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Development of Interactive Media: Promoting Museums in Copenhagen

An Interactive Qualifying Project

Submitted by:

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Date: May 2, 2008

Abstract

Museer i København (MIK) is an organization that promotes and collaborates with museums in and around Copenhagen. This report outlines the plan our project team implemented to assist MIK with the problem presented: creating online interactive media designed to effectively engage potential visitors and interest them in the contents of the museums. By applying the Object-Oriented Design Process, a proven method for creating software, we determined the requirements that our solution must satisfy, and created an interactive program that meets them.

Acknowledgements

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For their help and willingness to provide valuable information for our project, we would also like to thank Ms. Annie Mogensen from the National Museum of Denmark, Ms. Bente Petersen from the Medical Museion, and Ms. Tora Ribers from the ToldSkat Museum for allowing us to interview them.

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Executive Summary

Museums in Copenhagen (MIK) is a Danish organization, founded in 2003 by the Museum Council of Copenhagen and Frederiksberg, that has established itself as a marketing resource for the museums in the Copenhagen area. As a young organization, MIK is expanding daily and represents nearly seventy museums in the Copenhagen area, each of which pays MIK a fee for its promotional services. MIK represents each museum under the MIK name, while also retaining the individual identities of the museums. As an organization, one of MIK's main goals is to give exposure to the smaller museums that have trouble promoting themselves and to endorse the idea that museums can be enjoyable social experiences.

MIK raises awareness about its member museums using posters, pamphlets, newsletters, weekly museum tips in newspapers, and most importantly, its website. The MIK website has become the cornerstone of its marketing strategy, and with the ever-growing dependence on technology, computers and the Internet are vital tools to any business. Marketing on the Internet has become dependant on using interactive media, a dramatic shift from the days of conventional marketing. Interactive media allows the users to become part of the marketing, turning their interests and preferences into products they enjoy.

The goal of our project was to engage visitors in the content of the museums in the Copenhagen area through the use of interactive media. By implementing interactive media via the MIK website, we were able to provide our sponsor with a tool that could expose visitors to the museums' contents and increase visitation to the museums and to the MIK website. It was our objective to connect visitors with the museums that best suited their interests, and to better counteract any negative stereotypes of museums by showing visitors that museums had something of interest to offer them.

Our methods for creating interactive media were defined by a common computer science strategy known as the Object-Oriented Design Process. This process included the gathering of design requirements, analyzing the information gathered, designing the interactive media, implementing and testing the media, and then distributing the final version.

For the gathering of design requirements, we examined the parties affected by our project: MIK, the museums, and the visitors. To understand the needs of MIK and the museums we interviewed our sponsors and marketing experts from museums in Copenhagen. The interviews provided us with information regarding the current marketing techniques used by Copenhagen's museums and how interactive media played into their future strategies. To gain the visitor perspective, we became visitors ourselves, and explored a selection of the museums in Copenhagen. During these visits we examined what visitors were looking for in a typical museum experience by noting which aspects of the museum may apply to certain demographics. To properly design the interactive media we also needed to determine technological limitations surrounding our project.

After taking the technical restrictions and the needs of our sponsors and the museums into consideration we chose to design an online questionnaire, which we named the Museum Selector, to provide the interactive media experience. Through a series of questions, this questionnaire determines people's interests, ultimately connecting them with the museums that best suit those interests. To develop the paths for the questionnaire, we divided the museums into seventy-five categories based on the types of exhibits they offer, entry fee, and visitor environment. As users proceed through the series of questions, museum choices are eliminated based on their answers, and at the end of the questionnaire, they are given a list of recommended museums.

To evaluate its effectiveness, we tested a prototype version of the Museum Selector on two specific test groups. We chose one test group to consist of native Danes, as they are the predominant users of the MIK website, and the other group to consist of tourists because they represent a large portion of the museum visitors. We provided each of these groups with a survey intended to measure the usability of our questionnaire and account for any faults that it may have.

According to our survey results, our Museum Selector performed well, and provided users with helpful museum suggestions unique to each person. However, scored low in areas of its usability. Users complained about the absence of a “back button” that would allow them to go back to previous questions, or a “restart” button that would allow them to start the questionnaire over again. Although it was only temporary, users were turned off by the ugly appearance of the Museum Selector as well. Overall, our questionnaire performed its duties and was easily understood by all parties, with the exception of some slight grammatical errors.

User feedback from the questionnaire was important to our project team and each of the sub-par situations was rectified accordingly. In the final version of our questionnaire, we implemented a “back” button and “restart” button to improve the simple functionality. We also redesigned the questionnaire to mimic the appearance of the current MIK website and added images to each of the answers buttons to provide a more eye-catching experience.

We presented the final version of the questionnaire to MIK, and it is planned to become available to the public via the MIK website. Since we received feedback only from a select group of users, we recommended that MIK conduct a survey on its website to gain real-time visitor opinions on the questionnaire. This survey would be available to the public upon completion of the questionnaire and provide an ongoing source of information for improvements.

This survey can also be used to help evaluate the effectiveness of the interactive questionnaire as a tool to attract visitors to the MIK website and whether the questionnaire improves the visibility of the museums in Copenhagen.

In the future, we recommend that MIK update the questionnaire routinely to account for any changes in museum membership or available exhibits. Updating the questionnaire is simple, and can be completed by persons with little technical knowledge. We have provided MIK with an informative user's manual that details how to update the questions and answers, the list of museums, and the appearance of the questionnaire. Any changes to the functionality of the questionnaire maybe complicated, and should be performed by a professional, or outsourced to a web design company.

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1 Introduction

This project aims to create a connection between museums and the visitor, and to discourage a negative stereotype of museums as boring or dry educational institutions. By determining what fascinates visitors and matching their interests with the museum exhibits in the Copenhagen area, we seek to encourage curiosity about museums, resulting in an increase in both awareness and attendance.

Museums provide venues for the public to explore collections of historical and educational significance for inspiration, enjoyment, and learning. Museums are considered to be reliable sources of information, places one can trust to provide authentic and comprehensive presentations showcasing objects and ideas of art, history, natural history, and science (*Falk, 2000, p.8*).

Denmark has a well-established history of supporting artistic and cultural activities, including the funding, creation, and maintenance of their museums (Danish Ministry of Culture, 2008). Collectively, museums are popular tourist attractions in Denmark, and constant efforts are being made by the Danish government to improve the popularity of museums and quality of exhibits (Danish Ministry of Culture, 2008).

Museer i København (MIK), which translates to “Museums in Copenhagen”, is an organization dedicated to the promotion of museums throughout the city of Copenhagen. It desires to expand its audience by increasing the number of visitors to the MIK website with the aim of increasing the number of museum visitors. MIK is a young and growing organization, seeking to develop an effective mass-marketing strategy that uses online interactivity to help represent each of its member museums.

As technology and marketing techniques evolve, museums and organizations such as MIK need new ideas to engage potential museum-goers, or the museums risk fading away among more popular forms of entertainment (Renschler, 2007). By taking advantage of interactive media techniques, such as online questionnaires or virtual exhibits, MIK will be able to reach out to larger audiences. MIK is not the only organization to realize the power of new technology. Institutions such as the National Museum of Australia are currently applying interactive media which offers a number of advantages over more traditional media when it comes to engagement (Holy Grail, 2006). Static media, such as posters, only presents an individual with pre-set information, whereas interactive media allows an individual to communicate with the information source.

MIK would like to use various forms of interactive marketing on the Internet to reach a greater number of potential visitors and engage them in the contents of the member museums. Currently, MIK's website contains very little interactive media, an issue that exposes gaps in its marketing strategy (MIK, 2008). To implement a more effective marketing strategy, MIK needs to gather information on a number of topics, including: interactive marketing techniques, web development tools, demographic data about museum visitors, and interactive media.

To assist MIK in this project, we collected data and information from the sponsor organization and each of the member museums to establish design requirements for interactive media. We gathered information relevant to the museumgoer, such as interests and personal preferences, using a variety of research techniques. We designed and administered surveys, examined demographic data, and investigated published resources. The information we obtained is important to help us shape the content and design of interactive media that would interest the general public. Through analysis of the available information our project team, in cooperation

with MIK, was able to draw conclusions that helped us to properly design and implement an interactive media application that simultaneously educates, entertains, and engages the audience.

2 Background

The purpose of this chapter is to introduce topics to help the reader appreciate the use of interactive media for marketing museums. Museums, specifically those in Copenhagen, can use the Internet and online interactivity to enhance their marketing campaigns. Interactive marketing incorporates many aspects of technology, demographic profiling, and promotional techniques. By using advertisement and current technology, museums can connect with the public and engage them in the museums' collections.

2.1 Museums

Museums can take many forms, and can be described as "...public institutions for personal learning, places that people seek out to satisfy their learning needs" (Falk, 2000, p. xii). From arboretums to aquariums, art and history museums to science, they all have one thing in common: museums can offer something for everyone. Depending upon the individual, the museum experience can be either intellectual or emotional, or even a combination of both. For example, art exhibits present the chance for visitors to not only learn the historical information about the artwork, but also allow them the opportunity to feel the emotions represented in the works displayed. Museums house history and culture, preserve and recreate times of old, and display a variety of modern marvels (Falk, 2000).

The museums in Copenhagen, Denmark, as elsewhere throughout the world, are cultural institutions, not only because they display cultural artifacts, but also because they are derived from and extend the culture that sustains them (Carr, 2003). They present collections, exhibitions and educational activities that stimulate intellectual exploration, creativity and dialogue, and leave the visitor with a unique individual experience (Lidtke, 2005).

Museums in Copenhagen and museums in general can raise unforeseen questions and interests in the mind of the visitor (Carr, 2003). Museums, such as the Danish National Museum, serve to inspire and extend the reaches of historical knowledge and cultural insight (Danish National Museum, 2008). Exhibitions of history and culture offer an array of past lives and experiences to learn from and live by (Carr, 2003). These experiences form unique connections with the visitors, which evolve with them over time (Carr, 2003).

2.1.1 Connecting with Visitors

Because of prior knowledge, and preconceived notions, there is a great difference between a preconceived museum experience and the actual one (Falk, 1992). At the heart of every visitor's preconceptions is his or her personal reservoir of knowledge, attitudes, and experience, influenced by expectations concerning the characteristics of the museum. In the context of our project, a web-based application that exposes visitors to museum content before actually visiting serves as a marketing resource to engage potential visitors in the museum that most interests them.

Through the implementation of interactive media that is easily accessible to the public via the Internet, interest can be stimulated in museums and their offerings. This media will allow people to discover which museums best suit their needs. Museums in Copenhagen seeks to discover and understand people's interests, or even lack thereof, and further stimulate them.

2.2 Museums in Copenhagen

This section features information on the efforts of our sponsor organization, Museer i København (MIK). MIK is a Danish organization founded in 2003 by the Museum Council of

Copenhagen and Frederiksberg, and has established itself as a marketing resource for the museums in the Copenhagen area. The following subsections provide information about the members of the organization, as well as the current marketing techniques the organization practices. We will address the benefits of membership to the organization and then provide a description of the organization's website.

2.3.1 The Role of Museums in Copenhagen

Museums in Copenhagen (MIK) is an organization with the purpose of promoting museums, and it strives to increase awareness by marketing the Copenhagen museums in new ways, involving external marketing and interactive media. One of the organization's primary tasks is to develop the "museum portal," a website which creates a central online location for the museums in Copenhagen to provide visitors with information about the available museums.

In addition to creating and maintaining the museum portal, MIK is building cooperative connections with educational institutions and the business community to strengthen its external marketing (MIK, 2008). "[MIK] will in this way contribute to creating a renewed attention to the Museums' collections and the cultural heritage surrounding [Denmark], and to making even more people seek out the experiences and the knowledge available at the individual museums" (MIK, 2008). Incorporating interactive media and marketing is a key component of MIK's overall promotional strategy for each of its member museums.

MIK is both a privately and publicly funded organization. The public funding is provided by taxes and government programming through the Danish Ministry of Culture. The majority of the private funding stems from membership fees from each of the individual museums within the MIK collaborative (MIK, 2008).

2.3.2 Members of MIK

Currently, MIK represents nearly 70 museums and exhibits in the greater Copenhagen area. The content of these museums varies widely; ranging from art history at the Danish Museum of Art and Design, to police history at the Police Historical Museum. A list of member museums is shown in Table 2.1.

Table 2.1 - Member Organizations of MIK (MIK, 2008)

MUSEUMS IN COPENHAGEN (MIK) MEMBER MUSEUMS	
Amagermuseet	Holbo Herreds Kulturhistoriske Center
Armoury Museum	Industrial Works of Brede
Bakkehus Museum	Kroppedal Museum
Ballerup Egnsmuseum	Kunstforeningen GL STRAND
Bank & Savings Museum	Køge Art Museum of Sketches
Botanical Garden	Little Mill
Botanical Museum and Botanical Library	Medical Museion
Charlottenborg Exhibition Hall	Museum of Copenhagen
Charlottenborg, Kunsthall	Museum of Customs and Taxes
Circus Museum	Museum of Danish Resistance 1940-1945
Cisternerne - Museum of Modern Glass	National Museum of Denmark
Danish Architecture Museum	Nivaagaard Picture Gallery
Danish Jewish Museum	North Atlantic House
Danish Museum of Art & Design	Open-Air Museum
Danish Museum of Hunting and Forestry	Ordrupgaard
Danish Music Museum	Police Historical Museum
Danish National Gallery	Post & Tele Museum
Danish Revue Museum	Round Tower
Danish School Museum	Royal Cast Collection
David Collection	Royal Danish Naval Museum
DieselHouse	Royal Library
Dragor Museum	Skibshallerne
Esrum Abbey	Skibsklarerergaarden
Finn Juhl's House	Spjermuseet - Museum of Danish Scouts
Folk Museum	Storm P. Museum
Frederiksborg Museum	Theatre Museum in the Court Theatre
Frederiksvaerk Museum of Industry	Thorvaldsen's Museum
Furesø Museums	Town Museum in Helsingør
Geological Museum	Victorian Home
Gilleleje Museum	Worker's Museum
Greve Museum	Zoo Copenhagen
Heerup Museum	Zoological Museum
Hillerød Town Museum & Printing Museum	Æbelholt Abbey Museum
Hirschsprung Collection	Øresund Aquarium

Not all museums in the Copenhagen area belong to MIK. According to the MIK officers, museums outside the collaborative have generally chosen not to join because of the cost of membership (MIK, 2008).

MIK offers each of its member museums the opportunity to advertise their full spectrum of content via the Internet and other marketing mediums to potential visitors. The organization aims to assist the public in choosing the right museum for their needs. One of the benefits that member museums receive is advertising on one centralized website, MIK's homepage, where visitors are able to learn about and research each member museum in the greater Copenhagen area. It is likely that this tool will become MIK's primary means of marketing (MIK, 2008).

2.3.3 MIK's Current Services

MIK uses multiple methods of publicity to help draw visitors to the museums in Copenhagen. Currently, the promotional endeavors of MIK are both physical and digital. Examples of physical advertisement are pamphlets, biweekly newsletters, and periodical advertisements. Websites and newsletters via email are two examples of digital promotion.

Pamphlets that MIK offers are simple in design, and contain brief descriptions of each member museum, including the museums' content, addresses, and contact information. MIK has individuals in charge of public relations, who provide museum tips and suggestions, such as popular temporary exhibits or suggestions of how to make museum visits more exciting, in published periodicals such as *The Copenhagen Post*. During holiday periods, MIK augments its advertising as there are more tourists in the area, and more people on break from work and school. In addition, MIK publishes a biweekly online newsletter in Danish, to which visitors to the MIK website can subscribe at no cost, providing museum tips and highlighting upcoming exhibits at various museums (MIK, 2008).

The centerpiece of MIK's digital promotion is the website www.mik.dk, which contains of resources regarding museums in the Copenhagen area, and is available in both Danish and

English. One section contains a list of member museums, including basic summaries of each museum and links to their individual websites.

For avid museumgoers, MIK offers the option of selecting self-guided tours from a list organized by subject. For example, MIK designed a tour titled “Real Princesses” for those interested in royal history and a tour titled “Museums for Men,” designed for visitors looking for “museum adventures with hair on their chest” (mik.dk, 2008). To keep individuals visiting its website, MIK continuously updates the site with creative themes that change periodically. This shifting theme is present throughout the website, and provides different experiences for visitors each time it changes. This theme has varied from “Eating through the Museums,” featuring several food themed museum exhibits, and “Future Exhibitions,” which featured a listing of the new exhibitions coming in 2008. MIK also posts a new museum tip every week, updates a museum of the month section, and maintains a recommendations section for visitors (mik.dk, 2008). By providing website visitors with access to a variety of museum promotions, MIK is incorporating interactive media technology to make more information available at the click of a button.

To integrate interactivity into its website MIK has incorporated is a “Highlights” section, which showcases each museum in the organization. This section allows the user to search for featured exhibits by museum, art era, time period, or natural science category. Some other features include historical facts relevant to the selected category. For example, when a user selects the Round Tower from the museum category, the user is redirected to a webpage containing links to historical information about the tower’s construction and links to information about the exhibits offered. The “Highlights” section is currently under construction, and new content is continually being added.

Another way that MIK had added interactivity to its website is through the children's section of the site. This section of the website features a helpful character in the form of an interactive monkey, depicted in Figure 2.1.



Figure 2.1 – Interactive Monkey

The colorful objects on the monkey's body link to several interactive games, each of which features objects chosen from various museums and exhibits. These games include puzzles and a memory game in which one can match pictures of different objects from around the museums. The virtual monkey is present throughout this section of the website, and provides help and encouraging words to those participating in the activities.

In addition to benefiting its members, MIK also advertises museums outside of the collaborative. For example, one of the weekly museums tips on the website suggested an exhibit in a museum that is not currently within MIK. Furthermore, the website offers an extensive list of museums that are not members, with links to their websites and even directions to many non-MIK museums. While it seems that museums in the collaborative are more prominently featured, with a dedicated page within the website for each museum in MIK, the organization understands that it is their duty to market all museums.

2.3 Marketing

Marketing is a core component to the success of almost any organization, and extends beyond the business world to include educational institutions such as museums. The adoption of appropriate and current marketing practices, such as incorporating of interactivity into advertising, helps to keep museums culturally relevant (Rentschler, 2007). This effect of interactivity is particularly important in the context of changing consumer practices.

The promotion and presentation of a museum often follow a set of tactics, which may be different and more complicated than those of a business model. Because museums exist for the public benefit, their goals are usually social rather than monetary, and their marketing needs should reflect those goals (Mclean, 1997). Whereas a business uses people's interests to create its products, a museum would use its product, cultural history, for example, to stimulate people's interests.

The marketing strategy for museums consists of much more than advertising. Museums must also consider the overall presentation of the exhibits and available facilities. For example, Zoo Copenhagen would have trouble attracting visitors if it invested little for cleaning or maintenance of its exhibits and the living areas of the animals. If an institution appears rundown and its exhibits are poorly organized, it may discourage potential visitors from wanting to go inside (McNamara, 2008). Because of the unique challenges presented by museums in this context, special consideration must be given to the marketing associated with them.

2.3.1 Marketing a Museum

Although there are a number of components to it, a museum's overall marketing scheme can be divided into two areas: 1) the internal promotion of the museum, such as the maintenance and improvement of the exhibits and 2) the external promotion of the museum, such as advertising. These components combine to form the museum's presentation to its visitors and provide the foundation from which visitors draw their opinions (Gilmore and Rentschler, 2002).

Internal promotion is important because it directly influences the visitor's impression of the museum. Featured exhibits that fail to create a positive impact on a museumgoer can taint that visitor's opinion of the entire museum. The visitor is unlikely to visit again or recommend the museums to others (Misner, 2002).

External promotion of the museum focuses on the impression a person has of the museums before they actually visit. The primary characteristic of this area is advertising, the importance of which is fairly obvious. It can be difficult to draw new visitors to an exhibit with little or no advertising (Gilmore and Rentschler, 2002). The effectiveness of advertising is influenced by the quality of communication with potential visitors. Visitors should understand the content of the museum to ensure that they are interested in the exhibits (Gilmore and Rentschler, 2002). It is the responsibility of external promotion to effectively publicize the exhibits and attractions the museum has to offer.

Today, both internal and external components must adapt at an extraordinary pace to keep up with new uses for technology. Because people can access information almost instantly using the Internet, there is increased importance for museums to use such technology for museum promotion (Rentschler, 2007). The evolution of advertising and promotion has caused museums to apply marketing strategies that involve a combination of education, entertainment,

and technology (Rentschler, 2007). MIK was founded to assist the museums in Copenhagen through this marketing revolution.

2.3.2 Marketing Multiple Museums

MIK faces the challenge of creating a unified strategy to promote nearly 70 different museums in Copenhagen, each with its own identity (MIK, 2008). While each individual museum is unique, many of them offer differing content in their exhibits. MIK must work to unite all the museums under the MIK name while still preserving the individual identity of each museum. For example, the marketing department of the Danish National Museum functions as a body similar to MIK. The Danish National Museum consists of a collaborative of several different museums, such as the Museum of Danish Resistance and the Danish Music Museum. In an interview with Anni Mogensen, Marketing Officer for the Danish National Museum, she explained that each of the museums is held under the National Museum name, yet is promoted with individual, museum-specific pamphlets. The pamphlets created by the Danish National Museum are designed to highlight one easily identifiable aspect of the museum, so that visitors have an easier time identifying the museum (2008). For example, a pamphlet for the Museum of Danish Resistance presents a picture of a gun on the front because the museum contains exhibits of arms and weaponry used during the period of resistance, a tactic designed to target a specific visitor demographic.

2.3.3 Demographics

Demographics, which are characteristics of segments of populations, play an important role in identifying consumer markets (The American Heritage Dictionary of the English

Language, 2006). Specific audiences within demographics are defined by the person analyzing the target audience, and can be broken down in an infinite number of ways. Based on our observation of Copenhagen museums and discussion with the marketing officers that we interviewed, we have concluded that the simplest way to organize museum demographics is to group people into categories based on age and social groups. Understanding what appeals to our audience allows us to better accommodate their needs with a high-quality advertising solution.

The age category can be further divided into subgroups, such as children, youth, adults, and senior citizens. The particular interests of these subgroups are seemingly endless, but research done by the Australian Museum Audience Research Centre attempts to define what attracts museum visitors based on their age.

Children and their parents or caretakers typically search for museums with ample space, play areas, and activities that allow children to actively participate in the exhibits through sensory experiences. Parents enjoy museums where they can participate in the activities with the children or just sit back, relax, and watch. Other important qualifications include the safety of exhibits, the ability to monitor their children easily, accessible bathrooms and/or changing areas, and areas where children can be fed (AMARC, 2002).

The youth audience comprises a large portion of the visitor demographic, but often is one of the most difficult to market towards. Generally, youth have a lack of interest in museums, but if that preconceived notion can be changed, they will become the adult visitors of the future (AMARC, 2002). When dealing with the youth demographic, it is important for organizations such as MIK to note that the majority of this age group is still attending school, and may be visiting museums on school field trips. The youth division is not just a featureless group, but

intellectually and emotionally complex. This age group is preoccupied with three main issues (AMARC, 2002):

1. Developing their sense of personal identity, instead of trying to understand the identity of art or history.
2. Developing their relationships by sharing their views with friends and partners.
3. Building on skills and talents through exposure to current works, techniques, advances and designs.

Overall, the youth audience is interested in ideas linked to objects, rather than the actual objects themselves (AMARC, 2002). This is important to consider when creating a marketing strategy to target a youth audience.

A social group that is important to take into consideration within the demographics for our project is family groups. Because families can be composed of several age demographics, family-oriented museums must be able to cater to each group. In this case, marketing may need to focus on projecting a non-violent image for example, friendly animals instead of firearms, to cater to the young members of the family groups, while still trying to remain interesting to older visitors.

2.3.4 Current Museum Marketing Techniques

While most museums in and around Copenhagen work with MIK, they also use a variety of methods to advertise individually. They funnel information through different means such as pamphlets, posters, word of mouth, and the individual museum websites. Pamphlets offer up brief information about the museums and some of the more popular exhibits the museums offer

and often provide directions to the museums from main areas of Copenhagen. Pamphlets are useful as hardcopy information that people can take with them for reference at a later date.

Posters are used throughout the city, especially in the heavily used public transportation system. These provide advertisements for various museums and usually feature their newest or limited time exhibits. For example, during the spring of 2008 in Copenhagen, numerous signs promoting the Medial Museion's new Oldetopia exhibition showcasing the changing notions of aging, longevity, and health.

Today, the Internet is a popular marketing medium, and nearly all of the museums in Copenhagen have individual websites. These websites provide links to explanations of exhibits, directions to the museums, and general information about the museums. Museums have also started to implement interactivity on their own websites. They are trying to put more emphasis on their websites to draw more people to the museums.

Because all the museums in Copenhagen are state institutions it is difficult for them to obtain private funding. The funds museums receive from the state, especially the smaller museums, is often not adequate for a full marketing budget. The small budget does not allow museums to market to their full potential. This is where the help of MIK is so crucial in the museums' operation. Many visitors are drawn to the museums through the marketing and efforts of MIK (Ribers, 2008).

2.4 Evolution of Marketing

This section focuses on the technological areas of the MIK marketing strategies. It addresses the need for MIK to capitalize on the opportunities created by advances in technology. In particular, we focus on the importance and effectiveness of the Internet as a marketing tool,

and the potential for interactive marketing strategies. We address the popular technical tools used to create online interactive media, as well as the techniques by which those tools can be applied.

2.4.1 Using the Internet

The Internet is the focal point of MIK's interactive marketing strategy for external promotion of member museums. The World Wide Web provides a means to communicate with people across the globe, and is an ideal tool to engage potential customers. By the end of 2007, there were over 1.3 billion different users on the Internet, over 3.7 million of which were in Denmark, nearly 68% of the country's population (Internet World Stats, 2007). Used properly, the Internet can be a powerful marketing medium, and the number of companies developing and implementing solutions to take advantage of this invaluable resource continues to grow. The Internet has enabled audiences to virtually visit museums located far outside their physical region, frequently offering new and different experiences with which to engage visitors (Rentschler, 2007). MIK's website has already begun to take advantage of the power of online marketing, but has yet to fully utilize the potential of interactive media.

2.4.2 Lack of Interactivity

Adding targeted interactive marketing would allow MIK to reach out to potential visitors and offer them the chance to investigate museums and exhibits, and choose those that interest them. In fact, many of MIK's member organizations have been independently investigating interactive media for their own websites. Ms. Anni Mogensen informed us that some of the museums, such as the Danish National Museum, are eager to take advantage of interactive media's ability to attract and engage visitors. The museum is currently in the process of

upgrading its website and hardware, partially to help meet the demands of interactive technology (Mogensen, 2008).

2.4.3 What is Interactive Media?

According to Atchison, Topeka and Santa Fe Ltd. (ATSF), a company that trains software engineers, interactive media is defined as

“...the integration of digital media including combinations of electronic text, graphics, moving images, and sound, into a structured digital computerized environment that allows people to interact with the data for appropriate purposes. The digital environment can include the Internet, telecoms and interactive digital television”

(England and Finney, 2002, p.2).

This characterizes interactive media as an audio or visual tool with which a person can communicate (for example, by clicking a computer mouse button) to interact with digital information in some way.

The increasing popularity of computers and the Internet has provided an opportunity for implementing interactive media. By presenting website visitors with interactive media, companies and organizations are not only able to reach potential customers but they can use the online interactivity to advertise worldwide for relatively little cost. There are several types of interactive media available for use, each with its own advantages and disadvantages.

2.4.4 Interactive Marketing Techniques

Three commonly used options for interactive media available are web games, questionnaires, and virtual exhibits. Each of these options are available on various museum

websites, serving both as entertainment and as a method for maintaining the visitor's interest in further content the museum has to offer.

Web games formerly existed solely on dedicated gaming sites such as Shockwave.com or Poker.net, but this is no longer the case. Instead, many businesses that have little or nothing to do with gaming are using web games to attract visitors to their sites and keep them coming back for more (Kim, 2001). An increasing number of museums are following this trend as well. Whereas some websites use games like Hearts or Solitaire, which have little or no educational value, many museums try to use games that educate, advertise, and entertain all at the same time.

Questionnaires are another form of interactive media that can be frequently found online. A well-designed questionnaire-style web application can also double as a game, providing a degree of entertainment in addition to being a utility for the user. For our project, the design of a questionnaire would need to keep the entertainment aspect in mind, maintaining the user's interest to ensure that they did not find it boring or annoying. A questionnaire has the added advantage of being simple to design and easy to maintain and update.

A third popular option for interactive media for museums is a virtual exhibit. Some museums have opted to create digital representations of their exhibits – either by creating three-dimensional simulations that a user can virtually enter and move through freely, or by allowing a user to view all the information about an exhibit online complete with pictures, and possibly audio or video. One example of such a type of media is the virtual exhibit of the U.S.S. Blueback, at the Oregon Museum of Science and Industry, which provides a rotating three-dimensional view of the inside of a nuclear submarine (Oregon Museum of Science and Industry, 2008). This particular option is inherently more complex than the others, becoming even more complicated when involving nearly 70 separate museums within MIK, each with its own exhibits. However,

it is possible to use specific exhibits, from various museums, as samples to provide potential visitors with an idea of what the museums in the area have to offer.

2.5 Background Summary

Museums have already begun to make use of interactive marketing as a means of promoting their exhibits. The Museums in Copenhagen (MIK) organization is currently aiming to add web-based interactive media to its overall marketing strategy. By expanding its audience and exposing current attendees to museums they may not have known about, MIK hopes to increase the popularity of its member museums – not only as educational organizations, but as social and cultural centers as well.

To benefit its member museums, MIK uses multiple methods to promote the features of each museum, and is working to take advantage of the Internet through a host of interactive options that combine current advertising techniques and technology. Of the three different forms of interactive media opportunities considered for our project, the questionnaire is most likely the best fit for the requirements and restrictions involved, but each will be analyzed accordingly. The ability to easily update and maintain the questionnaire would allow for minimum upkeep, while simultaneously providing the customization that would enable MIK to keep the information current. Creating web games would also fit well, but would require a heavier emphasis on the entire design, require more resources to create and implement, and be difficult to maintain if used for advertising current exhibits. In the following chapter we present our plan for developing and implementing a web-based approach to interactive marketing for MIK.

3 Research Methods

This section explains the methods we applied, as well as the rationale for those methods, to develop interactive marketing media and effectively implement it via the MIK website. The goal was to develop an interactive media application that engages current and potential museum visitors in the museum offerings, integrate information from all museum members of MIK, ensure that the application is flexible so that it applies to a wide variety of users, and encourage increased visitation to the Copenhagen museums.

To complete this project, we pursued the following objectives:

- Identify the wants and needs of our audience and the museums
- Develop an interactive media application that satisfies the needs of our sponsor and our audience
- Evaluate the effectiveness of our interactive media

We discuss our approach to achieving each of these objectives in the following sections.

3.1 Object-Oriented Design Process

The method we used for the design and creation of our interactive media solution is based heavily upon the key concepts of Object-Oriented Design (Figure 3.1) – a generally well-known process in the field of computer science (McLaughlin et al, 2007). There are five major phases in this process, specifically: gathering requirements, analysis, design, implementation and testing, and distribution. Each phase of this process is important for the creation of a high-quality product that is easy to both maintain and update.

We have created a diagram, shown below in Figure 3.1, that displays the layout of the phases for the Object-Oriented Design Process. Note that the Testing and Development phases

occurred at the same time, and moving between those two phases is allowed, and oftentimes expected.

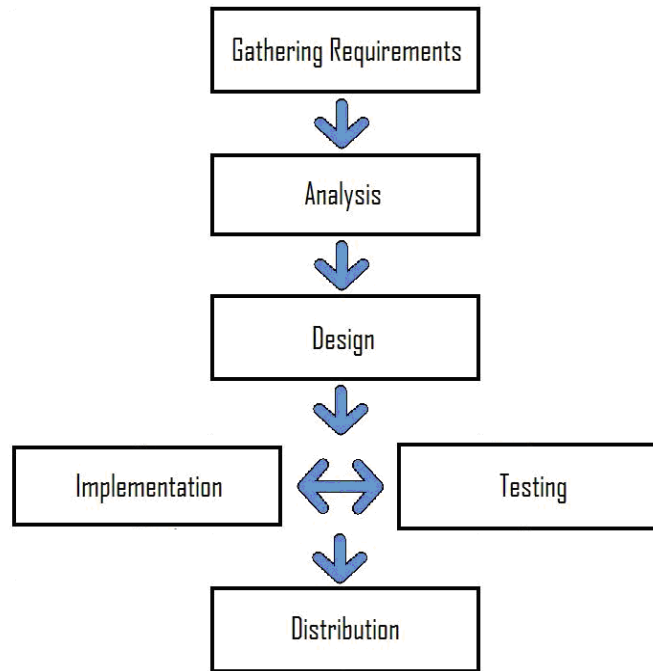


Figure 3.1 – Object-Oriented Design Process

In Phase 1, referred to as the “gathering requirements” phase, our project team combined all of the technical issues, such as hardware restrictions, and user needs to form a set of specifications that our software must meet. For our project, this step was addressed by interviewing our sponsor and marketing experts, and visiting museums as described in the following sub-sections of this chapter. These needs and restrictions were laid out in the beginning of the design process, to prevent confusion later. These requirements were subject to change, within reason, at any time, which meant that our design needed to be able to shift to accommodate any new specifications. One of the primary products of this step is a set of “use cases,” which are examples of how the software will react in expected scenarios, from the point

of view of the user, not the programmer. A list of the use cases we developed for this project can be found in Appendix E.

Phase 2 of this process is the “analysis” phase. When applied to software development, this means the prediction and prevention of potential problems before the application is placed into a real-world context. For the most part, this step involved identifying any possible issues that arise in the real world, simplifying them, planning out reliable solutions, and adding the solutions to the software requirements or updating use cases as necessary.

Next comes the “design” phase (Phase 3), which involved the architectural planning and design of the software. This required dividing the program into smaller modules that performed the low-level data crunching that allows an application to meet its requirements. This is where the requirements and “use case” specifications from the previous two steps helped to streamline the creation process. Instead of piecing together a program based on a vague idea of what it is supposed to do and formulating solutions to problems as they appear, it was possible to design the software based on a very clear set of guidelines. This step involved a small amount of coding, but it revolved around creating the preliminary skeleton for the program.

Phase 4, “implementation and testing,” is fairly self-explanatory. This is the step in which the actual software code was written, based firmly on the architecture set forth during the design phase. One of the most important items for programmers to keep in mind during this step is the clarity of their code; it should be possible for any programmer with background knowledge of the requirements to look at another programmer’s code and understand it with minimal effort. Testing the code during this phase provided assurances that each individual module successfully performed the required functions.

The final phase (Phase 5), “distribution,” involved planning and executing the distribution of the application to the users. Because the application designed through this project was a form of interactive web media, this step involved little more than uploading it to the web server and allowing the site visitors to access it.

3.2 Visiting Museums

Because of time and resource restrictions, our team decided to visit the museums ourselves rather than to survey or interview museum visitors, and we documented our personal observations. While we recognize that we are unable to fully grasp the perspective of the entirety of the museum visitor audience, we felt that by focusing on basic elements important to many visitors, such as children’s activities, we would be able to produce an accurate evaluation. For our field work, we visited a variety of museums in the Copenhagen area belonging to the MIK collaborative. These museums were carefully chosen with the assistance of MIK to provide us with a broad representation of museum sizes and experiences. We then decided to focus on determining the marketing needs of both MIK and the individual museums of the collaborative.

3.3 Interviews

It was important to conduct interviews with experts in the field of marketing museums, specifically the marketing of museums in the Copenhagen area. The people we selected to interview were our sponsors, and several other individuals in charge of marketing at museums throughout Copenhagen. We interviewed these individuals to better understand how the media we were designing would function as a marketing tool, and how to satisfy the needs of the

member museums. With the consent of the interviewee, any responses and data obtained from the interviews were recorded for future use

3.3.1 Sponsor Interviews

To define the focus of our project, we interviewed the MIK Head of Communications, Ms. Lise Korsgaard. Her areas of responsibility include the coordination of marketing, development of the website, and development of ideas on Museums in Copenhagen (MIK, 2008). Ms. Korsgaard has earned degrees in History and Communications, and her experience with the organization and educational background helped to communicate our ideas about interactive marketing, and connect them to the mission of MIK.

We also interviewed the Editor of the Danish version of the website, Ms. Sofie Linde. Though we focused on developing the interactive media for the English version of the website, her input was helpful to develop a version easily understood in both Danish and English. MIK also explained that it is much easier for their web developers to translate our work from English to Danish, as opposed to the other way around (MIK, 2008). Ms. Linde has a degree in communications, and she provided information on web development for museums, and the use of the Internet as a tool.

Interviews were conducted face-to-face and lightly structured, organized around open-ended questions, and involving free flowing conversation. However, even when the interviews were exploratory, they were still carefully planned to narrow the focus of our project (Knight, 2002). If lightly structured interviews were not guided by an agenda, there was a chance that our research would fall into the trap of relying on naïve or unexamined theories (Knight, 2002). We asked questions that allowed for definitive responses, but also allowed the interviewee to provide

personal insights and encourage additional dialogue. For example, we asked questions such as “How complex do you want the application to be?” and “Is there a specific demographic that you would like us to focus on?” which helped determine the exact specifications they wished to apply to the project.

By the end of the interviewing process, we established a list of specifications and guidelines for the interactive media we developed for the MIK website. Interviews allowed us to construct a timeline for our project, where we set weekly goals. Once the aims of our sponsor were explicitly determined, we focused on museum needs by obtaining information from various marketing experts from MIK’s member organizations.

3.3.2 Interviews with Marketing Experts

Whereas the interviews with the sponsors were conducted to determine the needs of the promoter, interviews with marketing experts clarified the needs of the individual museums being promoted. By interviewing persons from various museums in charge of marketing, we could further understand the current marketing standards and practices for museums, and learn what they wanted from our project.

We conducted interviews with Ms. Anni Mogensen from the Danish National Museum (referenced in Background Section 2.3.2 and 2.3.3), Ms. Bente Vinge Petersen from the Medical Museion, and with Ms. Tora Ribers from the ToldSkat Museum. These interviews were selected at the advice of our sponsors, and represented a diverse selection of museums. Because it is heavily funded, the Danish National Museum is expansive and offers a wide variety of exhibits. As stated in the Background, Ms. Mogensen also represents the Museum of Danish Resistance and the Open-Air Museum. The Medical Museion is a much smaller museum with a limited

budget. The Museion has had trouble attracting visitors, and is currently changing its image and marketing tactics to appeal to a wider audience. The ToldSkat Museum is one of the smallest museums in Copenhagen and lacks funding for marketing. We felt that these selections offered a broad range of characteristics and faced many of the same issues that other museums in Copenhagen were facing.

We also determined the relationships between MIK and its member museums. In addition, we learned the extent to which interactive media is already used in museum marketing, and by whom this interactivity was being implemented. Statistics about museum attendance were helpful in determining and profiling our target demographics. During interviews with the member museums, we focused on the following questions;

1. What is your current position?
2. How closely do you work with MIK in terms of marketing?
3. What current marketing methods do you employ?
4. Is your museum currently employing any interactive media of its own?
 - a. If so, how effective has it been?
5. Would our project be helpful to your museum?
6. Are there specific aspects of your museum you would like to see highlighted?
7. Do you have any statistics available regarding visitor attendance at the museums or the popularity of exhibits?

Responses to these questions allowed us to understand how our project would affect the current marketing practices of each of the museums, and whether it would be beneficial to them. They also provided insight into the current marketing practices employed by each of the museums, and if or how they use interactive media. We also posed other questions during each

interview, specifically tailored to the museum we were attending, which allowed us to obtain information on any individual problems. By analyzing marketing techniques the museums currently use, we were able to decide upon an interactive media program that would best serve their needs.

3.4 Comparing Forms of Interactive Media

As explained in the previous chapter, we narrowed the options for interactive media that we considered to three general categories: web games, questionnaires, and virtual exhibits. Each option had advantages and disadvantages, which we weighed in our consideration of possible solutions to our sponsor's problem.

Our final design for the program was influenced by several factors: the requirements of our sponsor, the requirements of the museums, demographic analysis of the museum-going audience, ease of use of the program, and feasibility of implementation. Once we completed the initial "gathering requirements" phase of our Object-Oriented Design Process, we developed a set of guidelines. These guidelines were input into a comparison matrix, weighing them against our three interactive media options. For each guideline that applied to a specific type of interactive media, we marked off the corresponding box. The following sample comparison matrix weighs three hypothetical guidelines against the three forms of interactive media. In this example, because the Questionnaire option satisfies the greatest number of "guidelines", it would be our optimum solution for interactive media. Our final analysis of the three forms of interactive media with the complete set of guidelines is located in Section 4.5.1 – Choosing Interactive Media, of the Results Chapter.

Table 3.1 – Example Comparison Matrix

	Guideline 1	Guideline 2	Guideline 3
Questionnaire	x		x
Game		x	
Virtual Exhibit			x

Once our form of interactive media was determined, we obtained content for our program by gathering in-depth information about each of the member museums.

3.4.1 Demographics and Museums

Our interactive media needed to form a connection between museums and the various demographics of museum visitors. For this we divided the museums into categories based on the types of exhibits they offer, attractions in the surrounding area, and other extras such as cafes and shops. Also taken into consideration were museums targeted towards specific demographics, such as children or families. The following chart is an example of how the museums could be categorized:

Table 3.2 – Example Museum Categories

Art	National History & Culture
Danish Museum of Art and Design	Frederiksborg Museum
Frederiksborg Museum	National Museum of Denmark
Kunstforeningen GL STRAND	Theatre Museum in the Court Theatre
National Museum of Denmark	DieselHouse
Storm P. Museum	Museum of Customs and Taxes
Theatre Museum in the Court Theatre	Round Tower
Science & Industry	Zoos and Gardens
DieselHouse	Botanical Garden
Geological Museum	Frederiksborg Museum
Industrial Works of Brede	Zoo Copenhagen
Medical Museion	Øresund Aquarium

Information about museums enabled us to create a program that matched visitors to the corresponding museums based on demographics and visitor interests.

3.5 Program Testing

After creating a prototype version of the program, we installed a pilot model for website visitors to test online. We placed the prototype application on our own personal website and distributed it to our test group. It was not feasible to get feedback from real-time website visitors, so at the advice of MIK, we chose a Danish test group and a “tourist” test group. The Danish test group consisted of staff members of MIK and related organizations, and the tourist group consisted of the other WPI students working on projects in Denmark. Users from these groups provided feedback and/or suggestions for the program via the survey on SurveyMonkey.com, a free online survey provider. This survey was designed to yield both quantitative and qualitative measurements so as to give the most accurate results possible.

3.5.1 Developing the Survey

The purpose of the survey was to determine if the program we created was easy to use and worked well. The questions in this survey were as specific, clear-cut, and unambiguous as we felt we could possibly make them (Ferber, 1980). The following table is a sample survey we used to determine the effectiveness of our program (The questions in the following survey are phrased as if we had already chosen the final form of interactive media):

Table 3.3 – Survey Sample

Which best describes you?

(A) From Denmark (Or the Surrounding Area) (B) Tourist

On a scale of 1 to 5, please rate the following qualities of the Questionnaire:

How easy was it to use? (Not easy) 1 2 3 4 5 (Very easy)

How easy was it to understand? (Not easy) 1 2 3 4 5 (Very easy)

On a scale of 1 to 5, how would you rate the appearance of the Questionnaire?

Appearance: (Very ugly) 1 2 3 4 5 (Very pretty)

Did the Questionnaire provide you with helpful suggestions?

Yes / No

Would you use this Questionnaire again?

Yes / No

Did you have any problems with the Questionnaire? If so, what were they?

Was there anything in particular that you liked about the Questionnaire?

Do you have any suggestions for improving the Questionnaire?

To quantify the ease of use and helpfulness of our program, we utilized the Likert Scale for a portion of the questions in the survey. Likert Scaling is a uni-dimensional scaling method, so it is assumed that the concept being measured is one-dimensional (Trochim, 2006). The Likert Scale most often uses a rating system of 1 to 5; this range of values assigns qualitative examples to the quantitative numbers. The value of 1 is assigned the metric of being “strongly

unfavorable” to the concept, and 5 is “strongly favorable” to the subject (Trochim, 2006). The Yes/No answer questions were also analyzed in a quantitative manner.

The qualitative questions posed in our survey were used to give a better understanding of the opinions of our visitor demographic. This would allow respondents to offer suggestions for improvement and inform us if they would use the program again, enabling us to improve our program to best suit their needs.

3.5.2 Translating the Survey

Because we wrote our survey in English, we needed to have it translated into Danish. In the translation we addressed possible cultural differences and avoid terminology that could be misconstrued, confusing, or offensive. Fortunately we could call upon our sponsors for help. As part of their jobs, Ms. Korsgaard and Ms. Linde develop surveys for Danish visitors to the MIK website. They were instrumental in providing a Danish version of our survey. Once the survey had been translated and modified to account for any misinterpretations, it was ready for distribution to our test groups.

3.5.3 Analyzing the Survey Data

After distributing the survey via the online client, we analyzed the data both qualitatively and quantitatively to gain an accurate understanding of the demographics. The analysis of data from questions answered with the Likert scale was quantitative, and involved dividing the responses into homogeneous groups, such as age and native language, and then simply averaging the responses together (Lubke, Date Unknown).

Qualitative responses were more difficult to analyze than quantitative responses, as quantitative analysis is easily translated into simple numerical graphs and charts to analyze trends. The application of qualitative analysis presented unique challenges, as there were many unknown factors that could not be described by numbers, but we discovered patterns from the diverse responses of visitors, which provided insight into the general consensus (Bayley, 2004). The process of analyzing such qualitative data for our survey was centered on finding distinct patterns among visitor responses to questions such as the inquiry about suggestions for improving the application in Table 3.3.

After analyzing the data, we used the analysis to expose the flaws in our program, and ultimately improved the interactivity based on the user's needs, such as ease of use and further suggestions. The analysis allowed us to understand the most common preferences and concerns among users, providing information about their expectations for our interactive media and its usability.

3.6 Summary of Research Methods

Using the Object-Oriented Design Process relies on the completion of each individual phase: gathering requirements (fulfilled using surveys, museum visits, and interviews with our sponsors and marketing experts), analysis, design, implementation and testing (using additional feedback from our test groups), and distribution via the MIK website. To complete our project, we recognized and satisfied the requirements of our sponsor, the museums, the persons who market museums, and our audience by designing and implementing an interactive media application which MIK can use as a marketing tool.

4 Results

This chapter details information relevant to our project gained through the implementation of our research methods. Designing an interactive program, like our Museum Selector application, that is intended to cater to visitor preferences and the different characteristics of museums was complicated, and many factors needed to be considered. Following the Object-Oriented Design Process outlined in the Research Methods chapter, we determined the needs of the museum visitors, our sponsors, the museums, as well as the technical requirements and restrictions relevant to the creation interactive media based computer program. Because our project focused on museums, MIK, museum visitors, and the relationships between these parties, we carefully examined their views on the museum experience and the effects of interactive media as a marketing tool.

4.1 Visiting Museums

We visited 15 of the 70 MIK member museums, and those visits were representative of what the museums in Copenhagen have to offer. At least one museum from each of the major museum categories was selected, including History & Culture, Science & Industry, Art, and Zoos & Gardens.

As visitors, we were looking for specific elements at each museum, including everything from simple amenities to interactive exhibits. To compare museums, and keep records of popular nuances of the museum experience, we quantified our list in the following example table. Criteria such as availability of children's activities and family-friendly exhibits are of great

importance to many visitors, and were taken into consideration for each of our visits. This table illustrates the results of our observation from two of the chosen museums:

Table 4.1 – Example Museum Experience Chart

	Danish National Museum	Danish Museum of Art and Design
Presentation	X	X
Shops	X	
Cafes	X	X
Bathrooms	X	X
Tours	X	
Children's exhibits	X	
Family friendly exhibits	X	X
Multiple Languages	X	

Our comparative data helped determine that many of the museums do not have explanations for the exhibits in languages other than Danish, which is an important consideration for many tourists. We also noted which types of museums offered family-friendly environments, and other amenities. Because our interactive program is intended to be a tool that will connect visitors with museums that best suit their interests, it is important to understand what they are looking for in a museum experience. From our personal experiences as visitors, we compiled a list of simple visitor needs, and they are as follows:

1. Quality of content
2. Information in multiple languages
3. Availability of shops and cafes
4. Children’s exhibits
5. Interactive exhibits
6. Guided vs. unguided tours
7. Navigability

After understanding the visitor perspective, we shifted our focus to the needs of the marketers at the individual museums, and MIK, which ultimately markets all the museums to potential visitors.

4.2 Interviews

The interviews we conducted allowed us to obtain important information for the creation of our interactive program. At Museums in Copenhagen (MIK), we interviewed our primary contacts: Ms. Lise Korsgaard and Ms. Sofie Linde. They explained that the objective was to create an interactive program that connected visitors to the MIK website with museums that appealed to their individual interests, confirming our original understanding of the project goals.

These interviews provided us with the project requirements from the point of view of an organization that markets museums to the museum visitors. Ms. Korsgaard and Ms. Linde informed us that the purpose of MIK was not to focus promotion on the most popular museums, but to represent all museums equally – a strategy that would need to be reflected in our interactive program. We were also informed that we should include other possible attractions near the museums, such as restaurants and parks, to further meet the needs of potential visitors. With this information, we developed a list of sponsor requirements for our interactive program that pertained to the MIK mission, shown in Table 4.2:

Table 4.2 – Sponsor Requirements

1. Involve the website visitor
2. Provide exposure for smaller museums
3. Must be fun to use
4. Must be dynamic
5. Apply to all museums
6. Showcase museum characteristics such as facilities, surroundings, etc.
7. Focus on family fun
8. Diminish negative stereotypes for museums
9. Provide multiple, appropriate, museum recommendations
10. Connect visitors with museums that suit their interests
11. Create the tool for tourists and residents

While this information is vital to our interactive program, we also took into account the needs of the museums being marketed. For that information we interviewed marketing officials from a selection of the MIK member museums.

As a representative sample of museums, we conducted interviews with Ms. Anni Mogensen from the Danish National Museum, Ms. Bente Vinge Petersen from the Medical Museion, and Ms. Tora Ribers from the ToldSkat Museum. These interviewees were recommended by our sponsors, and represent a diverse selection of museums.

Ms. Mogensen, Marketing Officer for the Danish National Museum, provided insight into what museums themselves may be looking for from our interactive program, and also the techniques that museums use to attract visitors. We met with an expert from the Danish National Museum because it is the largest museum in Copenhagen and also represents a number of smaller museums, such as the Danish Music Museum. Ms. Mogensen is in fact in charge of marketing for the Danish Museum, the Open-Air Museum, and the Museum of Danish Resistance 1940 – 1945, which all differ in size and popular attractions. Whereas MIK is concerned with promoting museums, the individual museums are concerned with promoting not only themselves, but their unique exhibits as well. From this interview, we determined how individual museums manage their marketing, and which content they focus on when advertising. From Ms. Mogensen, we learned that a large portion of museum marketing is keying in on people's interests based on what the museum has to offer. As explained in Sections 2.3.2 and 2.3.3 of the background, we discovered that it is important for marketers to highlight specific images of the museums that people can relate to as a means of appealing to visitors. For example, the Open Air Museum uses family-friendly imagery in their advertising to appeal to

visitors with children. In addition, we realized the importance of family friendly environments because families are among the most important and frequent customers for the larger museums.

Because the Danish National Museum is larger than many of the other museums, it offers a broad range of exhibits, and is well-funded. We felt it would be beneficial to interview marketing officials from some of Copenhagen's smaller, more unique museums as well. To represent the smaller museums, we interviewed Ms. Bente Vinge Petersen, the Communications Officer for the Medical Museion.

This interview shed light on the struggles that many of the smaller museums face. She explained how currently the museum is not well known to the general public, and with a relatively small marketing budget, the museum cannot afford pamphlets to promote itself. Because of the age of the building, the museum has no sign on the outside, so potential visitors cannot identify where the building is. In addition, she told us that the museum is currently undergoing several changes in their marketing strategy as a result of their recent efforts to attract new visitors. Originally, the museum only offered exhibits about the history of medicine and surgery techniques, but they are now creating exhibits that combine medical science with artistic undertones to make the exhibits more appealing to the masses. Currently, the Medical Museion's main audience is composed of researchers and others in the fields of science and medicine, because they work in conjunction with the University of Copenhagen on research endeavors.

To begin appealing more to the general public, the Medical Museion is working hard to create unique exhibits that change approximately every eight months to keep people interested and coming back. Due to the age of the building and a lack of fire exits, the Museion only offers guided tours that must be scheduled in advance. Unlike the guided tours, the unique exhibits the

museum will be offering allow visitors to make spontaneous visits. Working to change the image of the Medical Museion, Ms. Petersen emphasized that museums needed to be portrayed as providing enjoyable social experiences for visitors as opposed to being boring or dry.

In our interview with Tora Ribers, the curator of the ToldSkat Museum, we discovered how important our efforts were to the smaller museums in Copenhagen. The ToldSkat Museum is one of the smallest in Copenhagen and offers exhibits detailing the history of Danish customs and taxes. For years, the visitors to the museum have primarily been individuals involved in the field of customs, and the museum receives few visits from the general public. Because of this, the museum has little funding and cannot afford to advertise itself beyond the fee they pay MIK for its services. Ms. Ribers explained that she had recently been to museums in the United States and Australia, and was impressed by the level of interactivity these museums used to attract visitors. She pointed out that many of the Danish museums are far behind the times and are now working to update accordingly. She is currently planning an overhaul of the exhibits to bring them into the twenty-first century and attract visitors in brand new ways.

To some degree the marketing characteristics we unearthed from these interviews had already been included within MIK's project requirements, and therefore already included within our specifications. Shown below in Table 4.3 are the unique needs of the individually marketed museums, as summarized from our interview results:

Table 4.3 – Museum Requirements

1. Promote popular exhibits
2. Focus on particular demographic interests
3. Provide a degree of entertainment
4. Discourage the “museums are boring” stereotype
5. Provide multiple museum results if possible
6. Keep family-friendly
7. Include other attractions than exhibits

Our interviews provided us with useful qualitative information, as well as many statistics. Initially, we had planned to conduct visitor surveys at several museums to gain perspective on the potential visitor’s needs. However, MIK had already conducted such surveys using its website, and it had also conducted multiple focus groups. Therefore, MIK was able to provide our team with statistics that detailed the information we had intended to gain from our own surveys. We were provided with website statistics that assessed elements of their website, and other visitor demographic information.

4.3 Data Analysis

While most of the information outlined in the interviews pertained to the museums and their contents, the survey statistics highlighted information about the visitors. Although we had gathered information from our own personal visitor experiences, it was important for us to analyze the trends among actual museum visitors from Denmark. The percentages in the following tables display data obtained from a survey conducted on the MIK website from July 20, 2006 to September 14, 2006. Because the survey was in Danish, it cannot accurately address the visitor statistics for foreign tourists. Table 4.1 gives the gender of visitors to the MIK website.

One can see that women are the primary users of the MIK website, and our interview with Anni Mogensen echoed this trend for the gender statistics of museum visitors. However,

we were not able to obtain exact numbers from Ms. Mogenson for this information. Our goal is to focus on appealing to both genders equally, rather than key in on either demographic specifically.

Table 4.4 – MIK Website Users (Gender)

Gender	
Men	33%
Women	67%

These statistics also provided information about the areas of Denmark that local website users were from, and Table 4.5 displays the three major areas from which people are visiting. The data shows that the majority of the users are visiting from Copenhagen or nearby areas. The remaining 30% of visitors to the MIK website are people located outside of the immediate Copenhagen area.

Table 4.5 – MIK Website Users (Location)

Location	
In Copenhagen or Fredriksberg	31%
Area just outside of Copenhagen	29%
Area just outside of Fredriksberg	10%

Beyond the general information about visitor behavior, we used the data to understand visitor opinions about the website itself. Most of the data were very positive for MIK, and indicated that users appreciate the MIK website in terms of its appearance and available information. Statistics of particular importance to our project were those related to the frequency of user visits to the website.

Table 4.6 – MIK Website Users (Number of Visits)

How often do you visit the website?	
1st time	70%
Less than monthly	14%
Monthly	12%
Weekly	3%
Daily	1%

As shown in Table 4.6, 70% of visitors to the MIK website are first time visitors, and less than 20% visit on a regular basis. From this information we concluded that our interactive program should be engaging and entice visitors to return to the website on a regular basis. Visitors use the MIK website for specific reasons, and we wanted our interactive program to cater to those needs. As shown in Table 4.7 the majority (81%) of visitors use the website for private or personal reasons, most likely to find information about museums they may be interested in visiting for leisure. From this statistic we determined that our final product must be a tool to encourage users to visit more often and enable them to use the program in their everyday lives.

Table 4.7 – MIK Website Users (Reason for Visiting)

Why did you visit the website?	
Private	81%
Study/Research	8%
Job Reasons	11%

As a final consideration, we analyzed the statistics regarding navigation of the MIK website. As shown below in Table 4.8, an overwhelming percentage of people felt that the MIK website was easy or very easy to navigate, and we determined that our interactive program should look and feel as if it were a part of the MIK website in order to maintain the current ease

of use. Our interactive program must be simple enough that anyone can use it. Introducing new or complicated interfaces may confuse users, and reduce not only the usability of our application, but the user opinion of the MIK website.

Table 4.8 – MIK Website Users (Ease of Navigation)

Navigation	
Very Easy	72%
Easy	20%
Not Easy	6%
Very Not Easy	2%

With these statistics in mind, we further specified the requirements for our program. Other factors that we also needed to consider were the technical constraints we would face creating interactive media.

4.4 Technological Restrictions

Concept-wise, our interactive program is defined by the requirements developed from the meetings with MIK and the needs of the member museums. However, our interactive program ideas were restricted by various technological limitations involving the current MIK website, web browsers, and developer costs. Most importantly, we needed to develop an interactive program that could be integrated into MIK’s website and maintained by its operational staff. Overall, we adhered carefully to these constraints so as to ensure that we could create an interactive program that catered to the needs set forth in our interviews. Because our interactive program is intended to function on the MIK website, we analyzed its coding to test the technological limitations.

4.4.1 Current Website

We discovered that the internal code of the MIK website was coded in a combination of a CMS, HTML, and JavaScript. CMS stands for Content Management System and facilitates the organization, control, and publication of web-based content and other content, such as images and interactive media resources (AIIM, 2008). HTML stands for HyperText Markup Language, and is the prevalent coding language for web pages. Originally, we had planned to use Flash, a popular web application language for creating interactive web content, for our interactive program, but were hesitant to incorporate a new language that may not integrate well with the current MIK website. Also, to develop quality interactive media in Flash, we would need access to an expensive development tool that we could not obtain. While there is a trial version of the tool available, it would not have lasted long enough to complete the project. Based on these concerns, we decided to code using JavaScript, which is another commonly used coding language for web pages. JavaScript code can be created using programs such as Windows Notepad, which comes standard on any computer running Window Operating System.

The JavaScript language mixes well with HTML coding, so it was easy to integrate into the MIK website, either internally or externally. For both cases, the program code is placed within the current website code, but the interactive program would be accessed and displayed in different ways. With internal placement, our interactive program would be accessed through a link on the MIK website and would appear in the current window that the website visitor is viewing, overlaying the website itself. The external placement of the interactive program would allow the interactive program to appear in a separate window from the MIK web page that the website visitor was viewing, but still be a link on the MIK website. We chose to store the interactive program externally in order prevent people from losing their place on the MIK website, by allowing the interactive program to appear in a separate window. Although our

interactive program integrate well with the MIK website, graphics often display differently in various internet browsers and can result in a distorted web page presentation.

4.4.2 Internet Explorer vs. Firefox

Currently, many websites like MIK's have trouble displaying properly in both Internet Explorer and Mozilla Firefox, which are two of the world's most popular web browsers. In fact, according to TheCounter.com these web browsers make up 97% of the online market share (2008). Internet Explorer is still the most commonly used web browser, accounting for about 78% of online activity (depending on the source), but Mozilla Firefox is slowly gaining more of the market share. Other web browsers such as Opera or Safari were not taken into consideration because they account for a minimal amount of actual web users (Only about 3%), and they often have options that allow them to copy the more popular browsers when deciphering web pages.

In this case, the significant issue is that Internet Explorer and Mozilla Firefox interpret the pixel-size values of website code in slightly different ways. Because the MIK website is designed to appear in Internet Explorer the code will display perfectly in that browser, but in Mozilla Firefox the pictures may be resized or shifted slightly along the x or y-axis or have frames or text overlaid. In the following images (Figure 4.1) you can see the differences in the display:

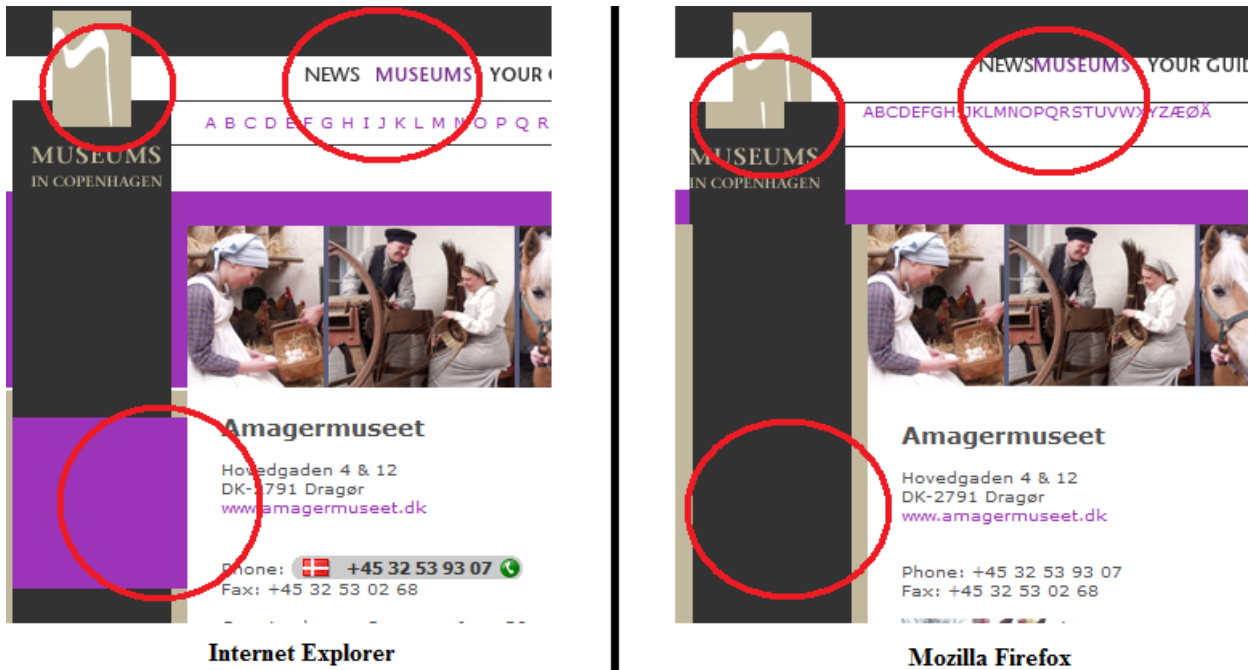


Figure 4.1 – Graphics Comparison: Microsoft Internet Explorer vs. Mozilla Firefox

In the figure above, the “Museums in Copenhagen” logo is severed in Mozilla Firefox, the text is cramped together, and the Internet Explorer version has the color purple in the sidebar. The differences displayed are clear, but are more of an annoyance than anything that truly obstructs the functionality of the website.

MIK is currently working to make its website display properly in both Internet Explorer and Firefox. For the time being, our interactive program will be coded to function most effectively in Internet Explorer, to keep the similarities with the MIK website. However, our interactive program will be easily updateable once they upgrade the rest of their website.

4.4.3 Outsourcing

For website maintenance and computer coding, MIK hires an outside source for development. Hiring professionals to update content on their website is expensive, and our sponsor requested that we create an interactive program that could be easily maintained by their employees with basic computer skills. Included in our program code are explanations that detail what each piece of code means, and how it relates to the overall function of the application. For example, the piece of code in Figure 4.2 contains the technical programming language, but is preceded by a series of comments explaining the code's function.

```
// Question (Object)
// Question - Object Constructor
// - Creates a "Question" object using the text assigned to
// the question, the set of answers for that question, and
// an image to display (if needed).
function Question(newQuestionID, newQuestionText, newAnswerArray, newQuestionImage) {
    this.questionID = newQuestionID;
    this.questionText = newQuestionText;
    this.answerArray = newAnswerArray;
    this.questionImage = newQuestionImage;
}
}
```

Figure 4.2 – Program Code with Comments

Combining comments inside the interactive program code with a basic user's manual that we have created and provided (See Section 4.7.4) should make it possible for anyone to easily update the media content. Changing or modifying the actual functions of the interactive program will still likely require professional assistance. This is an important feature to consider because MIK will want to update the interactive program to include new museums or exhibits without requiring outside assistance. Currently, adding or changing media content is a simple task, but it is tedious, and we have looked into finding a usable application with a graphical interface to assist in this task. This type of application would essentially allow MIK to type in the name of a

new museum, and the application itself would update the proper piece of the code, as opposed to physically searching through the code and manually changing it.

In order to properly code and create the interactive program, we developed a series of guidelines that our program should follow or adhere to.

4.5 Guidelines

The design of our interactive program was centered around a set of guidelines we developed based on the information obtained through interviews, review of technical constraints, and statistical analysis. As expected, many of the interactive program needs for both the member museums and MIK were one and the same. These few guidelines, including “making the interactive program fun” and “losing the boring museum stereotype” became important issues that we focused on in our program design. The important principles that we considered served as the foundation for our interactive media program, and it would not be completed without meeting each one of them. The following Table (Table 4.9) is a list of the guidelines we developed, as well as the reasoning behind them:

Table 4.9 – Program Design Guidelines

Guidelines	Importance
User Interaction	Increase user interest in content
Expose Smaller Museums	Provide a better picture of the museums available
Entertainment Value	Prevent the media from being tedious, if feels like work users will be less likely to want to use it
Variety	Providing a different experience each time encourages visitors to use the tool again
Represent Each Museum Equally	No preference should be given to any museum over another
Easy to Use	The application must be usable by any visitor to the website
Highlight Facilities, Surrounding Area, and Other Activities	Inform potential visitors of other activities they can enjoy before or after the museum visit
Family-Oriented	Families are a major demographic for MIK, and this should be a useful tool for those users
Tourist-Accessible	Should be able to assist tourists in finding museums that interest them
Multiple Results if Possible	Provide users with a reasonable number of museums for them to choose from
Focus on the Interests of Both Genders	Address the needs of the current major demographic (women), while attracting more men
Match the Visitor and the Museum	Connect potential visitors with museums that fit their interests
Discourage the Stereotype that Museums are “Boring”	Potential visitors do not want to be bored, encourage them to enjoy their museum visit
Promote Popular Exhibits	Each museum has at least one big exhibit, and they want to showcase them to attract visitors
Associate Museums with Categories	Each museum has its own content/focus, and many visitors are looking for specific types
Uses JavaScript for Code	Java Script is commonly used, works well, is more accessible than Flash, and is less likely to present problems with the MIK website
Internal/External placement	It should be possible to insert the program anywhere in the website
Functionality Across all Web Browsers	The program must <i>function</i> in all web browsers, even if the graphics are skewed
Understandable to our Sponsor	MIK must understand how the program works
Easy to Update/Modify	Our sponsor should be able to update or modify the program without having to pay for expensive professional help from an outside source
Feasibility of Completion	We need to be able to actually finish the program in the time period we have available
Appeal to all Demographics	The program should not be biased, and should encourage any user to be comfortable using it

To ensure our program’s effectiveness, each of these guidelines needed to be carefully considered and adhered to in order for our team to choose the most appropriate form of interactive media.

4.5.1 Choosing Interactive Media

After finalizing our list of guidelines we developed a comparison matrix that measured each of our guidelines against three of our proposed interactive media solutions. The following Table 4.10 is a truncated sample of the matrix we used to determine the best form of interactive media option for our project. It shows our guidelines across the top bar, and weighs them against the three forms of interactive media under consideration for this project in the sidebar:

Table 4.10 – Interactive Media/Requirement Comparison Matrix

	User interaction	Expose smaller museums	The program should be fun	It should be different every time	Apply to all museums	Highlight facilities and Surrounding area	Focus on families	Tool for tourists	Provide options at the end	Focus on both men and women	Connect visitor with museum that suits their interest	Lose boring museum stereotype	Promote popular exhibits	Highlight museums by genre	Must work with Java Script	Must work with (Website Code)	Internal/External placement	Function in all web browsers	Useable to common folk	Easy to change/update	Easy for us to code in 7 weeks	Must combine all aspects	Appeal to all demographics
Questionnaire	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	
Game	X		X	X			X			X		X	X	X			X						X
Virtual Exhibit	X		X				X	X		X		X	X				X						X

For each guideline that applied to a specific type of interactive media, we marked off the corresponding box. For some of the guidelines, other factors such as time needed to be

considered. For example, it is possible to have virtual exhibits “apply to all museums”, but it is a daunting task for us to create virtual exhibits for upwards of 70 museums in the Copenhagen area. In the end, our decision was based on which form of interactive media had accrued the greatest number of marked boxes. We decided that the interactive solution in the form of a questionnaire scored the best out of all three proposed solutions, and was the most feasible to create in the span of seven weeks.

A questionnaire requires the development of properly phrased and relevant questions, but before determining those, we needed to understand the makeup of the museums we were representing and the visitors that frequented them.

4.6 Demographics and Museums

The following section describes how we organized the museums into different categories based on the content they offered, and also how we accounted for various visitor demographics. With a questionnaire-based interactive media, we aimed to create a series of questions that acted as a tool determining any and all museums that appeal to particular visitors. This categorization process is one of the most important parts of our project, and is what we used to determine visitor preferences.

4.6.1 Categorizing the Museums

As part of the design process for our application, we labeled and catalogued all of MIK’s member museums for the questionnaire. Due to the impossibility of visiting every museum within MIK, the categorization of the museums was completed by analyzing the museum descriptions from the MIK website and supplemented by our personal visits to the museums.

Any misinformation or mistakes were edited by Ms. Korsgaard and Ms. Linde at MIK. The online descriptions we referenced were written by representatives from each museum, and then edited by MIK for distribution on the website; they therefore represent the interests of both MIK and the museum.

Based on the descriptions available on the MIK website we determined the cost of admission for each museum and took note of any attractions in the area surrounding the museum. Furthermore, we interpreted other, more abstract, data based on the descriptions of the exhibits and other museum offerings. For example, if any family exhibits or special events were mentioned in the description the museum was given a “family friendly” rating. When the museum contained exhibits that appeared to interest groups of friends, or when the museum offers cafes, shops, and an attractive surrounding area, the museum was given a “time with friends” rating. If the description of the museums implied that it would be appealing for a person to attend alone, it received a “time alone” rating.

As expected, most museums received multiple ratings. For example, where a museum such as the Royal Library received only a rating of “time alone,” a museum such as the Danish Museum of Art and Design received a rating of both “time alone” and “time with friends.” Museums such as the National Museum of Denmark and the Post and Telegraph Museum received all three ratings.

To separate the museums beyond the broad categories of history & culture, art, science & industry, and zoos & gardens we assigned certain keywords and phrases based on specific exhibits, genres, and information available in the museum descriptions. The museums were then placed into smaller categories based on the key words or phrases assigned to them (a full listing of the museums and their categories can be found in Appendix A).

As expected, many of the museums fell under multiple categories, and there was no limit set for the number of categories that could apply to a given museum. For example, the National Museum of Denmark offers such a variety of exhibits that simply defining its offerings as in the Art category or the History category would have been impossible, as well as impractical when choosing the final results of the questionnaire for the website visitor. The following table represents a division of the general categories into a series of key words in the left-hand column, and the corresponding description of the key word in the right-hand column:

Table 4.11 – Museum Categories and Subcategories

Art	
Graphic Art and Sculptures	Museums featuring paintings, sketches, tapestries or sculptures
Performing Arts	Museums with exhibits about Theatre or Music
Design	Museums featuring contemporary or classic design, or architectural design
Literature	Museums featuring literature on a variety of subjects
Science & Industry	
Science	Museums with specific areas of science such as Earth Science or Biological Science
Military	Museums featuring any aspect of the military or wars
Industry and Development	Museums dealing with areas of industry such as the fishing industry or agriculture
Labor and Services	Museums that portray occupations such as industrial workers or the police
History	
Art Culture	Museums dealing with the historical side of Art
Military or Professional Careers	Museums highlighting the history of the military and other various occupations
The Royal Family	Museums with exhibits pertaining to the Danish Royal Family
Monuments and Buildings	Buildings known for their historical significance
Lifestyles	Museums that are living museums or are focused on particular local cultures
World History and Culture	Museums that pertain to the history all over the world
Zoos and Gardens	
Zoos	Zoos and Zoological Museums
Aquariums	Aquariums
Small Gardens	Museums with small garden areas
Large Gardens	Museums dedicated to gardens or botany

The key words and phrases were adjusted during the review process, as not all descriptions were written similarly enough to be contained within the created guidelines. These classifications were reviewed by our sponsor to verify our groupings, and they pointed out any

inconsistencies we had. Once we properly grouped the museums based on their unique key words, we then developed the set of questions for our questionnaire.

4.6.2 Choosing the Questions

The questions were designed to correspond to the categories we created and establish which museums would relate best to the visitor. By determining what the website visitor likes, our questions systematically eliminate the museums that do not apply to any of the visitor's interests. Our questions are all multiple-choice to give the visitor a variety of options, but also to keep the answers controlled enough to predict an outcome. Each multiple-choice answer leads to a different question, eventually resulting in a final set of museums (3 top choices and up to 4 alternate suggestions) in which the visitor is likely to be interested. This allows website visitors to have a different experience each time they take the questionnaire, provided they pick different answers. (For a full explanation of how the interactive program works, see Section 4.7 – Designing the Program.) All of our questions were submitted to MIK for approval, and were edited to account for any language or cultural barriers

Many of the characteristics, such as price, distance, and family environment applied to each of the member museums. We developed a series of questions that would always appear at the beginning of every questionnaire, so we could immediately narrow down the list of museums that did not apply to these factors. The following is a sample question from the beginning of our questionnaire:

How much are you willing to spend (per person)?

- | | |
|---------------------------|----------------------------|
| A.) Free | B.) 35 DKK or less |
| C.) 50 DKK or less | D.) 130 DKK or less |

This question was implemented to determine if people are looking for an inexpensive day out, or if they intend to spend money to visit the museum of their interest. Of the MIK member museums, 16 have no admission fee, 40 are less than 35DKK, 59 are 50DKK or less, and only five cost more than 50DKK. Four member museums did not have pricing available, and therefore they are currently omitted from the above values.

The rest of the questions are based on the museum categorizations we have already established. For example, the following sample question shows how the answers are directly related to the categories and key words we already created:

What type of museum interests you today?

- | | |
|--------------------------|--------------------------------|
| A.) Art | B.) Science & Industry |
| C.) Zoo & Gardens | D.) History and Culture |

This question helps to decide which genre of museums the user would like to visit, thus reducing the available museums down to only those specifically related to that genre. The next question would relate to another much more specific categorization. For example, if the user selected Art as their category of choice, the following question would ask about specific genres, such as graphic or performing arts. All of our questions follow this same format, and when combined form a series of paths that allows the visitor to navigate our questionnaire.

To cater to both the Danish and English speaking visitors to the website, we translated each of the questions into Danish so we could have a version of the program on each the English site and the Danish site. The translation was done with the assistance of professionals that work on the translations for the MIK website. Following the finalization of the questions, our project team designed sister programs, one for each version of the site. These programs are identical in every way with the exception that one is in Danish and the other in English, and they can be developed in the exact same manner, without differences in coding.

4.7 Designing the Program

This section focuses on the design process, and how it went from theory and specification to an actual interactive program: the Museum Selector. We outline how we created the code, incorporated the ability to eliminate unwanted museum choices, how we created user interaction, and even added in extra functionality that MIK desired. When designing any interactive program, it is important to adhere to a set structure to prevent the code from being illogical or incomprehensible.

4.7.1 Code Structure

To allow for easy customization and upgrade, we designed the application to be highly modular, meaning that it can be divided into easily-separable components or “modules” – this is a generally well-known and popular technique in software engineering. The overall design can be compared to the concept of an assembly line: there are a number of individual parts, similar to industrial robots, each of which completes a certain step of the process to lead to the final product. None of these “robots” has any need to know how the other robots accomplish their tasks; all they require is that they receive the appropriate materials to do their job, so they can pass it on to the next station.

By designing the application in this manner, the client, our sponsor, will be able to switch out any of the internal parts with minimal effort. The interactive program simply requires that the code they insert meets the same input/output template as the code they replaced.

4.7.2 Modules and Objects

The interactive program is divided into five key parts: the Question module, the Answer module, the KeywordList, the Museum module, and the Interface. Each of these modules addresses a specific need of the application, and we have taken steps to internalize as much of the functionality for each part as possible – insuring that no module has direct access to another module’s functions.

Much of this is accomplished through the creation of so-called “objects”, which act as an abstract representation of a concept that a computer would be unable to understand normally. For example, if a programmer wished to create an object representing a human being, they may break down the aspects of a human into a set of information a computer is capable of storing and processing like so:

Object:
Human

Characteristics:
Name
Height
Weight
Hair Color
Eye Color
Skin Color

Figure 4.3 – Example Object Specification (Human)

The programmer could then use this template to create a “Human” object that the computer would be able to store as digital data.

The Question module essentially handles the creation and storage of “Question” objects. It provides a function that allows the interactive program to create a Question object by

providing all of the relevant fields. For the purpose of this application, the fields that we have designated for a Question are:

<i>questionID</i>	The ID number of the question, each question has its own unique ID
<i>questionText</i>	The text version of the question (this field can be left blank)
<i>answerArray</i>	A set of answer ID numbers, representing the set of answers associated with this question
<i>questionImage</i>	The image associated with this question, to be displayed by the interface

Figure 4.4 – Question Object Fields

Also inside the Question module is a function that allows the application to search a file for a question using that question's unique question ID number, and then create a "Question" object using the information from the file. This serves two very important purposes in the scope of this project. First, it allows our sponsor to add, remove, and modify questions for this quiz without having to write it out in programming language, which could easily lead to confusion and damage the functionality of the existing interactive program. Secondly, it prevents the interactive program from needing to store all of the information about the questions itself, which could easily slow down many older computers by creating and storing far more data than necessary.

The Answer module is similar to the Question module, and handles the creation and storage of "Answer" objects. It provides functions that allow the interactive program to create a Question object with the relevant data, and to search for an answer in a separate file using a unique answer ID number. For the purpose of this application, the fields that we have designated for an Answer object are:

<i>answerID</i>	The ID number of the answer, each answer has its own unique ID
<i>answerText</i>	The text version of the answer (this field can be left blank)
<i>keywordArray</i>	A set of keywords associated with this answer (for example: “art, history”)
<i>answerImage</i>	The image associated with this answer, to be displayed by the interface
<i>nextQuestion</i>	The ID number of the question the quiz-taker will be sent to if they select this answer

Figure 4.5 – Answer Object Fields

The third module, `KeywordList`, creates and maintains a “`KeywordList`” object that contains a set of keywords for which the Museum Selector-taker has shown a preference. For the purpose of this application, we have decided that the `KeywordList` should be composed of a single array of words, and contains no other information. To insure that any keyword is only added to the array a single time, there is a function in this module associated with the `KeywordList` object that receives a keyword as an input, searches the current `KeywordList` to see if it already exists in the list, and adds it to the end of the list if it is not present.

The `Museum` module handles the creation and storage of multiple “`Museum`” objects, and a single “`MuseumList`” object. It also provides a function that searches an external file containing a list of museums, then locates those that match the criteria gathered by the quiz regarding the quiz-taker’s preferences, creates `Museum` objects that represents the selected museums, and then stores it in the `MuseumList`. The fields in a `Museum` object are:

<i>museumName</i>	The name of the museum
<i>museumWebsite</i>	The museum’s website – this prevents the need to provide a large amount of information for each museum inside the file or program.
<i>keywordArray</i>	A set of keywords associated with this museum (for example: “art, history”)
<i>museumImage</i>	The image to display for the museum

Figure 4.6 – Museum Object Fields

The MuseumList operates in the same manner as the KeywordList, and is simply a data structure that stores a set of museums and does little else. It contains the same function that will add a Museum to the list after checking to make sure that it is not already present.

The Interface module is the most complex of all the application's parts, and handles the graphical display and the interaction with the quiz-taker. This module does not create or maintain any object; instead, it uses the functions provided by the other modules to orchestrate the communication, processing, and display of this data. Essentially, this module creates the webpage, sets the display to show the first question of the quiz, and then changes the display to the next question each time the visitor selects an answer until it arrives at the end of the Museum Selector – at which point it displays the list of museums.

4.7.3 External Files: Questions, Answers, and Museums

For our quiz, we came up with a total of 20 questions, from which select questions were presented to the user depending on their previous answers. Storing all of these questions inside of the interactive program would be highly inefficient, and would only serve to complicate the process of updating or modifying the quiz. These issues would only increase in scope when the sheer number of possible answers was taken into account.

As a solution, we decided to incorporate the use of three external files into the application, each of which would contain a type of data needed for the interactive program to perform its work. Each of these files is written in Extensible Markup Language (XML) – which, in this case, is used to provide labels for the data (forming a sort of simplistic database). Each piece of information is contained within a start and end tag that specifies the name of the field. For

example, if we wanted to create an XML representation of the physical characteristics of a human being, we could use a template like the one shown in Figure 4.7:

```
<human>
  <name>Frank</name>
  <height>180cm</height>
  <weight>72.5kg</weight>
  <hairColor>Brown</hairColor>
  <eyeColor>Brown</eyeColor>
  <skinColor>Light Brown</skinColor>
</human>
```

Figure 4.7 – XML Specification Example (Human)

This example demonstrates the how all of the individual pieces of information, such as the name, weight, and height each have their own field. And all of that information is encompassed by the “human” field, which designates that this is all the information about a single human. The three external files we have designated for this project contain the relevant information about Questions, Answers, and Museums respectively.

Each of the three files, named as “questions.xml”, “answers.xml”, and “museums.xml”, contain all of the information needed to construct their respective objects in the application using all of the data fields. An example of each an entry from each file can be seen below in Figure 4.8:

Question

```
<question>
  <questionID>#Q0002</questionID>
  <questionText>How much are you willing to spend?</questionText>
  <image>noimage</image>
  <answerIDs>#A0021,#A0022,#A0023,#A0024</answerIDs>
</question>
```

Answer

```
<answer>
  <answerID>#A0021</answerID>
  <answerText>1-50kr</answerText>
  <categoryRanking>
    <art>0</art>
    <science>0</science>
    <garden>0</garden>
    <zoo>0</zoo>
    <history>0</history>
  <keywords>1-50kr</keywords>
  <image>noimage</image>
  <nextQuestion>#Q0003</nextQuestion>
</answer>
```

Museum

```
<museum>
  <museumName>Danish National Gallery</museumName>
  <website>http://www.smk.dk</website>
  <image>smk.jpeg</image>
  <keywords>art,history,culture,military,free</keywords>
</museum>
```

Figure 4.8 – XML Specification (Question, Answer, Museum)

4.7.4 Program Maintenance Tools

To assist MIK in updating and maintaining the Museum Selector, we developed a user's manual they can reference. This user manual outlines how to update the code, add museums into the various categories we created, change any categories we made, and update any other information they may want to. It carefully explains how to insert the new pieces of code into program to prevent any unwanted malfunctions. The full user manual can be found in Appendix F.

4.8 User Interaction

MIK wanted our program to have a level of user interaction that allowed website visitors to make choices. The Museum Selector allows users to customize their museum preferences by working through a series of choices, such as cost, location, genre, and so on. By the end, the user is assigned a set of recommended museums based on personal preferences.

Users are directed onto different paths based on their answers to the questions in the MUSEUM SELECTOR, providing the opportunity for a varied experience each time they visit. The flow chart below provides a graphical representation of the various routes that the application can take (based on user input).

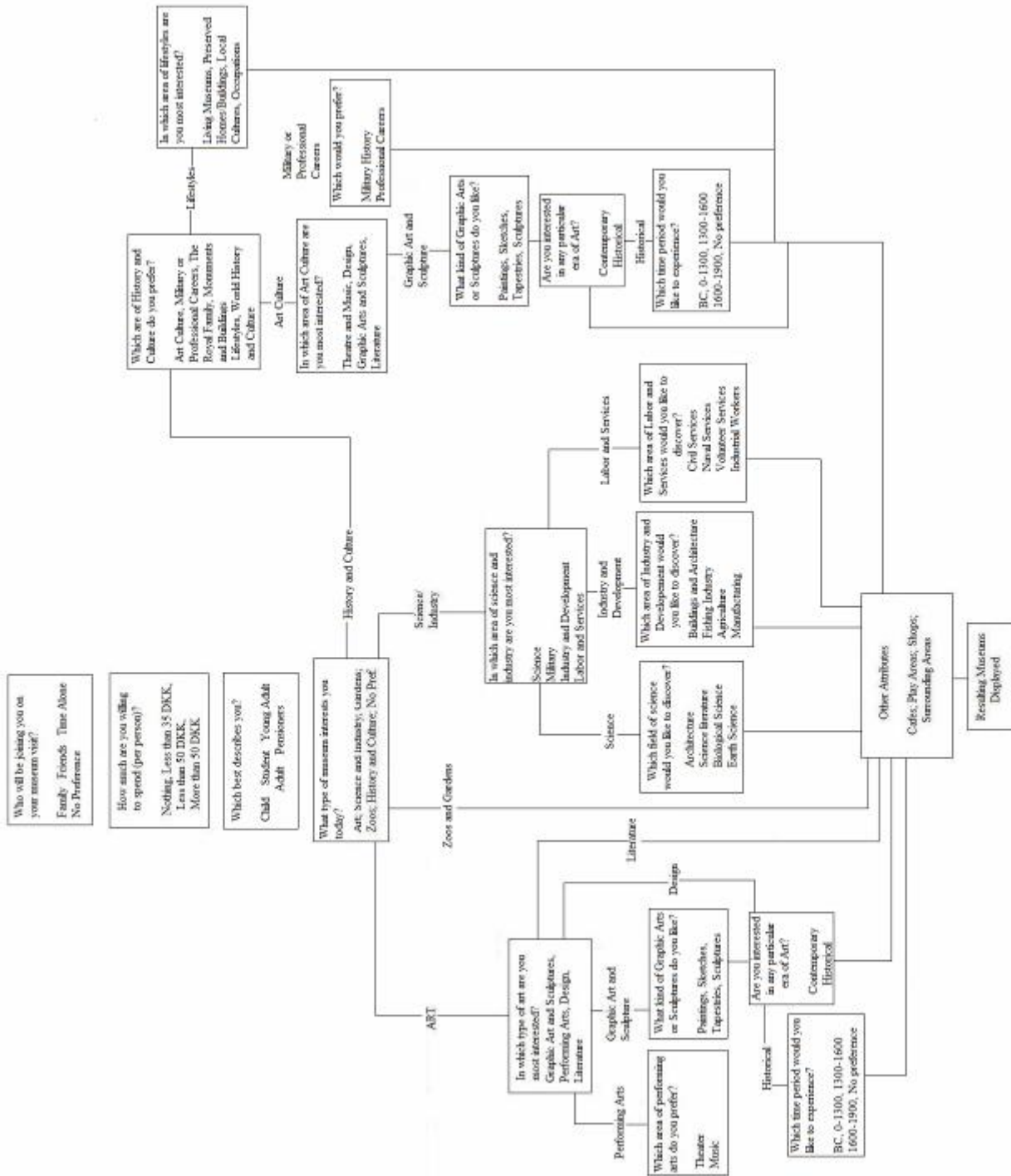


Figure 4.9 – Museum Selector: General Flow Chart

The first three questions in the application are mandatory, having no diverging paths until the fourth question. The answers to these first three questions are recorded and stored as the user moves through the remainder of the quiz. The fourth question leads to one of the five main branches of the application.

Among the choices in the fourth question are “Art”, “Science & Industry”, “Gardens & Zoos”, and “History & Culture”. There is also a “Surprise Me!” option, which sends the user to a random museum generator.

When “Art” is selected, the user is sent down a path to further explore their preferences for the application, as shown in Figure 4.10 below. The question that appears next offers several types of art for selection. An option to further specify the art category they are interested in, followed by a question regarding a preferred time period. From this point the user is directed to the final question in the quiz, relating to the offerings of the museum such as cafes, shops, and the surrounding areas. The results from this branch of the quiz are combined with the recorded answers to the first three questions and the results are then displayed to the user.

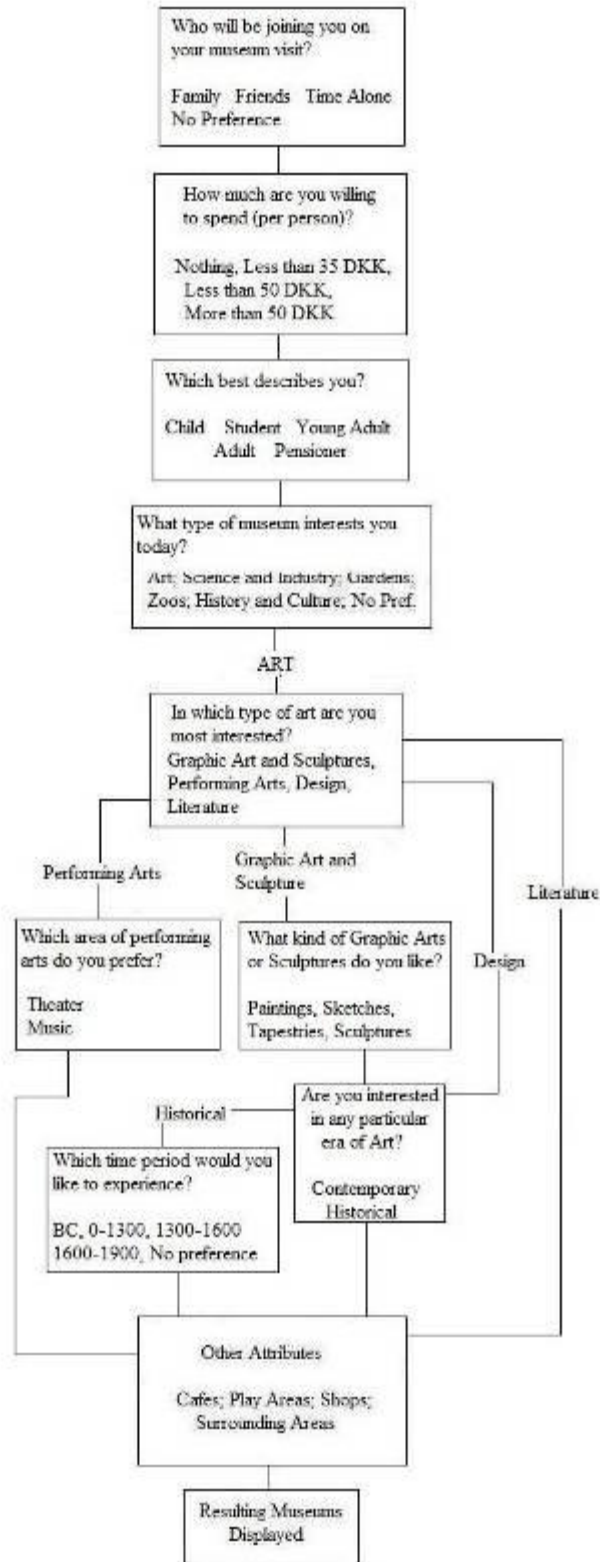


Figure 4.10 – Museum Selector: “Art” Section Flow Chart

As with the selection of Art in the fourth question, selecting Science & Industry or History & Culture sends the user to additional questions to further break down the possible museums. From these questions the user is sent to the final question and then to the results.

4.8.1 Providing Exposure for Smaller Museums

Many of the MIK member museums are underexposed and get overshadowed by the larger museums such as the Danish National Museum, and our sponsor specifically requested that our interactive program address this problem. So as not to alienate the larger museums, we implemented a random museum generator into our Museum Selector. By selecting the “Surprise Me!” option, the user would be provided with a random museum, and we can expose users to museums that they may not have thought about visiting before. Sometimes this works well, sometimes it does not, but the smaller museums gain a degree of exposure they may not have received otherwise. Because the process is random, every museum has an equal chance of appearing, but there are far more small museums within in MIK than there are large museums. Therefore, the odds are great that a small museum will appear as the random solution.

4.8.2 Providing Opportunities for More Information

Being a young organization, MIK is seeking to expand its voice and influence as much as possible. To help the organization in this regard we added an optional question at the end our questionnaire that offered users information about signing up for the MIK newsletter. This allows MIK to expand its audience and promote the member museums to a greater number of people. The user is given the opportunity to obtain further information about museums and upcoming events and exhibits.

4.9 Testing

To gain feedback about the MUSEUM SELECTOR, we distributed a survey along with a prototype version of the Museum Selector to our test groups. This survey was used to gauge the effectiveness of the program and measure visitor opinions about the program, leaving us with suggestions for improvement.

Our survey results established that our Museum Selector performed well, and provided users with helpful museum suggestions unique to each person. Everyone that responded to our survey said that our questionnaire was easy or very easy to use and understand. When asked if they would use the Museum Selector again, all but three users said they would. However, our questionnaire scored low in appearance ratings, and lacked some functionality that many users considered necessary. Users complained about the absence of a “back button”, which would allow them to access or change answers to previous questions, or a “restart” button that allowed them to start the questionnaire over again. The prototype version used in the survey test was complete in terms of functionality but not aesthetics, and many users commented on the unappealing visuals. It had been designed with a generic background and style, and several people noted that it lacked eye-catching pictures. With the exception of some slight grammatical errors, our Museum Selector performed its expected functions and was easily understood. Though only a small number of people stated that they would not use it again, their concerns would still be addressed.

Based on all the information gathered through research and field work, and feedback from our survey, we were able to formulate conclusions and offer MIK recommendations for the future.

5 Conclusions and Recommendations

After designing and testing our Museum Selector, we concluded that it is functional and, based on responses, that it provides the potential museum visitor with a set of museums to consider. The program takes into account museum content, cost, group and children's activities, and attractions in the surrounding area. The program provides museum recommendations to the user, with links to each of their pages on the MIK website. For example, if the user selects the "Art" path, museums such as the Danish Museum of Art and Design will appear as a result; the user is also provided with some of the smaller, more obscure museums, as options, which they may not have realized were available previously.

5.1 Technical Issues of the Program

Currently, our program is to be launched on both the English and Danish versions on the MIK website under the potential link heading of "Find Out Which Museum is Right for You". Although we created a translated version the Museum Selector in Danish, we experienced issues with the code because it would not display any Danish characters, and it resulted in the program crashing. However, we did find a solution to this problem; by using image-based answers and questions instead of text we were able to display the Danish characters without any problems.

Our testing showed that the program displays as intended in Internet Explorer, but, as stated in Section 4.4.3 of the Results, the display may be distorted slightly in other browsers such as Mozilla Firefox. Due to time constraints and general programming difficulties, we were unable to code the program to accommodate every browser currently in use. However, this issue

can be fixed, if necessary, as MIK updates the rest of its website to function properly in multiple browsers.

5.1.1 Maintenance

As stated in Section 4.7 of Results, maintenance of the technical portions of the MIK website is outsourced to a website management service; however, MIK itself maintains and updates most of the information on the site. Our program was created in a manner that requires no routine maintenance to function, and certain modifications can be made by MIK's current employees.

5.1.2 The User Manual

To allow MIK to maintain the program without outside assistance we have written a guide that should help them understand the design, and allow them to update and maintain the information in the questionnaire. The code itself was written with explanations included so that anyone with a background in program or website creation can understand it with minimal effort. Once the program has been established on the website, it will remain there and function properly. The only "maintenance" that the application will require is not technical, but refers to updating the content of the museums contained within the application. If unedited, the program code will continue to function, but will not account for any changes within the MIK collaborative.

5.1.3 Updating the Content

Because MIK is young and still expanding, more museums around Copenhagen may be joining the collaborative in the future. Also, some museums develop new exhibits regularly, and

their content is constantly changing. We allowed for this addition of new content by creating a simple method by which new information can be added to the application.

5.1.4 Aesthetic Recommendations

The prototype Museum Selector was rudimentary and performed the needed functions, but left room for aesthetic improvement. The screenshot below shows the original Museum Selector, which was designed to appear inside of an artistic picture frame.



Figure 5.1 – Prototype MUSEUM SELECTOR Graphic Design

Our survey results suggested that this background was ugly and unappealing. To rectify this situation our program was redesigned and now mimics the appearance of the current MIK website. In response to survey suggestions, we also added picture cues to each answer button which the user can visually relate. The updated version of the Museum Selector can be seen below, in Figure 5.2:

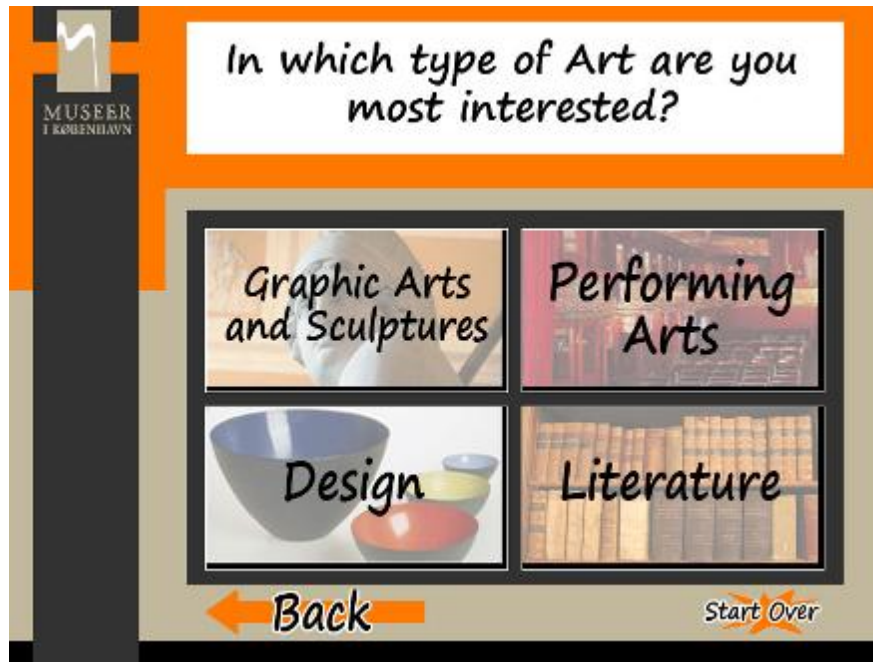


Figure 5.2 – Final MUSEUM SELECTOR Graphic Design

We recommend to MIK that they continue to update the graphics of the Museum Selector, improving on the foundation we have provided. The modular design of the program, outlined in Section 4.7.2, also extends to the visuals, and modifying the display elements would be a simple task.

5.2 Survey Recommendations

Through our survey, we gained useful quantitative and qualitative information which helped improve the program. To provide ongoing feedback for the program, a similar survey could be implemented in tandem with the Museum Selector on MIK's website. This would help establish if the questionnaire is still offering helpful suggestions to users, and if any modifications need to be made. The survey will also be able to help MIK determine if the Museum Selector is improving the visibility of the smaller museums in Copenhagen.

5.3 Further Interactive Opportunities

In addition to the development of our Museum Selector, we considered several other possibilities to help increase the interactivity of the MIK website. These web applications could be created in the future, and designed specifically to help promote smaller museums.

We recommend that MIK create a stand-alone random museum generator that website visitors can access easily. The creation of this application would be very simple, involving only a random number generator and a numbered list of all the museums in MIK. When a website visitor accesses this application a random number is generated. However, in place of the number, a corresponding museum would be displayed for the site visitor. Each museum would have equal chance of being drawn by the application, and therefore the program would be able to expose the smaller museums to the visitors of the website. This feature is already in our questionnaire as the “Surprise Me!” option within one of our questions, but a link to this random museum generator could be created outside of our program to allow site visitors easy access.

Another possible option for user interaction is a museum “Tour Creator”. This application can function using the same principle as our Museum Selector. By categorizing the museums and allowing the website visitor to input several descriptors from a provided list, the program could then produce a customized tour with museums that meet the interests of the visitor. The website visitor may also be able to indicate the number of museums they would like to be included in this tour. This interactive program is more complicated than the stand-alone museum generator, and may require much more work to divide the museums into appropriate categories (similar to the method described in Section 4.6 of the Results).

5.4 Summary of Conclusions and Recommendations

- Update the museum information within the Museum Selector as needed
- Outsource any form of advanced maintenance for the Museum Selector (if necessary)
- Use the survey as an ongoing source of information for improvements that can be made to the Museum Selector
- Look into the creation of more interactivity in the form of the recommended applications we provided
- Evaluate the effectiveness of the Museum Selector as a tool to attract visitors to MIK's website, select suitable museums for visitors, and improve the visibility of all museums in Copenhagen

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7 Appendices

7.1 Appendix A: Museum Categories

Art

Performing Arts

Danish Music Museum
Danish Revue Museum
Kunstforeningen GL STRAND
Theatre Museum in the Court Theatre

Design

Charlottenborg Exhibition Hall
Danish Museum of Art and Design
Kunstforeningen GL STRAND
National Museum of Denmark
North Atlantic House
Royal Library
Theatre Museum in the Court Theatre
Victorian Home

Graphic Arts and Sculptures

Danish Museum of Art and Design
Danish National Gallery
David Collection
Frederiksborg Castle
Heerup Museum
Hillerod Town Museum & Printing Museum
Hirschsprung Collection
Koge Art Museum of Sketches
Kunstforeningen GL STRAND
National Museum of Denmark
Nivaagaard Picture Gallery
North Atlantic House
Odrupgaard
Royal Cast Collection
Royal Library
Storm P. Museum
Thorvaldsen's Museum

Literature

Bakkehus
National Museum of Denmark
Royal Library

Graphic Arts and Sculptures

Paintings

Danish Museum of Art and Design
Danish National Gallery
David Collection
Frederiksborg Castle
Heerup Museum
Hillerod Town Museum & Printing Museum
Hirschsprung Collection
Kunstforeningen GL STRAND
National Museum of Denmark
Nivaagaard Picture Gallery
North Atlantic House
Odrupgaard
Storm P. Museum
Thorvaldsen's Museum

Sketches

Heerup Museum
Hirschsprung Collection
Koge Art Museum of Sketches
Kunstforeningen GL STRAND
Nivaagaard Picture Gallery
Storm P. Museum
Thorvaldsen's Museum

Tapestries

Frederiksborg Castle
National Museum of Denmark
Thorvaldsen's Museum
Danish National Gallery

Sculptures

Danish Museum of Art and Design
Danish National Gallery
Heerup Museum
Kunstforeningen GL STRAND
National Museum of Denmark
Nivaagaard Picture Gallery
North Atlantic House

Royal Cast Collection
Thorvaldsen's Museum

Performing Arts

Theater

Danish Revue Museum
Theatre Museum in the Court Theatre

Music

Danish Music Museum
Kunstforeningen GL STRAND

Art Eras

Contemporary

Charlottenborg Exhibition Hall
Cisterne
Danish Museum of Art and Design
Kunstforeningen GL STRAND
National Museum of Denmark
North Atlantic House
Post & Tele Museum
Storm P. Museum

Historical

Bakkehus Museum
Danish National Gallery
David Collection
Frederiksborg Castle
Hillerod Town Museum
Hirschsprung Collection
Koge Art Museum of Sketches
National Museum of Denmark
Nivaagaard Picture Gallery
Odrupgaard
Royal Library
Thorvaldsen's Museum

Historical Time Periods

1600-1900

Danish National Gallery
Frederiksborg Castle
Heerup Museum
Hirschsprung Collection
Koge Art Museum of Sketches
Kunstforeningen GL STRAND
National Museum of Denmark
Nivaagaard Picture Gallery
Odrupgaard
Royal Library

1300-1600

Frederiksborg Castle
Hillerod Town Museum
Danish National Gallery
Koge Art Museum of Sketches
National Museum of Denmark
Nivaagaard Picture Gallery
Royal Library
Thorvaldsen's Museum

0-1300

Danish National Gallery
Koge Art Museum of Sketches
National Museum of Denmark
Nivaagaard Picture Gallery

BC

Danish National Gallery
National Museum of Denmark

Science and Industry

Military

Armoury Museum
Museum of Danish Resistance
Royal Danish Naval Museum
Spejdermuseet

Industry and Development

Danish Arcitechtural Museum
Deisel House
Dragor Museum
Frederiksvaerk Museum of Industry
Hillerod Town Museum & Printing Museum
Industrial Works of Brede
Medical Museion
Round Tower
Royal Library
Theatre Museum in the Court Theatre
Town Museum in Helsingor
Victorian Home
Workers' Museum

Labor Services

Bank and Saving Museum
Danish Museum of Hunting and Forestry
Hillerod Town Museum & Printing Museum
Industrial Works of Brede
Museum of Customs and Taxes
National Museum of Denmark
Police Historical Museum
Post & Tele Museum
Royal Danish Naval Museum
Skibshallerne
Spejdermuseet
Town Museum in Helsingor
Workers' Museum

Science

Botanical Museum and Library
Danish Architecture Center
Geological Museum
Kroppedal Museum
Medical Museion
Royal Library
Zoological Museum
Øresund Aquarium

Science

Architecture

Danish Architecture Center
Royal Library

Scientific literature

Danish Architecture Center
Botanical Museum and Library
Kroppedal Museum
Royal Library
Zoological Museum

Biological Science

Medical Museion
Zoological Museum
Øresund Aquarium

Earth Science

Botanical Museum and Library
Geological Museum
Kroppedal Museum
Zoological Museum
Øresund Aquarium

Labor Services

Civil Services

Bank and Saving Museum
Danish Museum of Hunting and Forestry
Hillerod Town Museum & Printing Museum
Industrial Works of Brede
Museum of Customs and Taxes
Police Historical Museum
Post & Tele Museum

Naval Services

Royal Danish Naval Museum
Skibshallerne

Volunteer Services

Danish Museum of Hunting and Forestry
Post & Tele Museum
Workers' Museum

Industrial Workers

Hillerod Town Museum & Printing Museum
Industrial Works of Brede
Post & Tele Museum
Workers' Museum

Industry and Development

Buildings and Architecture

Danish Arcitechtural Museum
Round Tower
Royal Library
Theatre Museum in the Court Theatre
Town Museum in Helsingor
Victorian Home

Fishing Industry

Dragor Museum
Town Museum in Helsingor

Agriculture

Industrial Works of Brede
Town Museum in Helsingor

Manufacturing

Deisel House
Frederiksvaerk Museum of Industry
Hillerod Town Museum & Printing Museum
Industrial Works of Brede
Medical Museion
Workers' Museum

History

Art Culture

Amagemuseet
Bakkehus Museum
Ballerup Engmuseet
Charlottenborg Exhibition Hall
Cisternerne
Danish Museum of Art and Design
Danish National Gallery
Danish Revue Museum
David Collection
Frederiksborg Castle
Kunstforeningen GL STRAND
National Museum of Denmark
North Atlantic House
Odrupgaard
Royal Library
Storm P. Museum
Theatre Museum in the Court Theatre
Victorian Home

Military/Professions

Armoury Museum
Bank and Savings Museum
Danish Museum of Hunting and Forestry
Danish School Museum
Diesel House
Museum of Danish Resistance
Royal Danish Naval Museum
Spejdmuseet

Royal Family

Frederiksborg Castle
Koge Art Museum of Sketches
Museum of Copenhagen
National Museum of Denmark
Round Tower

Monuments/Preserved Buildings

Bakkehus Museum
Ballerup Engmuseum
Esrum Abbey
Frederiksborg Castle
Fureso Museum
Round Tower

Lifestyles

Amagermuseet
Ballerup Museum
Danish Jewish Museum
Fureso Museum
Gilleleje Museum
Greve Museum
Hillerod Town Museum & Printing Museum
Hirschsprung Collection
Industrial Works of Brede
Museum of Copenhagen
North Atlantic House
Open-Air Museum
Police Historical Museum
Royal Danish Naval Museum
Royal Library
Skibshallerne
Spejdmuseet
Theatre Museum in the Court Theatre
Town Museum in Helsingor
Victorian Home
Workers' Museum
Zoological Museum

World History/Culture

Museum of Danish Resistance
National Museum of Denmark
Odrupgaard
Royal Cast Collection
Royal Danish Naval Museum
Royal Library
Skibshallerne

Lifestyles

Living Museums

Amagermuseet
Fureso Museum
Gilleleje Museum
Open-Air Museum

Preserved Homes/Buildings

Ballerup Museum
Gilleleje Museum
Greve Museum
Hirschsprung Collection
Industrial Works of Brede
Museum of Copenhagen
North Atlantic House
Royal Library
Victorian Home

Local Cultures

Danish Jewish Museum
Gilleleje Museum
Museum of Copenhagen
Royal Library
Skibshallerne
Spejdmuseet
Theatre Museum in the Court Theatre
Town Museum in Helsingor

Occupations

Fureso Museum
Hillerod Town Museum & Printing Museum
Hirschsprung Collection
Industrial Works of Brede
Police Historical Museum
Royal Danish Naval Museum
Spejdmuseet
Workers' Museum
Zoological Museum

Art Culture

Theater and Music

Danish Revue Museum
Theatre Museum in the Court Theatre
Kunstforeningen GL STRAND

Design

Charlottenborg Exhibition Hall
Danish Museum of Art and Design
Kunstforeningen GL STRAND
National Museum of Denmark
North Atlantic House
Royal Library
Theatre Museum in the Court Theatre
Victorian Home

Graphic Art

Danish Museum of Art and Design
David Collection
Frederiksborg Castle
Kunstforeningen GL STRAND
National Museum of Denmark
North Atlantic House
North Atlantic House
Royal Library
Storm P. Museum
Danish National Gallery

Literature

Bakkehus
National Museum of Denmark
Royal Library

Graphic Art

Paintings

Danish Museum of Art and Design
Danish National Gallery
David Collection
Frederiksborg Castle
Kunstforeningen GL STRAND
National Museum of Denmark
North Atlantic House
Storm P. Museum
Thorvaldsen's Museum

Sketches

Kunstforeningen GL STRAND
Storm P. Museum
Thorvaldsen's Museum

Tapestries

Frederiksborg Castle
National Museum of Denmark
Thorvaldsen's Museum

Sculptures

Danish Museum of Art and Design
Danish National Gallery
Kunstforeningen GL STRAND
National Museum of Denmark
Nivaagaard Picture Gallery
North Atlantic House
Thorvaldsen's Museum

Zoos and Gardens

Small Gardens

Bakkehus Museum
Ballerup Egnmuseum
Danish National Gallery
Esrup Abbey
Æbelholt Abbey Museum

Large Gardens

Botanical Garden
Frederiksborg Museum
Ballerup Museum
Greve Museum

Zoos

Zoo Copenhagen

Aquariums

Oresund Aquarium

7.2 Appendix B: Museum Group Categories

Group Categories

Family Friendly
Amagermuseet
Botanical Gardens
Circus Museum
Danish Museum of Hunting and Forestry
Danish Music Museum
Danish School Museum
Dragør Museum
Esrum Abbey
Folk Museum
Frederiksborg Castle
Furesø Museum
Gilleleje Museum
Greve Museum
Hillerød Town Museum & Printing Museum
Kroppedal Museum
Little Mill
Museum of Copenhagen
National Museum of Denmark
Open-Air Museum
Post & Tele Museum
Round Tower
Royal Danish Naval Museum
Skibshallerne
Spejdermuseet
Theatre Museum in the Court Theatre
Workers' Museum
Zoo Copenhagen
Zoological Museum
Oresund Aquarium

Time with Friends

Amagermuseet
Armoury Museum
Ballerup Egnmuseum
Botanical Gardens
Charlottenborg Exhibition Hall
Circus Museum
Danish Architecture Museum
Danish Jewish Museum
Danish Museum of Hunting and Forestry
Danish National Gallery
Danish Revue Museum
Dragør Museum
Esrum Abbey
Folk Museum
Frederiksborg Castle
Furesø Museum
Gilleleje Museum
Greve Museum
Heerup Museum
Hillerød Town Museum & Printing Museum
Holbo Herreds Kulturhistoriske Centre
Køge Art Museum of Sketches
Kroppedal Museum
Kunstforeningen GL STRAND
Little Mill
Medical Museion
Museum of Copenhagen
Museum of Danish Resistance
National Museum of Denmark
Nivaagaard Picture Gallery
North Atlantic House
Open-Air Museum
Odrupgaard
Police Historical Museum
Post & Tele Museum
Round Tower
Royal Danish Naval Museum
Skibshallerne
Skibsklarerergaarden
Spejdermuseet
Storm P. Museum
Theatre Museum in the Court Theatre
Thorvaldsen's Museum
Town Museum in Helsingør
Victorian Home

Workers' Museum
Zoo Copenhagen
Zoological Museum
Oresund Aquarium
Aebelholt Abbey Museum

Time Alone

Armoury Museum
Bakkehus Museum
Ballerup Egnmuseum
Bank and Savings Museum
Botanical Gardens
Botanical Museum and Library
Charlottenborg Exhibition Hall
Cisternerne
Danish Architecture Museum
Danish Jewish Museum
Danish Museum of Art and Design
Danish Music Museum
Danish National Gallery
Danish Revue Museum
Danish School Museum
David Collection
Deisel House
Esrum Abbey
Finn Juhl's House
Folk Museum
Frederiksborg Castle
Frederiksværk Museum of Industry
Furesø Museum
Geological Museum
Heerup Museum

Hirschsprung Collection
Holbo Herreds Kulturhistoriske Centre
Industrial Works of Brede
Køge Art Museum of Sketches
Kroppedal Museum
Kunstforeningen GL STRAND
Little Mill
Museum of Customs and Taxes
Museum of Danish Resistance
National Museum of Denmark
Nivaagaard Picture Gallery
North Atlantic House
Odrupgaard
Police Historical Museum
Post & Tele Museum
Round Tower
Royal Cast Collection
Royal Danish Naval Museum
Royal Library
Skibsklarerergaarden
Spejdmuseet
Storm P. Museum
Theatre Museum in the Court Theatre
Thorvaldsen's Museum
Victorian Home
Workers' Museum
Zoological Museum
Oresund Aquarium
Aebelholt Abbey Museum

7.3 Appendix C: Museum Cost Categories

Free Museums

Museum	Adult Cost	Child Cost
Kroppedal Museum	0	0
Museum of Customs and Taxes	0	0
Museum of Danish Resistance	0	0
National Museum of Denmark	0	0
Open-Air Museum	0	0
Royal Cast Collection	0	0
Spejdermuseet	0	0
Bank and Savings Museum	0	0
Botanical Gardens	0	0
Botanical Museum and Library	0	0
Danish Music Museum	0	0
Danish National Gallery	0	0
David Collection	0	0
Deisel House	0	0
Furesø Museum	0	0
Greve Museum	0	0

36 DKK - 50 DKK

Museum	Adult Cost	Child Cost
Nivaagaard Picture Gallery	40	0
North Atlantic House	40	20
Post & Tele Museum	40	0
Royal Danish Naval Museum	40	0
Armoury Museum	40	0
Cisternerne	40	0
Danish Architecture Museum	40	0
Danish Jewish Museum	40	0
Danish Museum of Hunting and Forestry	40	0
Esrum Abbey	40	20
Kunstforeningen GL STRAND	45	0
Hirschsprung Collection	50	0
Industrial Works of Brede	50	0
Little Mill	50	0
Medical Museion	50	30
Victorian Home	50	0
Workers' Museum	50	0
Oresund Aquarium	50	30
Danish Museum of Art and Design	50	0

1 DKK - 35 DKK

Museum	Adult Cost	Child Cost
Hillerod Town Museum & Printing Museum	15	0
Aebelholt Abbey Museum	15	0
Folk Museum	15	0
Museum of Copenhagen	20	0
Thorvaldsen's Museum	20	0
Town Museum in Helsingor	20	0
Bakkehus Museum	20	1
Dragør Museum	20	0
Police Historical Museum	25	0
Round Tower	25	15
Skibshallerne	25	0
Circus Museum	25	15
Geological Museum	25	15
Gilleleje Museum	25	0
Koge Art Museum of Sketches	30	0
Storm P. Museum	30	0
Theatre Museum in the Court Theatre	30	0
Amagemuseet	30	0
Ballerup Egnmuseum	30	0
Danish School Museum	30	0
Frederiksværk Museum of Industry	30	0
Heerup Museum	35	0
Royal Library	35	0
Danish Revue Museum	35	25

51 DKK +

Museum	Adult Cost	Child Cost
Zoological Museum	60	25
Frederiksborg Castle	60	15
Odrupgaard	70	0
Finn Juhl's House	70	0
Zoo Copenhagen	130	60

7.4 Appendix D: Museum Selector Code

QuizFunctions.js

```
var answerArray;
var categoryRanks = new Array();
    categoryRanks[0] = 0;
    categoryRanks[1] = 0;
    categoryRanks[2] = 0;
    categoryRanks[3] = 0;
    categoryRanks[4] = 0;

var keywordArray = new KeywordList();
var museumArray = new MuseumList();
// *****
// ***** Utilities *****
// *****
// Opens a popup window from a link
function popUp(URL) {
    day = new Date(); id = day.getTime();
    eval("page" + id + " = window.open(URL, '" + id + "',
'toolbar=1,scrollbars=1,location=1,statusbar=1,menubar=1,resizable=1
,width=600,height=400,left = 340,top = 200');"");
}

// *****
// ***** Question *****
// *****

// Question (Object)
// Question - Object Constructor
// - Creates a "Question" object using the text assigned to
// the question, the set of answers for that question, and
// an image to display (if needed).
function Question(newQuestionID, newQuestionText, newAnswerArray,
newQuestionImage) {
    this.questionID = newQuestionID;
    this.questionText = newQuestionText;
    this.answerArray = newAnswerArray;
    this.questionImage = newQuestionImage;
}

// Question - findQuestion()
// - Searches XML file for a specific questionID number,
// and creates a Question object using the information.
function findQuestion(requestedID) {

    /* Checks the user's browser, and then opens the XML file
*/
    try { //Internet Explorer
        xmlDoc=new ActiveXObject("Microsoft.XMLDOM");
    }
    catch(e) {
        try { //Firefox, Mozilla, Opera, etc.

xmlDoc=document.implementation.createDocument("", "", null);
```

```

        }
        catch(e) {
            alert(e.message);
            return;
        }
    }
    xmlDoc.async=false;
    xmlDoc.load("questions.xml");

    /* Search the XML file for the requested QuestionID */
    x=xmlDoc.getElementsByTagName("questionID");
    for (i = 0; i < x.length; i++) {
        if(x[i].childNodes[0].nodeValue == requestedID) {
            // Parse questionText
            var newQuestionText =
xmlDoc.getElementsByTagName("questionText")[i].childNodes[0].nodeValue;

            // Parse image location
            var newQuestionImageLocation =
xmlDoc.getElementsByTagName("image")[i].childNodes[0].nodeValue;

            // Parse answerArray IDs
            var answerIDstring =
xmlDoc.getElementsByTagName("answerIDs")[i].childNodes[0].nodeValue;
            var newAnswerArray = answerIDstring.split(",");

            // Create the new Question
            var newQuestion = new Question(requestedID,
newQuestionText, newAnswerArray, newQuestionImageLocation);

            // Return the new Question.
            return newQuestion;
        }
    }
}

// Answer (Object)
// Answer - Object Constructor
// - Creates a "Answer" object using the text assigned to
// the answer, the ranking for the set of interest categories,
// an array of keywords associated with it, and an image to
// display (if needed).
function Answer(answerID, answerText, categoryRankingArray,
keywordArray,
            answerImage, nextQuestion) {
    this.answerID = answerID;
    this.answerText = answerText;
    this.categoryRankingArray = categoryRankingArray;
    this.keywordArray = keywordArray;
    this.answerImage = answerImage;
    this.nextQuestion = nextQuestion;

    this.evaluateAnswer = function() {
        /* Next question? */
    }
}

```



```

// Answer - findAnswer()
// - Searches XML file for a specific answerID number,
// and creates an Answer object using the information.
function findAnswer(requestedID) {

    /* Checks the user's browser, and then opens the XML file
*/
    try { //Internet Explorer
        xmlDoc=new ActiveXObject("Microsoft.XMLDOM");
    }
    catch(e) {
        try { //Firefox, Mozilla, Opera, etc.

xmlDoc=document.implementation.createDocument("", "", null);
        }
        catch(e) {
            alert(e.message);
            return;
        }
    }
    xmlDoc.async=false;
    xmlDoc.load("answers.xml");

    /* Search the XML file for the requested AnswerID */
    x=xmlDoc.getElementsByTagName("answerID");
    for (i = 0; i < x.length; i++) {
        if(x[i].childNodes[0].nodeValue == requestedID) {
            // Parse answerText
            var newAnswerText =
xmlDoc.getElementsByTagName("answerText")[i].childNodes[0].nodeValue;

            // Parse Category Rankings
            var categoryRankArray = new Array();
            categoryRankArray[0] =
xmlDoc.getElementsByTagName("art")[i].childNodes[0].nodeValue;
            categoryRankArray[1] =
xmlDoc.getElementsByTagName("science")[i].childNodes[0].nodeValue;
            categoryRankArray[2] =
xmlDoc.getElementsByTagName("garden")[i].childNodes[0].nodeValue;
            categoryRankArray[3] =
xmlDoc.getElementsByTagName("zoo")[i].childNodes[0].nodeValue;
            categoryRankArray[4] =
xmlDoc.getElementsByTagName("history")[i].childNodes[0].nodeValue;

            // Parse keywords
            var answerKeywordString =
xmlDoc.getElementsByTagName("keywords")[i].childNodes[0].nodeValue;
            var newKeywordArray =
answerKeywordString.split(",");

            // Parse image location
            var newAnswerImageLocation =
xmlDoc.getElementsByTagName("image")[i].childNodes[0].nodeValue;

            // Parse next question ID#

```

```

        var newNextQuestion =
xmlDoc.getElementsByTagName("nextQuestion")[i].childNodes[0].nodeValue;

        // Create the new Answer
        var newAnswer = new Answer(requestedID,
newAnswerText, categoryRankArray, newKeywordArray,
newAnswerImageLocation, newNextQuestion)

        // Return the new Answer.
        return newAnswer;
    }
}

// *****
// ***** Evaluation *****
// *****

// CategoryList (Object)
// - Handle as a bunch of separate ints in main code
// - Doesn't seem to fit with this quiz, reconsider

// KeywordList (Object)
function KeywordList() {
    this.keywordList = new Array();

    // KeywordList - addKeyword()
    // - Adds a keyword to the keywordList array for a
specific
    // "KeywordList" object.
    this.addKeyword = function(newKeyword) {
        var keywordFound = 0;
        var loopDone = 0;
        var i = 0;
        while(loopDone == 0) {
            if(this.keywordList[i] == newKeyword) {
                keywordFound = 1;
                loopDone = 1;
            }
            i++;
            if(i >= this.keywordList.length) loopDone = 1;
        }
        if(keywordFound != 1)
this.keywordList[this.keywordList.length] = newKeyword;
    }
}

// *****
// ***** Museum *****
// *****

// Custom Sorting Algorithm for Museum objects,
// (Sorts by keywordMatches, highest to lowest
function byMatches(a1,a2){
    if(a1.keywordMatches < a2.keywordMatches) return 1;

```

```

        if(a1.keywordMatches > a2.keywordMatches) return -1;
        if(a1.keywordMatches == a2.keywordMatches) return 0;
    }

// MuseumList (Object)
function MuseumList() {
    this.museumList = new Array();

    // MuseumList - addMuseum()
    // - Adds a Museum to the museumList array for a specific
    // "MuseumList" object.
    this.addMuseum = function(newMuseum) {
        if(this.museumList.length >= 7) {
            this.museumList[6] = newMuseum;
        }
        else {
            this.museumList[this.museumList.length] =
newMuseum;
        }
    }

    // MuseumList - sort()
    // - Sorts the MuseumList by the the number of keyword
    // matches each Museum entry has.
    this.sort = function() {
        this.museumList.sort(byMatches);
    }
}

// Museum (Object)
function Museum(museumName, museumWebsite, keywordMatches,
museumImage) {
    this.museumName = museumName;
    this.museumWebsite = museumWebsite;
    this.keywordMatches = keywordMatches;
    this.museumImage = museumImage;
}

// MuseumSelector()
function museumSelector() {
    /* Checks the user's browser, and then opens the XML file
*/
    try { //Internet Explorer
        xmlDoc=new ActiveXObject("Microsoft.XMLDOM");
    }
    catch(e) {
        try { //Firefox, Mozilla, Opera, etc.

xmlDoc=document.implementation.createDocument("", "", null);
        }
        catch(e) {
            alert(e.message);
            return;
        }
    }
    xmlDoc.async = false;
    xmlDoc.load("museums.xml");
}

```

```

/* Search the XML file for the requested AnswerID */
x = xmlDoc.getElementsByTagName("museumName");
var minimumMatches = 0;
for (var i = 0; i < x.length; i++) {
    var j = 0;
    var found = 0;
    var tempMuseumKeywordString =
xmlDoc.getElementsByTagName("keywords")[i].childNodes[0].nodeValue;
    var tempKeywordArray =
tempMuseumKeywordString.split(",");
    while(j < keywordArray.keywordList.length) {
        for(var z = 0; z < tempKeywordArray.length;
z++) {
            if(tempKeywordArray[z] ==
keywordArray.keywordList[j]) {
                found = 1;
                j =
keywordArray.keywordList.length;
            }
            j++;
        }

        if(found == 1) {
            // Parse keyword matches
            var keywordMatches = 0;
            var museumKeywordString =
xmlDoc.getElementsByTagName("keywords")[i].childNodes[0].nodeValue;
            var newKeywordArray =
museumKeywordString.split(",");
            for(var k = 0; k <
keywordArray.keywordList.length; k++) {
                for(var l = 0; l <
newKeywordArray.length; l++) {
                    if(newKeywordArray[l] ==
keywordArray.keywordList[k]) {
                        keywordMatches++;
                        l = newKeywordArray.length;
                    }
                }
            }

            // Sets the acceptable minimum keyword matches
to let a new Museum into the
            // current MuseumList
            for(var k = 0; k <
museumArray.museumList.length; k++) {
                if(museumArray.museumList.length != 0 &&
museumArray.museumList.length >= 7) {
                    minimumMatches =
museumArray.museumList[museumArray.museumList.length -
1].keywordMatches;
                }
            }
        }
    }
}

```

```

        // If the museum beats the number of minimum
matches, and has at least 1 match...
        // This will go through the process of
creating the Museum object and adding it to the List
        if(keywordMatches > minimumMatches &&
keywordMatches > 0) {
            // Parse Museum Name
            var newMuseumName =
xmlDoc.getElementsByTagName("museumName")[i].childNodes[0].nodeValue;

            // Parse website
            var newWebsite =
xmlDoc.getElementsByTagName("website")[i].childNodes[0].nodeValue;

            // Parse Category Rankings
            var categoryRankArray = new Array();
            categoryRankArray[0] =
xmlDoc.getElementsByTagName("art")[i].childNodes[0].nodeValue;
            categoryRankArray[1] =
xmlDoc.getElementsByTagName("science")[i].childNodes[0].nodeValue;
            categoryRankArray[2] =
xmlDoc.getElementsByTagName("garden")[i].childNodes[0].nodeValue;
            categoryRankArray[3] =
xmlDoc.getElementsByTagName("zoo")[i].childNodes[0].nodeValue;
            categoryRankArray[4] =
xmlDoc.getElementsByTagName("history")[i].childNodes[0].nodeValue;

            // Parse image location
            var newMuseumImageLocation =
xmlDoc.getElementsByTagName("image")[i].childNodes[0].nodeValue;

            // Create the new Museum
            var newMuseum = new Museum(newMuseumName,
newWebsite, keywordMatches, newMuseumImageLocation);

            // Add the new Museum.
            museumArray.addMuseum(newMuseum);
            museumArray.sort();
        }
    }
}

// *****
// ***** Interface *****
// *****

// Dynamic Display
function renewDisplay(nextQuestionID) {

    /*****
    /*      Questions      */
    /*****
    var currentQuestion = findQuestion(nextQuestionID);

    /*****
    /*      Answers      */
    /*****

```

```

/*****/
// Answer Array
answerArray = new Array();
    for(var i = 0; i < currentQuestion.answerArray.length; i++)
{
    answerArray[i] =
findAnswer(currentQuestion.answerArray[i]);
}

/*****/
/*      Display      */
/*****/
var tableLinkString1 = "<table border=\"0\"
cellspacing=\"0\"><tr><td height=\"\";
var tableLinkString2 = \"\" width=\"\";
var tableLinkString3 = \"\" align=\"center\" valign=\"center\"
style=\"background: #cccccc\";
    tableLinkString3 += \"onClick=\"selectAnswer(\"';
var tableLinkString4 = \"'\");\"
style=\"cursor:pointer;cursor:hand\"><h3 class='answer_text'>";
var tableLinkString5 = "</h3></td></tr></table>";

// Question Text
document.getElementById("question").innerHTML =
currentQuestion.questionText;

// Answer Text
var j = answerArray.length;
if(j <= 4) {
    var height = 125;
    var width = 245;
}
else {
    var height = 85;
    var width = 245;
}

if(j >= 1) {
    document.getElementById("answer1").innerHTML =
tableLinkString1 + height + tableLinkString2 + width +
tableLinkString3 + 1 + tableLinkString4 + answerArray[0].answerText
+ tableLinkString5;
}
else {
    document.getElementById("answer1").innerHTML = "";
}

if(j >= 2) {
    document.getElementById("answer2").innerHTML =
tableLinkString1 + height + tableLinkString2 + width +
tableLinkString3 + 2 + tableLinkString4 + answerArray[1].answerText
+ tableLinkString5;
}
else {
    document.getElementById("answer2").innerHTML = "";
}
}

```

```

        if(j >= 3) {
            document.getElementById("answer3").innerHTML =
tableLinkString1 + height + tableLinkString2 + width +
tableLinkString3 + 3 + tableLinkString4 + answerArray[2].answerText
+ tableLinkString5;
        }
        else {
            document.getElementById("answer3").innerHTML = "";
        }

        if(j >= 4) {
            document.getElementById("answer4").innerHTML =
tableLinkString1 + height + tableLinkString2 + width +
tableLinkString3 + 4 + tableLinkString4 + answerArray[3].answerText
+ tableLinkString5;
        }
        else {
            document.getElementById("answer4").innerHTML = "";
        }

        if(j >= 5) {
            document.getElementById("answer5").innerHTML =
tableLinkString1 + height + tableLinkString2 + width +
tableLinkString3 + 5 + tableLinkString4 + answerArray[4].answerText
+ tableLinkString5;
        }
        else {
            document.getElementById("answer5").innerHTML = "";
        }

        if(j >= 6) {
            document.getElementById("answer6").innerHTML =
tableLinkString1 + height + tableLinkString2 + width +
tableLinkString3 + 6 + tableLinkString4 + answerArray[5].answerText
+ tableLinkString5;
        }
        else {
            document.getElementById("answer6").innerHTML = "";
        }
    }

// Final Display
function finalDisplay(pageNumber) {

    /***/
    /*      Museums      */
    /***/
    // Museums
    //answerArray = new Array();
    //  for(var i = 0; i < currentQuestion.answerArray.length; i++)
    {
        //          answerArray[i] =
findAnswer(currentQuestion.answerArray[i]);
        //      }

    /***/
    /*      Display      */
    /***/

```

```

    /*****/
    var tableLinkString1 = "<table border=\"0\"
cellspacing=\"0\"><tr><td height=\"125\" width=\"245\"
align=\"center\" valign=\"center\" style=\"background: #ffffff\"";
    tableLinkString1 += "onClick=\"javascript:popUp(\"";
    var tableLinkString2 = "\');\"";
style=\"cursor:pointer;cursor:hand\"><h3 class='answer_text'>";
    var tableLinkString3 = "</h3></td></tr><table>";

    // Question Text
    document.getElementById("question").innerHTML = "Museum
Recommendations";

    // Answer Text
    var j = museumArray.museumList.length;

    if(pageNumber == 1) {
        if(j >= 1) {
            document.getElementById("answer1").innerHTML =
tableLinkString1 + museumArray.museumList[0].museumWebsite +
tableLinkString2 + museumArray.museumList[0].museumName;
        }
        else {
            document.getElementById("answer1").innerHTML = "";
        }

        if(j >= 2) {
            document.getElementById("answer2").innerHTML =
tableLinkString1 + museumArray.museumList[1].museumWebsite +
tableLinkString2 + museumArray.museumList[1].museumName;
        }
        else {
            document.getElementById("answer2").innerHTML = "";
        }

        if(j >= 3) {
            document.getElementById("answer3").innerHTML =
tableLinkString1 + museumArray.museumList[2].museumWebsite +
tableLinkString2 + museumArray.museumList[2].museumName;
        }
        else {
            document.getElementById("answer3").innerHTML = "";
        }

        if(j >= 4) {
            var moreLinkString1 = "<table border=\"0\"
cellspacing=\"0\"><tr><td height=\"125\" width=\"245\"
align=\"center\" valign=\"center\" style=\"background: #ffffff\"";
            moreLinkString1 += "onClick=\"finalDisplay(\"";
            var moreLinkString2 = "\');\"";
style=\"cursor:pointer;cursor:hand\"><h3 class='answer_text'>";
            var moreLinkString3 = "</h3></td></tr><table>";
            document.getElementById("answer4").innerHTML =
moreLinkString1 + 2 + moreLinkString2 + "More...";
        }
        else {
            document.getElementById("answer4").innerHTML = "";
        }
    }

```



```

        }
    }

    else if(pageNumber == 2) {
        if(j >= 4) {
            document.getElementById("answer1").innerHTML =
tableLinkString1 + museumArray.museumList[3].museumWebsite +
tableLinkString2 + museumArray.museumList[3].museumName;
        }
        else {
            document.getElementById("answer1").innerHTML = "";
        }

        if(j >= 5) {
            document.getElementById("answer2").innerHTML =
tableLinkString1 + museumArray.museumList[4].museumWebsite +
tableLinkString2 + museumArray.museumList[4].museumName;
        }
        else {
            document.getElementById("answer2").innerHTML = "";
        }

        if(j >= 6) {
            document.getElementById("answer3").innerHTML =
tableLinkString1 + museumArray.museumList[5].museumWebsite +
tableLinkString2 + museumArray.museumList[5].museumName;
        }
        else {
            document.getElementById("answer3").innerHTML = "";
        }

        if(j >= 7) {
            document.getElementById("answer4").innerHTML =
tableLinkString1 + museumArray.museumList[6].museumWebsite +
tableLinkString2 + museumArray.museumList[6].museumName;
        }
        else {
            document.getElementById("answer4").innerHTML = "";
        }
    }
}

// Selecting an Answer
function selectAnswer(answerNumber) {
    answerNumber--;

    /* Update Category Ranks */
    for(var i = 0; i <
answerArray[answerNumber].categoryRankingArray.length && i <
categoryRanks.length; i++) {
        categoryRanks[i] +=
answerArray[answerNumber].categoryRankingArray[i];
    }

    /* Update Keywords */
    for(var j = 0; j < answerArray[answerNumber].keywordArray.length;
j++) {

```

```

keywordArray.addKeyword(answerArray[answerNumber].keywordArray[j
]);
}

/* Go to next question, or end the quiz */
if(answerArray[answerNumber].nextQuestion != "#FINAL") {
    renewDisplay(answerArray[answerNumber].nextQuestion);
}

else {
    museumSelector();
    finalDisplay(1);
}
}

```

QuizMain.js

```
renewDisplay("#Q0001");
```

Quiz.html

```

<html>
<head>
    <link rel="stylesheet" type="text/css" href="QuizCSS.css" />
</head>
<body>
    <h2 class='question_text_table'><table border='0'>
        <tr><td height='120' width='520' valign='center'
align='center'>
            <h2 class='question_text'>
                <span id="question"></span>
            </h2>
        </td></tr>
    </table></h2>
    <p id="answers">
        <h3 class='answer_text_table'><table border='0'
cellspacing='5'>
            <tr>
                <td>
                    <span id="answer1"></span>
                </td>
                <td>
                    <span id="answer2"></span>
                </td>
            </tr>
            <tr>
                <td>
                    <span id="answer3"></span>
                </td>
                <td>
                    <span id="answer4"></span>
                </td>
            </tr>
        </table>
    </p>

```

```

                </td>
            </tr>
            <tr>
                <td>
                    <span id="answer5"></span>
                </td>
                <td>
                    <span id="answer6"></span>
                </td>
            </tr>
        </table></h3>
    </p>

    <script src="QuizFunctions.js"></script>
    <script src="QuizMain.js"></script>

</body>

</html>

```

7.5 Appendix E: Use Cases

ID: MIK-IQP-UC1
Name: Starting the Quiz
Actors: Visitor

Basic Flow:

The Visitor wants to start a new Interactive Quiz Profile, and does so by activating the corresponding control on the MIK web page. A new Quiz opens, and the user begins answering questions. The use case ends.

Revision History:

25-Mar-2008, Nolan Colter, Version 1.0

ID: MIK-IQP-UC2
Name: Answering Questions on the Quiz
Actors: Visitor

Basic Flow:

The Visitor has started an Interactive Quiz Profile, and is presented with a Question and a number of possible Answers. The user selects an Answer, and the Interactive Quiz Profile either presents the Visitor with a new Question with a new set of Answers, or with a set of museums that may cater to the tastes they have communicated while filling out the Quiz.

Revision History:

25-Mar-2008, Nolan Colter, Version 1.0

7.5 Appendix F: User Manual

Description of the Museum Selector

The Museum Selector is a program designed to be run in an internet browser that acts like a questionnaire for determining good museums to visit. This program is designed to be easy to update and change whenever needed.

Files:	<i>Quiz.html</i>	The webpage that runs and displays the program.
	<i>QuizCSS.css</i>	The CSS file that controls placement of display elements for <i>Quiz.html</i> .
	<i>QuizBG.jpg</i>	The background display for the webpage.
	<i>quizPictures</i> (folder)	The folder containing all of the images used for the Museum Selector.
	<i>QuizFunctions.js</i>	The JavaScript file containing the functions used to run the program.
	<i>QuizMain.js</i>	The JavaScript file containing the code used to start the program.
	<i>questions.xml</i>	The XML file used to store information for each Question in the Museum Selector.
	<i>answers.xml</i>	The XML file used to store information for each Answer in the Museum Selector.
	<i>museums.xml</i>	The XML file used to store information for each Question in the Museum Selector.

IMPORTANT: Updating the information about the museums, questions, and answers is designed to be simple and can be done easily by people who are not computer programming experts.

We highly recommend using experts for changing anything that has to do with how the program works.

1. JavaScript

This program is written in JavaScript, a scripting language commonly used for writing web programs that will be running on a website visitor's computer. Despite the name, this language is *not* related to the Java programming language, so knowing how to program in Java will not be very helpful for changing the Museum Selector.

An explanation of the structure of the JavaScript can be found in Section 5, "JavaScript Structure".

2. Cascading Style Sheets (CSS)

When used for web pages, CSS is style sheet language used to describe the presentation of a web document written in a markup language like HTML. The

webpage that displays the Museum Selector uses very basic CSS to control placement of graphics on the screen and the style of the text displayed on the page. The CSS used for this program is so simple that changing it can be done without the help of a web programming expert.

An explanation of how to edit the CSS file can be found in Section 7, “Editing the CSS”.

3. Extensible Markup Language (XML)

XML is a specification that can be used to create custom markup languages or to store data in a standard format. The Museum Selector uses a set of XML files to act like a simple database for the information used to display Questions, Answers, and Museums in the program.

An explanation of how the XML files work can be found in Section 8, “XML Files”.

An explanation of how to use the XML files to add new Questions, Answers, and Museums can be found in Section 9, “Manual XML Entry Creation”.

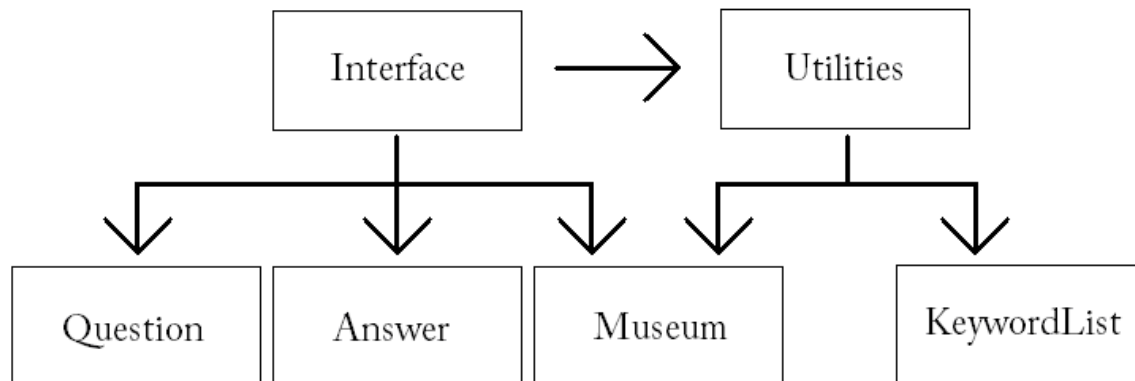
4. HyperText Markup Language (HTML)

HTML is the most common markup language used for creating web pages. It is used to describe the structure of information, and to describe how the information should be displayed to someone using a program that displays web pages.

An explanation of the HTML file can be found in Section 10, “The HTML File”.

5. JavaScript Structure

This is a general description for the program that runs the Museum Selector. It includes a diagram showing how each part of the program communicates, and a small description of the function of each of those parts. The general design of this program uses Object-Oriented Design, so that each piece can be changed separately if needed. Further details about how specific parts of the program can be found in comments inside of the program code.



The arrows show which parts talk to each other. For example, the arrow pointing from *Interface* to *Question* shows that the *Interface* part of the program asks the *Question* part for information, but the *Question* part does not ask the *Interface* for anything.

- **Question**
This part of the program is in charge of creating Question objects, maintaining those objects, and finding Question information in the *questions.xml* file.
- **Answer**
This part of the program is in charge of creating Answer objects, maintaining those objects, and finding Answer information in the *answers.xml* file.
- **Museum**
This part of the program is in charge of creating Museum and MuseumList objects, maintaining those objects, and finding Museum information in the *museums.xml* file. It also contains the function that finds a random Museum in the *museums.xml* file.
- **KeywordList**
This part of the program is in charge of creating KeywordList objects, maintaining those objects, and finding the number of matches between a given set of keywords, and the words in the KeywordList.
- **Interface**
This part of the program controls the display of information to the user. It sends and receives information from the Utilities part of the program. It contains the functions that control renewing the display while it is being used, and the final display of museum recommendations.
- **Utilities**
This part of the program handles all of the work in selecting which information to display based on the user's actions. It contains the functions that control the actions to take when a user selects any of the answers or buttons on the screen.

6. How does it work?

The basic idea behind this program is that the user moves through a series of questions until they reach the end, where the program displays a list of recommended museums based on the answers the user has picked.

- **Question IDs**
All of the Questions available to the program are stored in the *questions.xml* file. Each Question has several required pieces of information, which will be explained in Section 8, "XML Files". The Question ID number is the most important part of a question.
The Question ID is a unique identification number used when the program is searching through the XML file to find the next question to display.
The IDs we have provided with the questions in *questions.xml* are all made of exactly five characters. The first 2 characters show the question's category, and the last 3 characters show the question number.

You do not have to use this 5-character rule when giving a Question an ID number. The only rule is that the ID must be unique.

Here is a list of the important Question IDs in the program:

- #Q0001 This Question ID is used for the very first question that the program displays. If you wish to use a new starting Question, this is the ID number it must have, and the previous starting question must be given a new number.
- #QRAND This Question ID is used to tell the program to randomly select a museum, and then go straight to the end of the questionnaire and display the museum.
- #FINAL This Question ID is used to tell the program to go to the end of the questionnaire, and display the museum recommendations.

To make it easier to look at the *questions.xml* file, the Question IDs are letter-coded. The first letter is always “Q”, followed the first letter of the category the question is in:

- # Q 0 _ _ _ The “0” after the “Q” means that this question is required, and is not in a specific category.
- # Q A _ _ _ The “A” after the “Q” means that this question is in the “Art” category.
- # Q H _ _ _ The “H” after the “Q” means that this question is in the “History/Culture” category.
- # Q S _ _ _ The “S” after the “Q” means that this question is in the “Science/Industry” category.
- # Q Z _ _ _ The “Z” after the “Q” means that this question is in the “Zoos/Gardens” category.

- **Answer IDs**

All of the Answers available to the program are stored in the *answers.xml* file. Each Answer has several required pieces of information, which will be explained in Section 8, “XML Files”. The Answer ID number is the most important part of an answer.

The Answer ID is a unique identification number used when the program is searching through the XML file to find the next answer to display.

The IDs we have provided with the answers in *answers.xml* are all made of exactly six characters. The first 2 characters show the answer’s category and the last 4 characters show the question number.

You do not have to use this 6-character rule when giving an Answer an ID number. The only rule is that the ID must be unique.

To make it easier to look at the *answers.xml* file, the Answer IDs are letter-coded. The first letter is always “A”, followed the first letter of the category the question is in:

- # A 0 _ _ _ _ The “0” after the “A” means that this answer is used for a required question, and is not in a specific category.
- # A A _ _ _ _ The “A” after the first “A” means that this answer is for a question in the “Art” category.
- # A H _ _ _ _ The “H” after the “A” means that this answer is for a question in the “History/Culture” category.
- # A S _ _ _ _ The “S” after the “A” means that this answer is for a question in the “Science/Industry” category.
- # A Z _ _ _ _ The “Z” after the “A” means that this answer is for a question in the “Zoos/Gardens” category.

- **Answer Keywords**

Each time a user selects an answer, the program stores that answer’s keywords. An answer’s keywords are a part of the information for each Answer in the *answers.xml* file.

This way, the program builds up a set of keywords based on the user’s choices. The list of keywords can be used later to figure out which museums to recommend.

- **Museum Keywords**

Each museum has a set of keywords. This set of keywords is defined in the *museums.xml* file. When a user reaches the end of the Museum Selector questionnaire, the program will compare the stored list of Answer Keywords with the keywords for each Museum to find the best matches.

- **Example: User Selecting an Answer**

1 – A user looks at a question.



2 – The program has a Question ID for each answer.

- Art - #QA001
- Science & Industry - #QS001
- Zoos & Gardens - #QZ001
- History & Culture - #QH001
- Surprise Me! - #QRAND

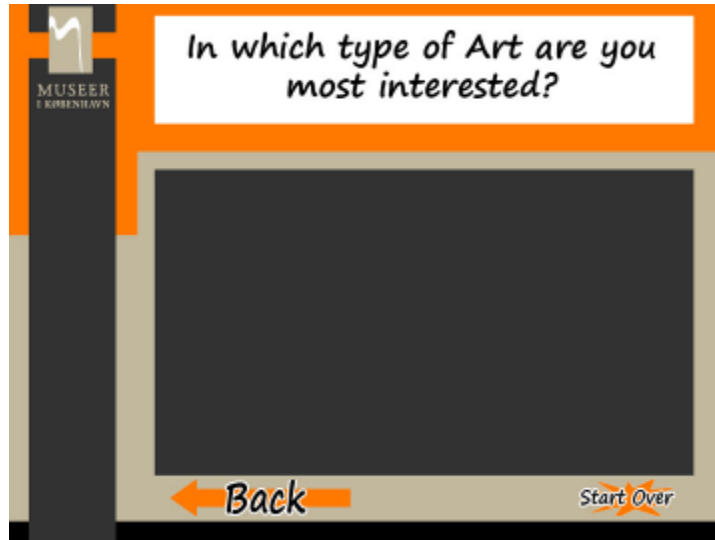
3 – The user selects the “Art” answer.



4 – The program will select the Question ID for that Answer.

Art - #QA001
Science & Industry - #QS001
Zoos & Gardens - #QZ001
History & Culture - #QH001
Surprise Me! - #QRAND

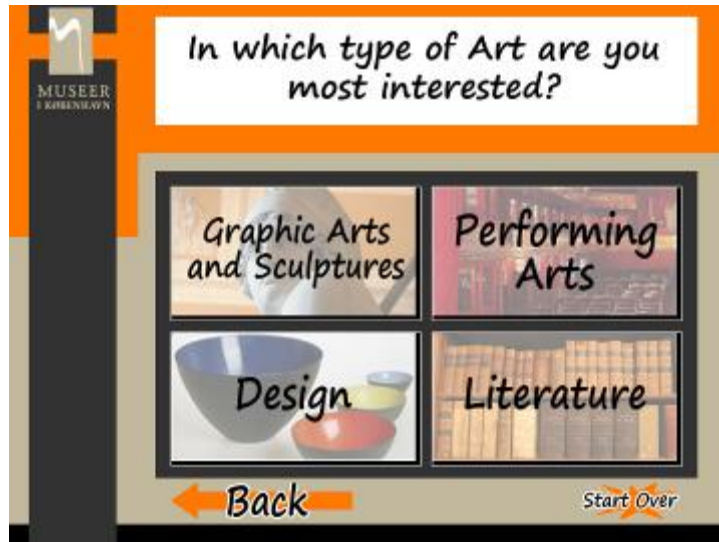
5 – The program displays the next question, based on the Question ID of the last answer.



6 – The program then looks at the question's list of Answer IDs.

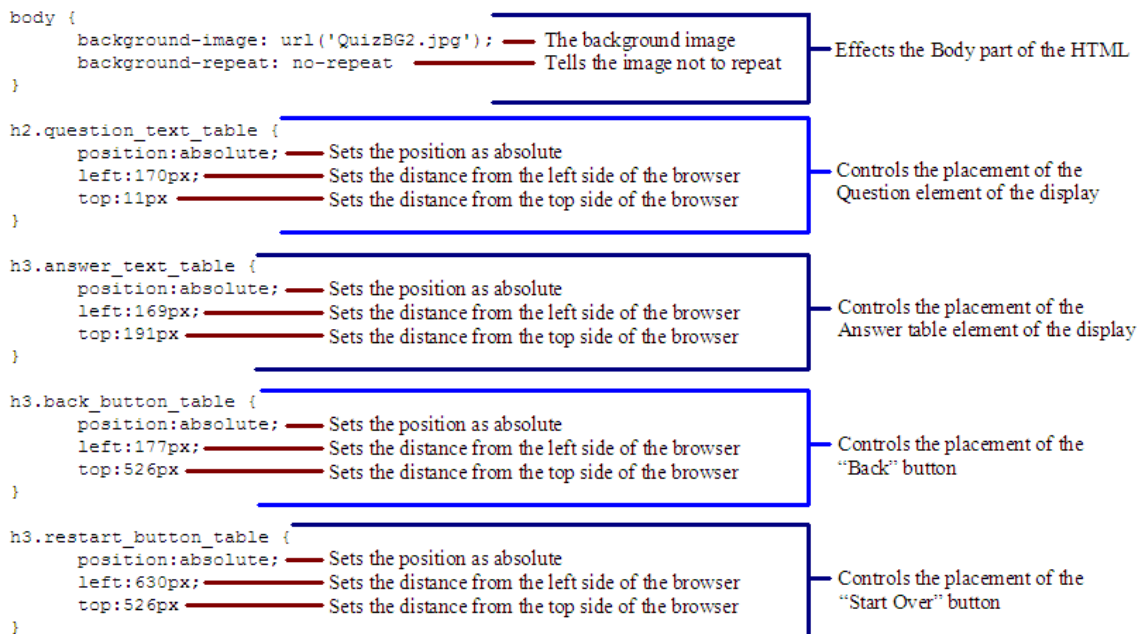
#AA0011 – Graphic Arts and Sculptures
#AA0012 – Performing Arts
#AA0013 – Design
#AA0015 - Literature

7 – The program displays the answers for the new question, and the user can keep going.



7. Editing the CSS

This is a description of the CSS file that controls the display elements of the *Quiz.html*. Below is a diagram displaying the contents of the CSS file, along with a description of each part. The values used to position the display elements are fixed to provide an accurate display in Internet Explorer, and may cause the Museum Selector to look strange in other web browsers. The values that affect the display are easy to change when needed.



8. XML Files

There are three XML files that this program uses to get information for all of the questions, answers, and museums involved in the Museum Selector.

For this program, we use XML to provide labels for the data. This creates a very simple version of a database, which can be used to hold all the information needed. Each piece of information is contained within a start and end tag that specifies the name of the field.

For example, if we wanted to create an XML representation of a human being, we could use something like this:

```
<human>
  <name>Frank</name>
  <height>180cm</height>
  <weight>72.5kg</weight>
  <hairColor>Brown</hairColor>
  <eyeColor>Brown</eyeColor>
  <skinColor>Light Brown</skinColor>
</human>
```

- **questions.xml**

This file contains the information for all of the questions in the Museum Selector. Each question has 4 pieces of information:

<i>questionID</i>	The ID number of the question, each question has its own unique ID
<i>questionText</i>	The text version of the question, this field can be left blank
<i>answerArray</i>	A set of answer ID numbers, representing the set of answers for this question
<i>questionImage</i>	The image to be displayed for this question

The XML file contains this information for each question using this format:

```
<question category="_____">
  <questionID>_____</questionID>
  <questionText>_____</questionText>
  <image>_____</image>
  <answerIDs>_____, _____, _____, _____</answerIDs>
</question>
```

Here is an example of a question that has been filled in:

```
<question category="intro">
  <questionID>#Q0003</questionID>
  <questionText>Which best describes you?</questionText>
  <image>quizPictures/Questions/Age.jpg</image>
  <answerIDs>#A00031, #A00032, #A00033, #A00034</answerIDs>
</question>
```

Notice that each of the Answer IDs in the “answerIDs” field are separated by a “,” character. Also notice that the “,” only goes in-between the Answer IDs, and that there is no “,” at the beginning or end of the field.

The version of the Museum Selector we are delivering to you is designed to handle anywhere between 1-6 answers per question.

- **answers.xml**

This file contains the information for all of the answers in the Museum Selector. Each answer has 5 pieces of information:

<i>answerID</i>	The ID number of the answer, each answer has its own unique ID
<i>answerText</i>	The text version of the answer, this field can be left blank
<i>keywordArray</i>	A set of keywords for this answer (for example: "art, history")
<i>answerImage</i>	The image to be displayed for this answer
<i>nextQuestion</i>	The ID number of the question the program will go to if the user selects this answer

The XML file contains this information for each question using this format:

```
<answer category="_____">
  <answerID>_____</answerID>
  <answerText>_____</answerText>
  <keywords>_____</keywords>
  <image>_____</image>
  <nextQuestion>_____</nextQuestion>
</answer>
```

Here is an example of a question that has been filled in:

```
<answer category="intro">
  <answerID>#A00032</answerID>
  <answerText>Student</answerText>
  <keywords>student</keywords>
  <image>quizPictures/Answers/Student.jpg</image>
  <nextQuestion>#Q0004</nextQuestion>
</answer>
```

Notice that there can only be one Question ID in the "nextQuestion" field. There can be any number of keywords in the "keywords" field. Each of the words must be separated by a ",". For example:

```
<keywords>student, school, books, learning</keywords>
```

- **museums.xml**

This file contains the information for all of the museums in the Museum Selector. Each museum has 4 pieces of information:

<i>answerID</i>	The ID number of the answer, each answer has its own unique ID
<i>answerText</i>	The text version of the answer, this field can be left blank
<i>keywordArray</i>	A set of keywords for this answer (for example: "art, history")
<i>answerImage</i>	The image to be displayed for this answer
<i>nextQuestion</i>	The ID number of the question the program will go to if the user selects this answer

The XML file contains this information for each question using this format:

```
<museum category="_____">
  <museumName>_____</museumName>
  <website>_____</website>
  <keywords>_____</keywords>
  <image>_____</image>
</museum>
```

Here is an example of a question that has been filled in:

```

<museum category="none">
  <museumName>Amagermuseet</museumName>
  <website>http://mik.dk/museer/Amagermuseet.aspx</website>
  <keywords>group, family, 35, history and culture</keywords>
  <image>quizPictures/Museums/Amagermuseet.jpg</image>
</museum>

```

There can be any number of keywords in the “keywords” field. Each of the words must be separated by a “,”. For example:

```
<keywords>student, school, books, learning</keywords>
```

9. Manual XML Entry Creation

You can enter new Questions, Answers, and Museums into the Museum Selector by editing the XML files. The example below shows how to create and enter a new Question. The same method is used for Answers and Museums as well, you just have to use the correct format. For more information on the formats for Questions, Answers, and Museums in the XML files, see the previous section, “XML Files”.

- **Creating a New Question**

To create a new question, first determine the information needed to fill in the 4 fields required in the *questions.xml* file.

<i>questionID</i>	The ID number of the question, each question has its own unique ID
<i>questionText</i>	The text version of the question, this field can be left blank
<i>answerArray</i>	A set of answer ID numbers, representing the set of answers for this question
<i>questionImage</i>	The image to be displayed for this question

For example, this could be our new question:

<i>questionID</i>	"#Q1234"
<i>questionText</i>	"Do you like this question?"
<i>answerArray</i>	"#A12341, #A12342, #A12343, #A12344"
<i>questionImage</i>	quizPictures/Questions/Like.jpg

Next, we place this into the XML format used by our *questions.xml* file:

```

<question category="any">
  <questionID>#Q1234</questionID>
  <questionText>Do you like this question?</questionText>
  <image>quizPictures/Questions/Like.jpg</image>
  <answerIDs>#A12341, #A12342, #A12343, #A12344</answerIDs>
</question>

```

Then, we place our XML Question into the *questions.xml* file:

```

<questionList>
  <question category="intro">
    <questionID>#Q0001</questionID>
    <questionText>Who will be joining you on your museum visit?</questionText>
    <image>quizPictures/Questions/Visit.jpg</image>
    <answerIDs>#A00011,#A00012,#A00013,#A00014</answerIDs>
  </question>
  ...
  ...
  ...
</questionList>

```

IMPORTANT: The new Question must go between the beginning and end tags of the “questionList”. These tags have been highlighted in red to show you where they are.

ALSO: The new Question must not go between the beginning and end tags of another Question. These tags have been highlighted in blue to show you what they look like.

10. The HTML File

The HTML file used for the Museum Selector is very simple. It is only used to provide a frame that the program can change to display the questionnaire. We recommend not changing this file unless absolutely needed. If you need to change the placement of the questions, answers, or buttons, we recommend that you use the CSS file, which is explained in Section 7, “Editing the CSS”.