by playing a scavenger hunt game or by simply using the guide to answer questions from their companions.



Figure 8.5: A research participant playing the Match Game

### **Hobbyists/Professionals**

Hobbyists/Professionals can use the guide to locate an artist or genre of interest and may also open themselves to exploring the collection and going beyond the particular work or exhibition that they intended to see.

### **Rechargers**

Rechargers' goal is to relax in a peaceful setting, so unless they move from their current goal to that of another visitor type, they would not have much need for any type of guide or interpretive system. A Recharger may use the guide if their interest is piqued by signs or by seeing others using the guide, prompting them to move toward another visitor type such as Explorer or Experience Seeker.

### **Level of Comfort with Art**

Aside from visit goals, users will also vary with respect to their comfort with the subject matter of a museum or exhibition, which is captured in the Dallas Museum of Art's visitor model (Figure 2.2). Tentative Observers may benefit the most from the guide because of the dramatic difference between the amount of supportive content on a terse wall label and in an interactive guide with access to the Internet.

## **8.4 Testing with Museum Visitors**

University undergraduate and graduate students ranging in age from 19 to 30 tested the guide in the Hall of Architecture at the Carnegie Museum of Art. The guide was also evaluated by museum staff.



## Evaluation Criteria

Concepts must support critical design criteria from the literature review and stakeholder research, as well as mediate the challenges of the specific exhibition. They should also balance implementation difficulty and potential visitor engagement.

## Positive Feedback

- Participants said that the contextual information answered their questions.
- Participants were pleased to see local examples of artistic styles.
- References to established interactions from their daily lives were appreciated, such as Google maps.
- Novices were supported and even felt that they could use the guide to tell others about the exhibition.
- The guide fit well into social visits—participants said that they would use the guide alone or in a group and that the guide was less isolating than traditional audio guides.
- The game provided a pathway and goal for visiting the exhibition and was an opportunity to compete with companions.
- Participants were interested in hearing compelling and relevant stories from other visitors.

## Concerns

- A participant found the game too difficult and became frustrated.
- Some game aspects were unnecessary.
- Users may already have too many online accounts and might appreciate a way to view their saved works later on without having to create an account on the museum website.

## Design Implications

- Games and other content should be evaluated by non-experts before releasing them to visitors. Through the process of designing guide content, one gains a deeper knowledge of the collections and should be careful to keep novices in mind.
- It is important to acknowledge that visitors generally come to a museum to learn. Guides should make visitors feel proud that they have chosen to have a learning experience, and should make the content fun and easy to comprehend, while avoiding any condescension.
- Alternatives to a new user account should be explored, such as integrating with popular organizations with which users may already have an account, such as Facebook or Google.

- Contextual information, references to well-known related content, and references to common interactions or tools will help to inform and engage visitors and to make them feel comfortable using the guide.
- Users may be interested in using the guide to connect with companions and well as other visitors. Ways to elicit and present quality visitor-generated content should be explored.

## **Response to Testing Results**

There were several rounds of testing with modifications to the guide made in the interim.

### **Match Game**

Testing showed that the Match Game was too difficult at first, and that the clues were too obscure. In the final design of the game, the first clue reveals what type of object to look for (e.g. column, doorway, bust) and the second clue limits the search area in the exhibition. Later testing sessions with these clues were more successful than earlier sessions. The Hall of Architecture invites exploring due to its large size and variety of objects, but those characteristics also make it a difficult search space. Other game features were also changed based on testing. The game originally showed a user's score, but testing showed that users play the game in order to learn in a casual way, and that not all of the trappings of games are necessary. Some users also felt that the incentive given at the beginning of the game, which offers a discount or free item at the museum gift shop, was unnecessary as motivation to play the game. Overall, it is important to respect visitors and acknowledge that they want to learn. While an over-reliance on game features or incentives could suggest that the museum thinks that visitors need to be tricked into learning, which is insulting to visitors, some game aspects and incentives can be fun and encouraging. The final game does include a nominal incentive, meant as a promotion for the gift shop rather than a hard-handed way to make users play a game, and was appreciated as such.

### **Track Your Visit**

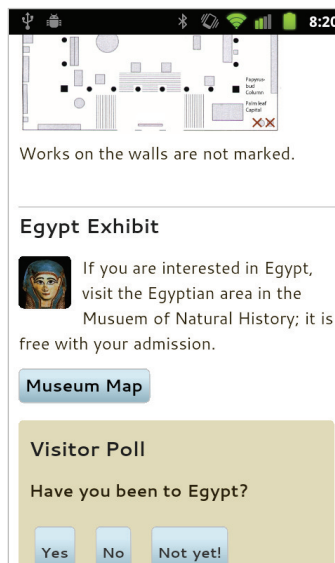
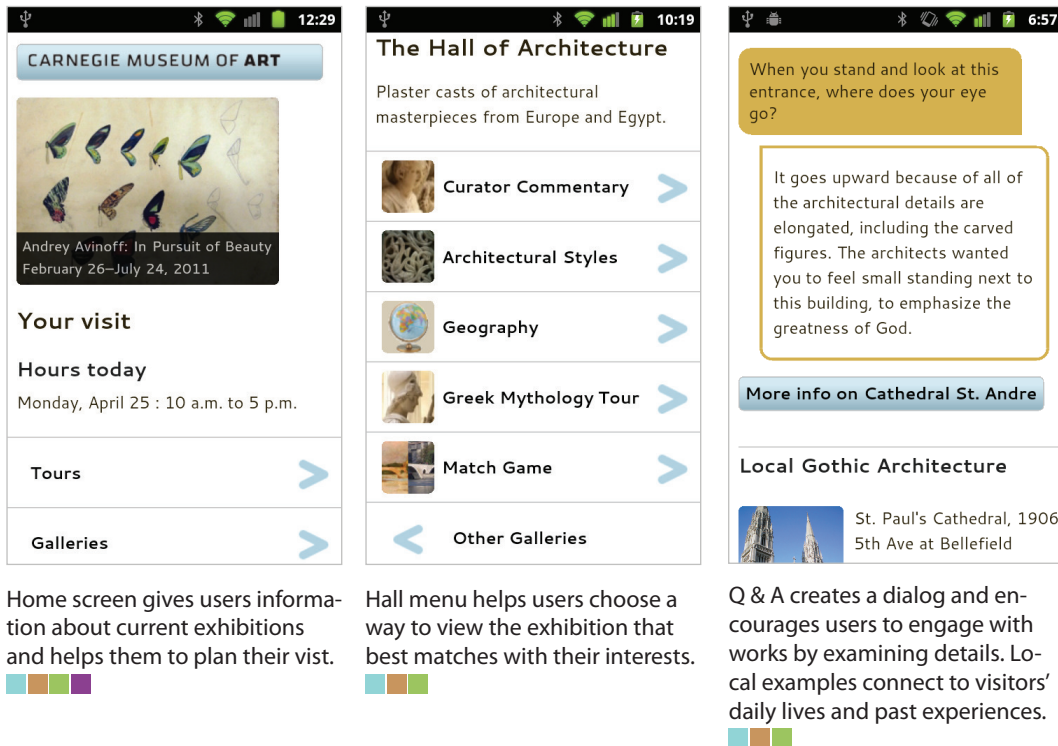
When testing this feature, users were asked about their preferences for receiving follow-up content for artworks that they saved during a visit. Some expected and wanted to have an account on the museum's website, some wanted an email with links to content, others wanted it to be accessible from the museum website without needing to create an account with the museum, and still others wanted their list of works to appear in their Facebook accounts. Given the varied responses and the issues of content copyright, public versus private saved lists, and if no account is made, determining when a museum should remove a user's list, this feature requires more investigation. In the final guide, users are given the option of emailing themselves a link that will direct them to view their list on the museum's desktop website. If users choose not to use that feature, they can still view their saved works through the mobile guide at the museum or later at home.

### **Visual Hierarchy**

First versions of the guide copy were improved based on user feedback and include increased visual hierarchy (additional headings, section demarcations, and use of bold text to reveal highlights).

## **8.5 Final Guide Design**

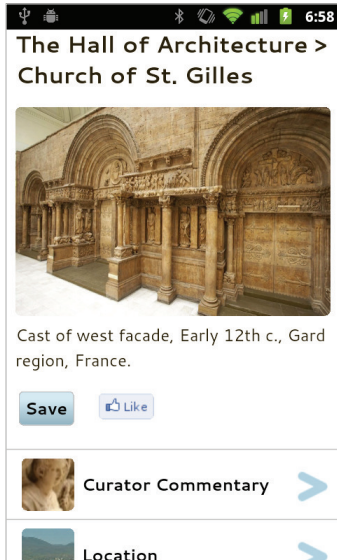
The following figures 8.6 and 8.7 show screenshots of the finished guide and figures 8.8 and 8.9 show a sample scenario of two visitors using the guide.



Visitor types served:

- Explorers
- Experience Seekers
- Facilitators
- Hobbyists/Professionals

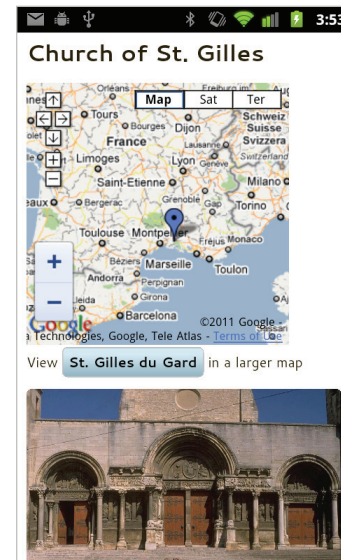
Figure 8.6: Screenshots of sample guide screens, and how the features illustrated support visitor engagement.



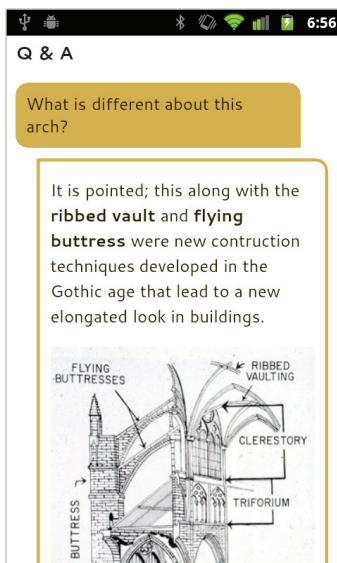
Artwork menu helps users choose a way to learn about the artwork that best matches their interests.



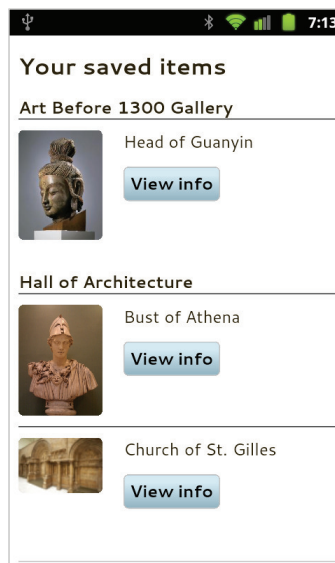
Related works and content creates connections with the artworks and with broader culture and history, giving visitors more ways to relate to the artworks.



Location information and photos of the original buildings from which the casts were taken makes the works come alive and seem more relevant.



Diagrams help explain architectural terms, making novices feel more comfortable in the exhibition, an important step in becoming engaged.



Saving artworks allows visitors to explore favorite works more deeply after their visit, freeing them to explore broadly at the museum and pay attention to the works rather than becoming distracted by the guide content.



Visitor types served:





-  Explorers
-  Experience Seekers
-  Facilitators
-  Hobbyists/Professionals

Figure 8.7: Screenshots of sample guide screens, and how the features illustrated support visitor engagement.

### Sample Use-Case

David is visiting the museum with his girlfriend Christine. He sees a notice about the guide in the Hall of Architecture and uses the guide to learn about Gothic Architecture, view an example of the style, and find related works in the museum.




<p><b>The Hall of Architecture</b></p> <p>Plaster casts of architectural masterpieces from Europe and Egypt.</p> <p><a href="#">Museum Map</a></p> <ul style="list-style-type: none"> <li> Curator Commentary &gt;</li> <li> Architectural Styles &gt;</li> <li> Geography &gt;</li> <li> Greek Mythology Tour &gt;</li> <li> Match Game &gt;</li> </ul>	<p><b>Architecture Styles &gt; Gothic</b></p> <p><b>Historical Origin</b></p> <p>With the defeat of the Albigensian heretics and the romantic success of the Crusades, the temper of the times was changing from the sin and guilt of the early middle ages.</p> <p>The world was now in relative safety and man was free to experience the beauty that surrounded him, and passionately rever the god who had made it. Structurally, this led to <b>buildings bathed in light</b>, with vaulting arches that dwarfed the very men who build them, and ornate details that celebrated and <b>exalted God</b> and his majesty.</p>	<p><b>Cast of Cathedral St. Andre</b></p>  <p>Cast of the north transept portal 13th-14th c., Bordeaux, France</p> <p>Walk to this cast so that we can take a closer look at this fine example of Gothic architecture.</p> <p><a href="#">Gallery Map</a></p> <p><b>Q &amp; A</b></p>
<p><b>1 Exhibition Home Screen</b></p> <p>David sees sign at the entrance to the exhibition and scans a QR code to view this screen.</p>	<p><b>2 Gothic Architecture Section</b></p> <p>He clicks "Architectural Styles" and then selects "Gothic."</p>	<p><b>3 Example of the Gothic Style</b></p> <p>He scrolls down and sees an example of the style that is in the gallery.</p>

Figure 8.8: Sample scenario of visitors David and Christine.







When you stand and look at this entrance, where does your eye go?

It goes upward because of all of the architectural details are elongated, including the carved figures. The architects wanted you to feel small standing next to this building, to emphasize the greatness of God.


[More info on Cathedral St. Andre](#)


**Local Gothic Architecture**


 St. Paul's Cathedral, 1906  
5th Ave at Bellefield

 Cast of the north transept portal  
13th–14th c., Bordeaux, France

[Save](#) [Like](#)


 [Curator Commentary](#)

 [Location](#)

 [Related Works](#)

**Cathedral St. Andre >**  
**Related Works**

12th & 13th c. artworks in other media

 Head of Guanyin, Yuan Dynasty, Chinese, 1279 – 1368

This large wood sculpture represents the

- 4 Q & A About the Example**  
David and Christine walk to the cast and learn about the style through examining details of the cast. They also see local examples that they recognize. This helps them to understand common characteristics of Gothic architecture and makes a connection to their prior experiences.

- 5 Cast Information**  
David clicks to get more information about the example work, Cathedral St. Andre, and then chooses “Related Works.”

- 6 Related Work**  
David reads about Chinese sculpture and starts to think about what might have been going on in different countries at the time that St. Andre was built. He and Christine decide to finish viewing the current exhibition and then view this sculpture in the Art Before 1300 Gallery.

Figure 8.9: Sample scenario of visitors David and Christine.





## 9 Conclusion

Museums and other educational institutions are underutilized by many visitors. A mobile guide, available on visitors' own devices and containing resonant, rich and interactive information, will encourage visitors to further explore exhibitions and become engaged. Through the planning, exploring, and reviewing stages of their visits, visitors can find exhibitions that speak to their interests; discover multi-faceted content that makes connections between the exhibitions and their interests, past experiences and goals; and continue the experience at home. Access and control over the guide content will encourage and support visitors beginning or continuing self-guided learning.

### 9.1 Feasibility & Implementation

The prototype guide system is built on existing technologies and does not require any hardware installation. The guide is a Web application, accessible from any Internet-enabled device, provided the user has a data plan or access to a network (such as the museum's wireless network). If an institution would like to implement such a guide, they should consider installing wireless access in their galleries if they have not done so already. Free wireless access allows those users with limited data plans or slow connections greater access to the guide. The guide system is built as a Web application as opposed to a native (platform-specific) application, because it provides the greatest access for the greatest number of visitors and requires less development time and cost—one application can be built for all users instead of a separate application for each device platform (or simply one application for one platform, leaving many without access).

To directly access content about a specific gallery or work, users scan QR codes on museum brochures, signs, and object labels by taking a picture through a QR code scanner application installed on their phone. The codes are fast, easy, and free to create. In the future, as more NFC-enabled phones come on the market, NFC will become a viable (and likely preferable option) to QR codes. Flat NFC stickers can be placed on museum labels and visitors can be directed to simply tap their phone or place it near the sticker to access the guide (without the need to install any scanner application).

In terms of guide content, institutions will need to build a database of the works and related content that they would like to include in the guide; many are already creating such databases. Researching, organizing, and deciding which content to include is a large task, but any additional information about the works is an improvement over current object labels. The guide can begin small, perhaps restricted to one gallery, and change and expand as visitor feedback is gathered and more content is added.

## 9.2 Future Work

This project is focused on developing an understanding of the space of art museums and visitors, and developing a specific case study to prototype a possible implementation. The conceptual findings and experimental results, however, can be used to create a larger application at a variety of museums. Moving forward, exhibitions should be evaluated and key themes or ways of viewing the works determined. Curators and museum educators may already have such knowledge, but lack a platform such as this guide system to share all of their information. Future work might also include:

- Testing the inclusion of visitor stories related to a particular exhibition. In order to include substantive content from visitors, a physical space could be provided outside of the gallery where visitors are encouraged to share their stories, as text-entry on mobile devices is difficult.
- Creating follow-up interactions on the museum website or through social media channels.

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# Appendix A

## Current Mobile Guides

### SFMOMA

The San Francisco Museum of Modern Art's SFMOMA guide [22] is a native application for both the iPhone and Android phones. The application allows visitors to get information about visiting the museum (hours, prices, etc.), view artwork by museum floor, and also enter codes to get information about a specific piece of art. The information available to users is primarily audio content and thumbnails of the artwork. While users can access the guide content outside of the museum, it is only easy for them to browse the highlights listed by floor as the other works must all be accessed through stop numbers, which can only be found next to each piece of work in the museum. This system is an example of a simple guide that primarily replicates audio guide features, and is not making use of many features possible on new devices.

### The Louvre

The Louvre's Mon Guide system comes on a small device about the size of a smartphone or PDA and users navigate with the help of a stylus. The system provides many features such as an interactive map; video commentaries in multiple languages, including sign language; and tour options (by "theme, duration or difficulty" [6]). Information about specific artworks is accessed by entering numeric codes listed next to the physical works. The Louvre also has plans to make the guide commentaries available on their website so that visitors can continue to use the content at home. Extending the life of guide content can encourage visitors to continue learning after their visit and also relieve them of worrying that they have to use all of the guide content during the visit so that they can spend more time enjoying the actual artwork at the museum.

### The Cooper-Hewitt

In addition to companies that focus on mobile guides, more general design studios are also adding guides to their offerings. The well-received guide for the Cooper-Hewitt's temporary exhibition *Design USA: Contemporary Innovation at the National Design Museum* was created by the graphic design firm 2x4. Their guide included artist interviews, videos and images, as well as the ability to comment on the exhibition [12].

Visitor comments were displayed publicly in the museum and also posted online to Twitter. While soliciting and displaying visitor comments can create a sense of dialog and a respect for visitor opinions, there is the possibility that comments will be off-topic, insensible or simply boring. The question of how and to what extent museums should include

visitor input is debatable and controversial within the museum community. The answer may depend largely on variables such as the museum's culture, goals, specific exhibition topics and anticipated audience.

Another novel aspect to the guide is that it pulls content from public sources such as YouTube. Making use of pre-existing content can be helpful to museums because they often have thousands of artworks and insufficient time and staffing to develop or curate interpretive content. However, the trade-off with this practice is precisely that the content is not truly curated and may not fit an exhibition as well as content created by or at least reviewed by the museum. The Cooper Hewitt guide did receive some criticism that the YouTube videos to which they linked were much too long to view during a visit and were thus distracting and frustrating [27].

### **The Brooklyn Museum**

The Brooklyn Museum is known for experimentation and innovation [9] [13]. One experiment they have tried is asking visitors to tag artworks with descriptive words. The tagging activity is offered as "Gallery Tag!," a game in which users choose a word such as "Lion" or "Fruit" and then enter an artwork's numeric code when they see a work that matches that tag. When a user is finished playing, he can see his score (based on number of works tagged), enter his initials, and view the top scores. The game is available online and can be played in the museum or using the museum's online collection. Like the *steve.museum* project [24], this example of tagging is not especially fun or engaging—there is no learning or other reward for visitors' efforts beyond seeing their score.

The guide [17] also incorporates buttons that visitors can press to indicate that they like a particular artwork. The number of "votes" that an artwork receives is used in order to recommend artworks to other visitors. Like 2x4's inclusion of uncurated content, this leverages the work of others but risks providing lower-quality content than that generated by the museum. In particular, these user-generated recommendations do not provide any explanation of why an artwork was compelling or how it relates to other works in the exhibition, as one would expect with museum-generated recommendations.

### **The Mattress Factory**

The Mattress Factory [18], a small installation art museum, provides links to interpretive content such as artist process and interview videos through QR codes placed on artwork wall labels. This simple and inexpensive system has allowed a small museum to efficiently provide additional content to interested visitors without distracting from the artwork as might larger and additional wall labels. Visitors enter the exhibitions and whenever they read a label, they can choose to get more information by reading the code with a (typically free) application on their own device (typically a smartphone). In this way, visitors do not have to make an upfront decision about using a guide and the guide is advertised throughout the exhibitions (on the wall labels), so that visitors are aware of the option to use a guide. Interesting content can easily be saved for later viewing by using the bookmarking capability already built into browsers.

# Appendix B

## User Research

I conducted interviews with professionals at local art museums, a gallery and with undergraduate students at Carnegie Mellon University. My direct research (IRB HS10-447), in combination with my literature reviews and other findings, led to several design criteria that drove the concept development phase of the project.

### Museum Professionals

I conducted interviews at the Carnegie Museum of Art, The Mattress Factory (an installation art museum) and the Society for Contemporary Craft (a gallery and instructional center). The professionals to whom I spoke came from a variety of areas including curation, education, and marketing. The focus of the interviews was the professionals' goals for visitor experience, and what the institutions have tried in order to support visitor experience. I also attended public lectures given by the Carnegie Museum of Art's director, curator of education, and curator of contemporary art; attended a lecture by Nina Simon, a well-known, visitor-engagement strategist; and attended Culture Club, a recurring social event at the Carnegie Museum of Art where visitors meet other visitors and museum staff for art-related discussions.

### Undergraduate Students

In order to better understand undergraduate students and how they experience museums, I interviewed students in the Carnegie Museum of Art and asked them to think aloud as they viewed artwork in several galleries. Through this technique I was able to gain insight into what questions and impressions participants had about the museum. I also interviewed students on the Carnegie Mellon University campus and conducted an online survey about local free-choice learning sites, experience with visual art and personal interests. Through this research I developed several personas of students which I then used to generate scenarios in which a mobile guide could help student visitors in art museums. Research participants were all Carnegie Mellon University students but came from a variety of departments, such as Chemical Engineering, Mathematics, Design, Professional Writing, and Global Studies. They had varying degrees of free time and affinity for visual art and museums. Some were given nominal gift cards in appreciation of their participation.

## Scenarios

### Rick and Anna

#### Current Experience

At the museum, Rick takes a look at the brochure he picked up. He has not been to this particular museum before, so he is not sure what to see. They could rent audio guides, but decide not to because they want to talk to each other, rather than listen alone. There is not much information in the brochure about the galleries, so Rick and Anna just wander into a nearby gallery. Anna has questions about the artwork, but Rick can not answer any of them, so she soon stops asking and they just gaze at the artworks as they continue along.

#### Future Experience

When they enter an exhibition area, Rick and Anna notice an introductory sign with information about a guide. They do not need to go back to the admissions area to check out the guide, because it is online and Rick has a smartphone. He takes his phone and scans a QR code on the sign to quickly access the guide. It has an overview of the exhibition and suggests a few ways that the works connect to each other. Rick also sees that they can get information about any specific work that they are interested in, or even do a scavenger hunt game that will teach them about a related subset of the exhibition. Rick and Anna continue viewing the exhibition while the guide stories and images serve as a launching point for conversations about the artwork. Some works are intriguing and have a lot of related content in the guide, including links to Wikipedia and news articles, so they save those works and will investigate them further at home. With the help of the guide, Rick and Anna have an entry point for connecting with the artworks. Rick is glad that Anna had a good time and is pleasantly surprised that he really enjoyed the museum. Next time, he will challenge her to do the scavenger hunt with him.

### Nicole

#### Current Experience

Nicole arrives at the art museum and studies the brochure. She wants to know if they have any famous artworks that she should see. There are a few highlights mentioned in the brochure and one of them is a large waterlily painting by Monet which she thinks must be very impressive, so she decides to check it out. She enjoys the watercolor painting and then begins to walk through the galleries. She sees other paintings by artists that she recognizes and feels that she is seeing some important artwork.

#### Future Experience

Nicole walks through the galleries and notices a painting by John Singer Sargent. She thinks that he is famous, but she does not remember anything in particular about him. She likes his painting and reads the label next to it. There is a note on it about a smartphone guide and Nicole wonders if there is any interesting information about the artwork or the artist, so she uses her phone to scan the code on the artwork label. She reads about Sargent's life and some background on the painting, which is a portrait of a well-to-do family. There are even photographs of the estate where the family lived. Nicole tries to imagine what it might



have been like to live back then and in such an estate. She wonders about Sargent's social status—if whether the gentry who he painted respected him or treated him as lower-class. Nicole has a lot of questions now, but there is still a lot to see at the museum, so she decides to save the artwork and look into it more when she gets home. At the end of her visit, Nicole feels that she saw important and impressive artwork and also got a chance to think more deeply about the works and issues related to them.

## **Cassie and Katherine**

### **Current Experience**

Cassie and Katherine get museum brochures at the entrance and begin to wander through the galleries. Cassie sees some paintings that she likes and takes photos of them. After the visit, Cassie enjoys looking at the photos that she took, but she does not feel like she learned a lot during her visit and can not remember the names of the artworks that she liked.

### **Future Experience**

Cassie and Katherine are in one of the galleries when Cassie notices that a wall label has a code on it. She takes a closer look at the label and finds out that she can view more information about the painting by the label by using her smartphone. She checks it out and is taken to some content about the painting. There is an interesting story about the artist, so she calls Katherine over. Cassie and Katherine think about the story and look back to the painting. They can now see that the artist created tension in the painting by using very fine, soft brushstrokes to depict a violent scene. The artist grew up in Hungary, like Cassie's grandparents. She decides to save the story and an image of the painting so that she can send it to her dad when she gets home. Cassie gained insight into some of the artworks and feels a little more confident in her abilities to discuss visual art—she even recommends the museum to other friends.

Cassie feels like she has learned something and has some understanding of art even though it is outside of her field of expertise. Cassie tells others about her visit because she is proud that she has ventured outside of her normal activities and is becoming more "well-rounded."

## **Martin**

### **Current Experience**

Martin is taking a class on the history of American furniture design and has to choose a topic for his final research paper. He heads over to the Carnegie Museum of Art to see their furniture collection—maybe he will be inspired and come up with a topic. Martin sees that there are a lot of chairs in the collection; maybe he will do a paper about American chair design, he thinks. Back at his apartment Martin starts searching online and trying to figure out what he can say about chair design.

### **Future Experience**

Martin sees a small label by a chair with some dates, the designer's name, and a note about the museum's mobile guide to the collection. Martin takes out his phone and find the guide online. He is taken to information about the chair at which he is looking and learns that its

design is a precursor to the ergonomics movement. There are links in the guide to related works and he finds a couple of other examples of ergonomics, as well as other 19th century American furniture and some examples of contemporary failures in ergonomics. Martin thinks that the development of the ergonomics movement in American furniture sounds like an interesting topic because a lot of products are still not very comfortable to use. He feels like he already has some good information to start his research.

# Appendix C

## UI Design

### Color

The prototype uses a light blue for UI elements such as buttons (See Figure 2). The color blue is generally thought of as a cool, calming color and it goes well with most other colors (an important consideration when dealing with visual content such as images of artworks). The Carnegie Museum of Art's website uses minimal color and is primarily black and white with red links. While it might seem reasonable to adapt the link color from the desktop website to the UI controls of the mobile website, red could be overwhelming when used for the large buttons found in touchscreen interfaces such as those for mobile websites.

When creating a mobile guide, a decision should be made about whether it should match or coordinate with the desktop website or whether it should have a separate look. In general, integration should be the default as guide users may already be familiar with the desktop site and integration can help to build the brand of the institution. However, if there is a guide for a particular audience, such as children, it may be appropriate to deviate from the look of the desktop site. Aside from the UI controls, the guide is primarily black and white, as the content is of primary concern and the UI style is meant to support the content rather than draw attention to itself.

### Typography

Cantarell, a sans-serif typeface, was selected for its legibility and clean look. While there are several common sans-serif web typefaces, a non-standard one was included in the site in order to give the site a subtly different look that will set it apart.

### Grid

Given the limited screen space available to mobile websites, the guide primarily uses a one-column grid (see Figure 1). Pages that include lists of thumbnails and related comments use a three-column grid with the image in the left column and text spanning the remaining two columns. Although images are rich and inviting, limiting thumbnails to one column is necessary to allow room for text with a comfortable line-length.

### Image Selection and Treatment

When possible, professional photographs are included. While users may want a realistic view of the location of an artwork or how it looked at various times, snapshots or photographs with poor lighting or contrast will not inspire users in the way that higher-quality

## Grid Overviews

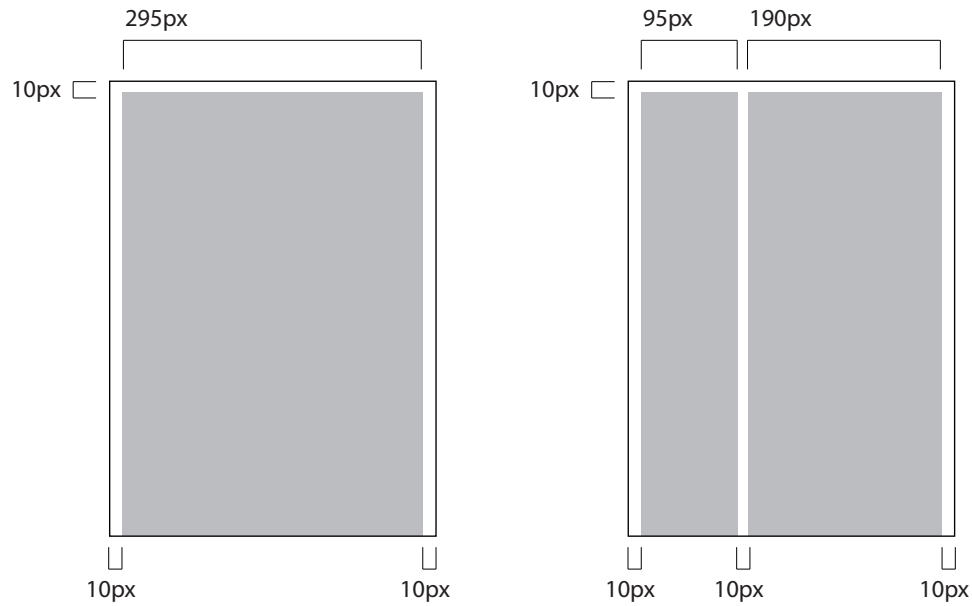


Figure 1: UI grid structures

## Color Palette

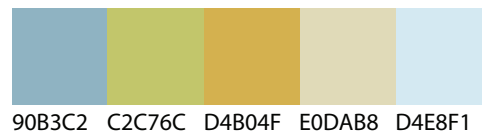


Figure 2: Color palette and Hex codes

images will. Images in the guide have rounded corners to create a softer and more casual appearance, inline with encouraging novices to feel comfortable in the museum and with the interpretive content.

## Navigation Style

The guide uses a common mobile UI pattern with a vertical navigation list and arrows indicating whether the item will take the user up or down in the system hierarchy. This pattern was chosen because many users may have experience navigating through similar systems. Another pattern, based on application screens of mobile phones, was explored (Figure 3), but was found to be inappropriate as it relies primarily on icons and leaves little room for textual labels. As many guide users will be first-time users, it would likely be more efficient for them to read a text label as opposed to learning an icon. Additionally, it can be difficult to define logical or intuitive icons for abstract navigation items such as those on the home screen of the guide.

A constant (always on screen) navigation element was considered instead of the navi-



Figure 3: Alternate navigation style

gation that now appears at the bottom of each page when scrolled. A scrolling navigation was chosen in order to save screen space for content since, based on user observation, users primarily use the back button on their phone instead of the on-screen navigation. If a user does enter the guide at a content page (perhaps by scanning the QR code next to an artwork) then the on-screen navigation will be essential for that user to navigate the hierarchy of the guide.

The key considerations in creating the navigation system for the guide were intuitiveness (achieved through using a known design pattern) and enabling the user to quickly evaluate their options. With the chosen style, there is ample room for descriptive titles and all of the text is aligned and easy to scan, making it easy for users to evaluate their options.

### Progressive Enhancements

Some style choices, as seen in the screenshots, will not appear in all browsers because they depend on support for CSS3. However, major platforms such as the iPhone and Android phones use Webkit-based browsers which support the inclusion of such features as embedded typefaces and the rounded corners used in the guide.



# Appendix D

## Interpretive Aids for the Carnegie Museum of Art

The mobile guide should be integrated with other interpretive aids in the museum. The following figures show examples of how that integration can be accomplished. When NFC-enabled mobile phones become more common, it will be possible to use icons in place of QR codes (See Section 9.1).

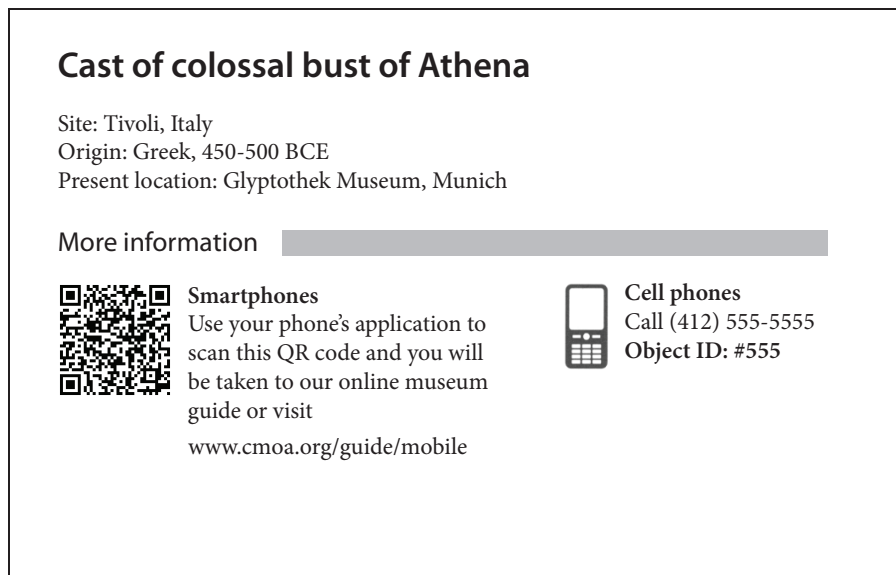


Figure 4: Object labels, such as this one, should provide QR codes to access the guide.

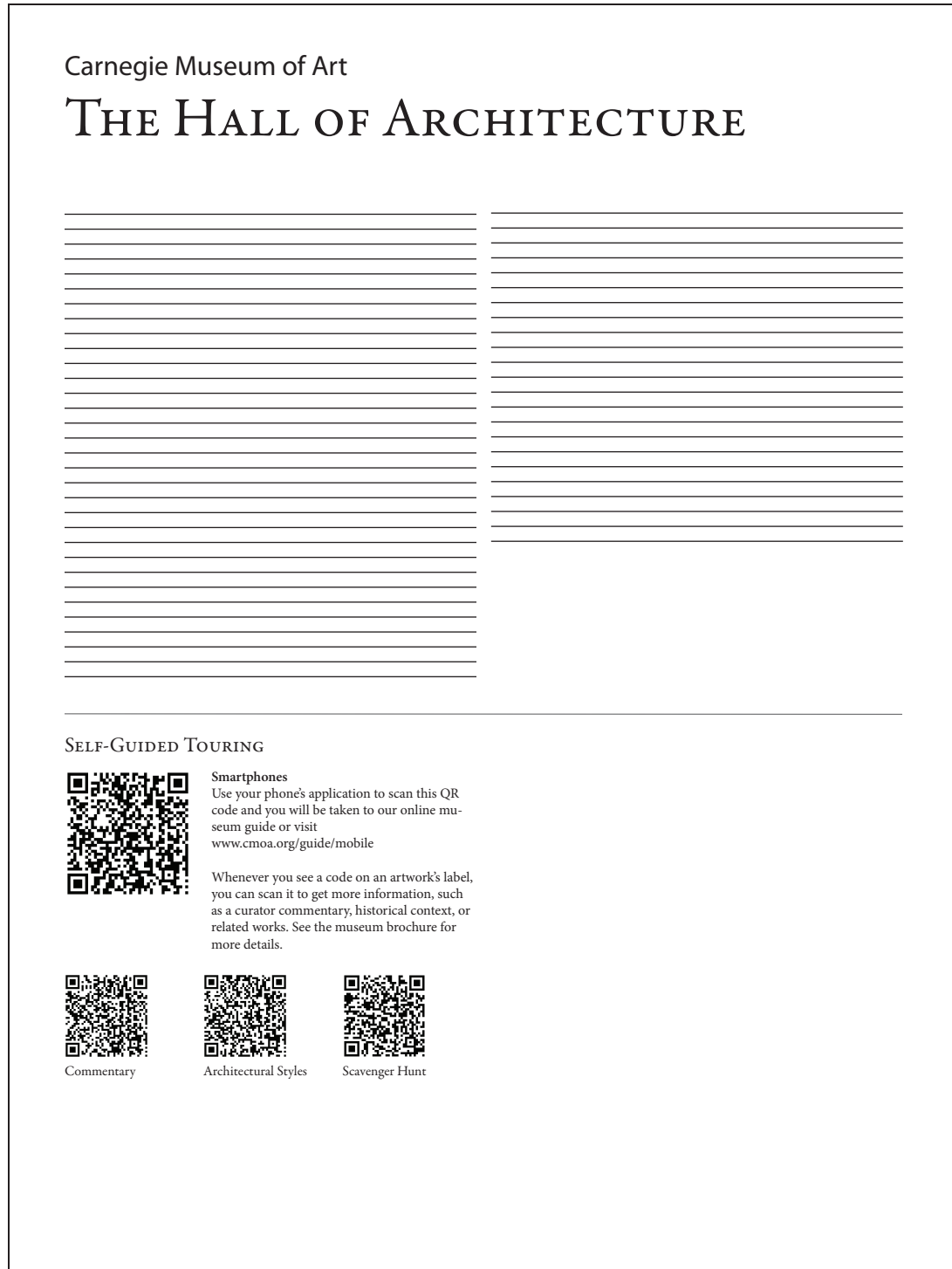


Figure 5: Signs at the entrances to galleries, such as this one, should inform visitors about the mobile guide and provide QR codes to access the guide.