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Virtual Tour for the Charles Dickens Museum

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VIRTUAL TOUR FOR THE CHARLES DICKENS MUSEUM

A Report Submitted to:

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This report is the product of an educational program, and is intended to serve as partial documentation for the evaluation of academic achievement. The reader should not construe the report as a working document.

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Abstract

This report, prepared for the Charles Dickens Museum, details the development and implementation of a virtual tour of the museum in order to allow more complete access for those with disabilities. Our team conducted research about different media used in virtual tours, and then created prototypes using them. Using the feedback we received about them, along with visitor surveys about aspects of the actual museum visit, we created a virtual tour which the Museum then made available through the internet.

<u>Authorship Page</u>

All group members contributed equally both in the writing of this report and the completion of the virtual tour.

<u>Acknowledgements</u>

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<u>Executive Summary</u>

The goal of our project was to solve a problem that the Charles Dickens Museum was experiencing. This problem was that disabled persons, primarily those with mobility and sight impairments, were unable to enjoy the full experience that non-disabled persons could. This was true because the museum is contained within a former home of Dickens, who lived there nearly two centuries ago, which still has the steep staircases and tight hallways that were present in Dickens's time. Unfortunately the usual solution to such a problem, the addition of lifts and ramps, was not an option. Such modifications to the physical structure would have taken away from the historical value of the house. Also, adding an elevator to the house might not have been possible due to the strength of the structure.

Not only did a change need to be made because of moral obligations and to allow anyone interested in Dickens with the chance to see the artifacts of the museum, but it was also needed because of legal issues. The Disability Discrimination Act of 1995 requires that all public places allow access to everyone, regardless of disabilities. However, certain provisions allow alternative options to structural modification when such modification is unreasonable, as is the case for the Charles Dickens Museum. One such option is a virtual tour, and that was the decision the museum decided to explore.

A virtual tour tries to take everything it can from an actual visit to the facility and present it through computer interface. This can be viewed from on-site or through the internet, depending on how the owner decides to make it available. The Charles Dickens Museum in particular was interested in an online tour. There are many different formats for a virtual tour, including text-based, photographic, video, or three dimensional modeling. Each has its own strengths and weaknesses, and all are advantageous in different situations. The first part of our project was to research the possible tours we could create and decide which would be most suitable for the Charles Dickens Museum.

After researching the types of tours available to us, we decided on four possibilities. These were text-only, still photographic with text, panoramic photographic with text, and video-only. We then proceeded to make a prototype of a single room in the

museum, the Morning Room, in each format. All four prototypes showcased the same artifacts, the only difference between the different tours being the medium used. We then had members of the museum staff and a member of a disabled rights group test the prototypes and fill out a feedback form. The feedback form asked them to rank the tours in categories such as the ease of use they experienced while perusing the tour and their sense of immersion in the tour. Applying each tour's rankings in a decision matrix, having given each category a predetermined weight, we compared them using the results. We also added in considerations for any production and upkeep costs, and for computer requirements to run the tour. After doing a complete analysis using these methods, we decided on a tour centered on panoramic photography.

We also carried out surveys of the visitors to the museum. The questions we asked included such topics as what their favorite displays and artifacts were, why they came to the museum, and how they felt about a virtual tour. We tallied the results and discovered a few things. First, visitors were interested in a huge array of items, there was no clear favorite. This meant that we would have to try and include as many items as possible, not focus on specific ones. Also, we learned that some visitors were discouraged by the lack of a theme or set path to travel through the museum. This gave us the idea to give users the option of exploring the virtual tour on their own, or simply following links to move through along a preplanned path. Lastly, we found that more than half of those surveyed would be interested in visiting a virtual tour of the museum, but almost all of those surveyed would still want to visit the actual museum.

After performing the research and analysis, we began the second part of our project: creating and implementing the actual tour. We decided to use PHP for the coding language, and created a template for the pages so that creating the site would be as fast as possible, as well as ensuring that future updates could be quickly and easily accomplished. We began by taking several pictures of each room and stitching them together with panoramic photography software. We then mapped parts of the image as hyperlinks to separate pages. We also included a hyperlink to the same page in a text format. The pages pointed to by these hyperlinks featured a close up photo of the item that was represented by the hyperlink, along with a text description of it. The whole tour

was designed to make it easy to use, as well as informative. Each page features several ways to navigate to the next room or go back to a previous room or item. A tutorial was also created so that users could read about all the features available on the tour.

Although the tour we finished is fully functional and includes almost all the items of the museum, some future work could be done. Professional photographers could be hired to retake the pictures for even better quality. Also, the text descriptions of the items could be rewritten or elaborated on, to make the tour even more informative. Lastly, as more people have access to broadband high speed internet, video or more audio features could be added to the tour for an even more immersive experience

1. Introduction

It is estimated that around fifteen percent of the United Kingdom's population has a disability (Employer's Forum on Disability, 2003). Until the Disability Discrimination Act (DDA) of 1995 became effective, these people had no protection from being discriminated against. The DDA defined discrimination as "less favorable treatment" or a failure to carry out "reasonable adjustments" in order to accommodate for a person's impairments. Employers, landlords, and public facilities have all been affected by this Act (DDA, 1995, part III, section 20). The DDA allows a person suffering from disabilities to bring lawsuits against anyone who discriminates against them.

In 2004 the Act extended the requirements of non-discrimination to include physical changes to premises if such changes would improve accessibility to people with disabilities. However, in some situations, structural modifications to the building can be considered unreasonable. In such situations, the DDA allows other methods than structural modification to be used in improving accessibility (COP, 2002, p. 39).

The Charles Dickens Museum of London showcases artifacts from Dickens's life works. Since the building began its time as a museum in 1925, it has been open to the public, but it has provided limited access for those with mobility and visual impairments (Charles Dickens Museum London [CDML, 2004]). The limited accessibility for persons affected by mobility impairments is because access between the floors of the museum can only be obtained by using stairs. This flaw in the building is present because buildings in Dickens's time were not built with the needs of mobility impaired persons in mind. The access limitations for people with visual impairments came about because of the mainly visual designs and nature of the exhibits.

According to the Disability Discrimination Act the Charles Dickens Museum has been discriminating against people with disabilities by having had access limitations arising from the museum's structure. The museum is therefore required to make adjustments and changes. Solutions for improving accessibility to those with visual impairments are already being implemented by the museum, and it is working on an

audio tour to assist those with visual impairments. Providing better access to those with mobility impairments is more complex. The museum building was the home of Dickens from 1837 until 1839; therefore any physical modifications such as the interior installation of ramps or lifts could detract from its historical value, thus making them unreasonable (CDML, 2004).

It is inappropriate for mobility impaired visitors to experience limited access to the museum while other, able-bodied visitors do not. The museum therefore has had to consider alternative methods of providing the entire museum experience to disabled patrons. Our project attempted to assist the museum in its effort to become more accessible. After evaluating various routes to DDA compliance, such as building modifications and virtual tours, we determined that a virtual tour seems to be the most viable option. For our group to make our best recommendation to the museum on accessibility, we needed to take several factors into account. We investigated several different types of virtual tours in an effort to provide the best substitute, being sure to consider the needs of the patrons and those of the museum itself. We took into account the effectiveness and costs of our options, as well as the available resources of the museum. Another action we took was to inquire into how people of any disability status felt discriminated against, in order to ensure that we were working with the knowledge of the complete problem. Additionally, the popularity of the different displays played a large role in determining which displays were represented in the method decided upon. We not only considered visitor preferences, but we also found what factors of the museum experience the staff feel are most important. Even though the population that we surveyed was mainly composed of non-disabled persons, we felt that there should not have been any large differences between disabled persons' and non-disabled persons' interests. In fact, in one brochure about disability access, it mentions that the interests of the disabled mentioned in the brochure were the same as non-disabled persons (Royal National Institute for the Blind, 2001). At the conclusion of our project, we were able to present a complete virtual tour that the museum then uploaded to their website. It will hopefully assist the museum in lessening the extent to which those with disabilities feel discriminated against.

NOTE: This report was prepared by members of the Worcester Polytechnic Institute London Project Center. The relationship of the Center to the Charles Dickens Museum and the relevance of the topic to the Charles Dickens Museum are presented in Appendix A.

2. Background

This chapter summarizes and explains the background information and research related to our project of creating a virtual tour for the Charles Dickens Museum. This includes a brief history of Charles Dickens's life, a description of the museum and its workings, and a summary of the Disability Discrimination Act, in particular the sections applicable to public places. We also discuss audience considerations, building modification, and virtual tours as a solution to the problem of limited access to the museum.

History of Charles Dickens

Born into a family whose many financial troubles caused him to experience terrible stresses, Charles Dickens grew up to be one of the greatest writers of all time. Dickens never spoke of his childhood hardships, but these experiences did shape the rest of his life. In fact they became the basis for one of his best known works, *David Copperfield.* It is no surprise that one of his best works had its basis in reality, as most of his characters were based on people in real life. Charles Dickens was something of a people-watcher, which allowed him to create realistic physical descriptions. The behavior, attitudes, and souls of his characters were often taken directly from someone that he had known (Becker, 1940, p.135).

Charles Dickens was born on February 7, 1812 in Landport, England. Through his early life, he lived in several cities including London and Chatham. His father was sent to prison for debt, and Charles was sent to work in a factory by the age of 12. He resented this manual labor and was far more satisfied when he was able to attend school at Wellington House Academy in London. After graduating, Dickens moved on to become a law office clerk in London. Shortly after, he began his writing career as a reporter in 1830. He wrote for several magazines and newspapers, including *True Son, Mirror of Parliament,* and *The Morning Chronicle.* By 1840, he was even writing for more prestigious papers including *The London Daily News.* Dickens's career as a fiction writer

began in the early 1830's while writing for these periodicals. Many of his stories were published in monthly segments. Some famous works of fiction by Dickens include *Oliver Twist, Nicholas Nickleby,* and *A Christmas Carol* (MacKenzie, 1979, pp.1-60).

Dickens often wrote about the social injustices of 19th century England in his works, especially the pollution by factories, corruption in business, the devastating effects of capitalism on the poor and working class, and activities of the London underworld. This hatred of injustice was carried into his everyday life through fighting for the rights of the poor. He wanted educational reform and an end to slum life. In addition, he planned and carried out several charity events, including reading *A Christmas Carol* for the benefit of a newly opened Children's Hospital. Charles Dickens was not the kind of person who, having become famous, would neglect the individuals and care only about groups of people. Dickens even cared for his parents whenever they fell into debt, the same parents who had forced him into demeaning labor to help pay the family debts when he was a child (MacKenzie, 1979, pp.79, 253).

Upon the purchase of Gad's Hill Place in 1857, the last place he was to call home, Dickens realized that he would need another source of income beyond the amount that his books brought in. This realization resulted in his public talks, which are today remembered as being part of what was so remarkable about Dickens. Dickens died June 9, 1870 and his body was buried in the Poet's Corner of Westminster Abbey (Becker, 1940, pp. 226-248).

History of 48 Doughty Street

Due to his frequent inclusion of characters' home-lives in his stories, it is only fitting that at least one of the places that he called home be preserved. From 1837 to 1839 Dickens, his wife Catherine, sister-in-law Mary, and the first of their children resided at 48 Doughty Street, London. The last few chapters of the *Pickwick Papers* were written here, as were major parts of *Oliver Twist* and *Nicholas Nickleby*. Dickens was quite successful while living in the 12-room home. He did, however, experience some trauma while living here. As mentioned, Mary, his wife's sister, was there to help

care for the children and the house.   He later described her as "the dearest friend he ever had", as well as having "not a fault" (MacKenzie, 1979, p.59). While Mary had never been sick in her 17 years, one day she took ill. The next morning, she died while Charles sat with her. Dickens took two months off from writing his current stories that were being published serially by chapter, much to the disappointment of the reading public (Becker, 1940, p130).

The growth of Dickens's family, along with this tragic loss of Mary, caused the family to move from this house. Just under a century later the building was under the threat of demolition. In 1923 the Dickens Fellowship stepped in and saved the building from its scheduled destruction. The building was opened as a museum called the "Charles Dickens House" two years later, and is today known as the "Charles Dickens Museum." Information about the current policies of the museum can be found in Appendix A (Charles Dickens Museum London [CDML], 2004).

Unfortunately, the design and location of the museum make it difficult for some visitors with disabilities to enjoy it. The mainly visual designs of exhibits place restrictions on exhibits' accessibility to those with visual impairments. Persons who have mobility impairments experience difficulty because of the structure and location of the building. Not only is this limited accessibility unfair to those visitors, but it is also illegal under recent legislation. Providing equal access regardless of any disability falls under the Disability Discrimination Act of 1995, the details of which will be explained in the next section.

Disability Discrimination Act – Overview

The Disability Discrimination Act of 1995 (DDA) was signed by Parliament on November 8, 1995. This Act provides disabled persons in the United Kingdom equal treatment under the law in employment, access to goods and facilities, and in renting and owning land. According to the DDA, a person is considered disabled if he or she: "has a physical or mental impairment which has a substantial and long-term adverse effect on his ability to carry out normal day-to-day activities." (DDA, 1995, I, 1-3). This also

includes people who have recovered from such a disability, those with physical disfigurements, and some genetic conditions (COP, 2002, p.165).

The DDA is split into several subsections. They are:

- Employment
- Discrimination in Other Areas
- Education
- Public Transport
- The National Disability Council

The "Employment" section applies to all employers with 20 or more employees. It declares it illegal to discriminate against disabled people when considering who to hire for a position and the terms of such employment. It also declares that awarding opportunities to a non-disabled person over someone who has a disability, such as promotions or training, is illegal. Finally, it requires employers to make reasonable adjustments to accommodate disabled employees. This could include, but is not limited to, changes to the physical premises, altering hours, allowing absences due to treatment of the disability, acquiring necessary equipment, modifying instructions and procedures, and providing for interpretation or supervision (DDA, 1995, part II, sections 4-18).

The subsection titled "Discrimination in Other Areas" applies mostly to the provision of goods and services. It has been implemented in three stages. The first stage took effect on December 2, 1996, and made it unlawful for businesses to treat a disabled patron less favorably than another patron without disability. Since October 1, 1999, businesses have been required to make "reasonable adjustments" to the way they provide goods and services to better accommodate disabled customers. The definition of "reasonable adjustments" depends on many factors, including the good or service provided, the size of the business, and the cost to make such changes. The changes could include allowing guide dogs to enter a store for blind patrons, providing special seating for mobility impaired patrons, or employing a few sign language assistants at conferences. The application is very wide in scope, and relies on the business to decide what is reasonable for their situation. Mostly, the DDA simply required equal treatment in provision of goods, such as not refusing service to the disabled. The last stage took

effect on October 1, 2004. Since coming into effect, this has required businesses to make "reasonable adjustments" to the actual physical structures in order to provide for disabled customers. Examples of cooperation could include the addition of ramps and lifts, disabled accessible toilets, and telephones that can be easily reached by customers in wheelchairs (COP, 2002, p.iii).

The subsection on "Education" requires all counties to submit an annual report on the provisions for disabled students. Each county's annual report must include arrangements made for disabled students, steps taken to ensure equal treatment, and additional access provided for those with disabilities. The DDA also makes amendments connecting existing laws regarding education of the disabled to the DDA (DDA, 1995, part IV, section 29-31).

The "Public Transportation" section covers provisions that will be required of all companies that provide transportation to the public. It requires taxis, buses, railcars, and other public service vehicles (PSV) to be accommodating of disabled passengers, including those in wheelchairs. All PSVs are required to fit wheelchair bound passengers into the passenger compartment without removal from their chair. It also requires PSVs to allow passengers to bring their guide dogs into the vehicle. No additional charge can be added for any of these provisions (DDA, 1995, part V, section 32-49).

Lastly, the DDA establishes a government organization called the National Disability Council. The Council is created to work on the elimination of discrimination in the United Kingdom, to decide on new measures to reduce discrimination and provide further accessibility, and to interpret the DDA. The Council also will propose codes of practice, and review current codes. Finally, it reviews and proposes new bills regarding the treatment of disabled persons (DDA, 1995, part VI, section 50-52).

Disability Discrimination Act - How the Charles Dickens Museum is Affected

As far as the DDA is concerned, the Charles Dickens Museum falls under the regulations of "Part III: Discrimination in Other Areas". Since October 2004 has come and gone, all the stages of Part III are currently in effect, requiring the museum to take

any and all means to make "reasonable adjustments" to accommodate disabled patrons. This can include anything up to actual physical changes in the museum, but also includes changes in the way service is provided. Basically, the museum needs to change anything that offers a disabled person an experience that treats them less favorably than another visitor. The service provided must not be of a lower standard, and it also needs to preserve the disabled person's dignity. Also, service providers need to be sure to consider all types of disabilities. Providing only for deaf patrons, but not mobility impaired visitors, is illegal. All of these factors need to be taken into consideration when deciding on provisions to be made by the museum (COP, 2002, p.7-9).

The DDA requires the museum to provide an auxiliary service, such as assisting visitors up stairs, that enables disabled people to use its services. Also, it requires that they make physical changes to the facility that would allow patrons to make use of the services. There is, however, a separate part in the DDA that states that the museum can instead provide an alternative method of making the service available. This alternative method needs to be "reasonable", which is, unfortunately, very much open to interpretation. However, this is the only way around physically altering the museum to allow disability access. If an alternative method, such as a virtual tour, was created and a disabled patron said this was less favorable treatment, the museum could be brought to court for a judge to decide on whether the method was "reasonable" or not. If another museum or facility has employed a solution that has been deemed acceptable, it would probably indicate that a similar solution could work in similar cases (COP, 2002, p.37-39).

If the museum were to ignore the needs of the disabled, the wronged person(s) could bring the museum to court for providing less favorable treatment, and the museum can face fines. If the patron were to win the preceding, the museum would be forced to pay for any financial losses the patron suffered. Also, the patron could be awarded money for emotional suffering from the less favorable treatment. Lastly, the patron could seek to file an injunction against the museum preventing any further discrimination (COP, 2002, p.163-164).

Disability Discrimination Act - What the Museum is Doing to Comply

Before this project started, the Charles Dickens Museum had already begun taking steps towards becoming accessible to those with disabilities. First of all, it acquired a ramp that could be used by persons in wheelchairs to gain access to the ground floor. This allowed increased access to parts of the museum. However, due to the museum being inside an old building that does not have stairs or ramps between floors, physical access to other floors has been and continues to be nonexistent for persons who cannot climb stairs. They were also in the process of creating an audio tour for the visually impaired, which, when completed, would heighten the museum's accessibility even more. The Code of Practice specifically mentioned audio tours as suitable adjustments for such disabilities. The audio tour was being created as a supplement for the walking tour, with in-depth descriptions of a few select items, so it would be an inappropriate substitute for moving around the museum, and would not assist mobility impaired visitors much. Another feature the museum has offered are handling sessions where visitors can feel and hold certain artifacts the museum owns. These sessions have also been good for supplying more access to the material for visually impaired patrons. Lastly, it has been planning on creating a large print version of their web site for web users (CDML, 2004).

The museum has been taking some steps towards making itself more accessible. However, most of the changes accommodate visually impaired visitors more than other types of disabilities. Mobility impaired visitors received a severely limited accessibility as of the start of our project, and that was a problem. The museum needed to make some type of change to allow for equal treatment of all guests who wanted to visit (CDML, 2004).

Possible Building Modifications

The problem that faced the Charles Dickens Museum was that access was limited for those with mobility impairments. Historically, other facilities with the same problem have utilized a variety of ways to address this problem; the most common solution in use being to have installed ramps and lifts. This was most often costly; however, if the

Charles Dickens Museum had pursued it, it would have been a permanent fix and most likely provide complete access to the museum for those with mobility impairments. Another possible solution could have been to move the contents of the museum to a new building which could provide better accessibility.

Although updating the museum with the addition of ramps and lifts between floors of the museum or moving the museum to a new building would both have been possible solutions, neither were viable options in the case of the Charles Dickens Museum. As noted earlier in this paper, the building that the museum is housed in (48 Doughty Street) was home to Charles Dickens from 1837 to 1839, making the house itself an exhibit of historical value. Although this has added to the atmosphere of the museum, it has also adversely affected the possible solutions that could have been instated in order to improve disabled accessibility. Modifications affecting the building's architecture would have caused some loss to the building's historical value, which ruled out the possibility of installing ramps and lifts. The prospect of moving the museum to a new location was also inappropriate since the current location of the museum is the only house in London Dickens inhabited that has not been destroyed (CDML, 2004).

Virtual Tours – Overview

Another possible solution to the accessibility problem that was considered was a virtual tour. The Charles Dickens Museum Board of Trustees, after considering the idea building modifications, agreed that a virtual tour would be the most appropriate method of providing better access to those with disabilities. Virtual tours, in general, are attempts to take as much as possible from the true experience of an on-site tour and convey it to the user of the virtual tour as if they were actually there. There are many types of virtual tours, each with their own advantages and disadvantages. Some virtual tours have made use of still photography and text descriptions, while others use computer programs to allow the user to "walk around" a virtual building and interact with objects. Depending on an organization's situation and requirements, different types of virtual tours could be

more appropriate. The following sections discuss a few of the possible methods used to create virtual tours.

Virtual Tours - Text-Based

Perhaps one of the simplest types of virtual tours is the text-based tour. This type of tour attempts to bring the tour experience to the user by utilizing only descriptive text. While this may be the simplest tour to understand, it can be quite difficult to create an effective version. In order to bring the museum to life for the reader, the writer would have to be quite descriptive and able to convey an accurate sense of the space. One negative aspect of a text-based tour is that since it is all text, there is no visual aid to help the user picture what it would be like to visit the museum. On the other hand, since this type of tour is purely text based, it would be quite easy to distribute. This tour would be easy to print out for distribution, since it is text it could be converted to Braille for those who are visually impaired or read aloud with a screen reader such as Microsoft's Narrator.

Virtual Tours – Photography

Another option we considered was using still-photography to capture the most important parts of the museum. Photographs could be paired with descriptions to give the user a better idea of what the passage is trying to explain. Also, through the use of digital photography, the images could easily be put on the Internet to allow people from all over the world to experience the virtual tour. If the photographs were digitalized, the tour could be made interactive, with the user clicking on specific parts of the pictures to perform different actions. For example, the tour could be designed to allow users to advance through rooms by clicking on a door in the picture. It would also be possible to make it so that if they click on a specific artifact the tour could give them a detailed description of the piece in question. One benefit of this type of tour is that users can actually see the exhibits, which means less of the tour would be left to the imagination. This could help prevent any misinterpretations that could result from text based tours.

Although still-photography is visual, it is not immersive, which may take away from the reality of the experience (Brannon, 2002).

One way to make photography more immersive would be to use panorama technology. Using specialized equipment, panorama photography creates an interactive computer image which can allow the user to interact with the picture, and can also allow the viewer a 360° view of the room. This method adds further realism to the tour since the user is allowed to look around the room almost as if they were actually there. One limiting factor to this approach is the fact that the panorama only allows the user to view a certain area of the room. While the user is free to look to the left and right, the ability to look up and down can be greatly limited unless specialized equipment is used to position the camera. In most cases this is not a problem, because the interesting aspects are in field of view. In situations where there is elaborate carpeting or a painting on the ceiling, however, a more complicated panorama should be created by using a specialized piece of equipment that would hold the camera appropriately, and stitching them together (Brannon, 2002).

Virtual Tours - Three-Dimensional Models

To make the tours even more realistically interactive, 3D animation was another alternative we considered. Three-dimensional animation allows users to load files into computer programs to let them to interact with specific artifacts. Depending on how the 3D animation is done, the user has the ability to rotate and zoom in on the item to view it in virtually any way they please. This is beneficial because it allows the user to hold the object in a way that may not even be available in real life. For example, if there were an old, fragile artifact that may break if handled roughly it could be modeled on the computer so users could still look at it from any direction they please. One drawback to this method is that programming the physical object into a three-dimensional computer image takes a lot of time and knowledge in computer modeling. There are some free software programs that allow the programmer to model the item, but these programs are often difficult to learn. One such program, Blender (http://www.blender3d.org/), allows the programmer to model the item and then export a file that is viewable by most modern

computers. While this media works with modern computers, it is difficult to ensure that all users on the Internet will have computers and a connection capable of handling a complicated 3D-model (Brannon, 2002).

Virtual Tours – Audio

While most virtual tours are visual, audio is another method that can be used in creating a virtual tour. Most audio tours are used while someone is walking through a museum; this approach could be adapted for those who are not able to walk throughout the building. While this may not work in all situations, if it were done correctly this method could effectively meet the needs of some of the members of the target disabled population. A narrator could describe the different rooms and artifacts as the user is guided through the museum, and other special effects could be used to enhance the experience. Voice actors could act out a scene complete with sound effects and music to make the tour as entertaining as possible.

Virtual Tours – Video

In addition to using photographs and audio, these two media can be combined to make video tours. This could either be a video that just plays start to finish, or it could be an interactive activity where the user can pick which video they want to watch. This approach would work well since the user will be able both to see what is going on, and to listen to the audio descriptions. Also, with video the tour would be able to incorporate music, animation, and other special effects not present in some of the other types of virtual tours. Although some of these effects would be costly, both in terms of time and financially, they would enrich the experience for the user, and may be able to convey the message in a more interesting way (Drake, 2002).

Virtual Tours - Distribution

At the beginning of the project, we asked our liaison to the museum, Curator Florian Schweizer, how a virtual tour, if one were created, would be made available to

the public. He indicated that it was the museum's wish not to limit access to the tour only to people who were able to visit the museum. This indicated to us that if our final product was a virtual tour, it should be one that would be easily viewable using the internet.

Virtual Tours - Accessibility Considerations

To ensure that the adjustments the museum made were satisfactory for its patrons and the guidelines of the DDA, every kind of disability and all accessibility issues had to be taken into consideration. As discussed in the last section, one service the museum wanted to implement in order to improve accessibility without modifying the building was the creation a virtual tour available through the Internet. In order to view the virtual tour, internet access would be needed. If a person did not have access to the Internet, he or she could not view the virtual tour and no progress will have been made in improving access to the museum. One way to address this issue that we suggested was to have computers connected to the internet available for use in a disabled-accessible part of the museum.

A second issue considered was making sure the website containing the virtual tour was accessible to disabled persons who have access to the internet. Although the DDA does not specifically mention web accessibility, there are indications that the DDA could be applied to websites. There are four ways a provider of services can discriminate against a disabled person according to the DDA. Three out of the four could be applied to web accessibility. These three ways are by refusing to provide a service to a disabled person one offered to members of the public; making it unreasonably difficult for a disabled person to use any service; or offering sub-standard service to someone with a disability (DDA, 1995, part III, section 32).

There are no official guidelines for web accessibility in or referenced by the DDA, but the Worldwide Web Consortium's (W3C) Web Content Accessibility Guidelines (WCAG, 1999) have been accepted worldwide as a benchmark. According to articles published in the *Journal of Information, Law and Technology*, Level A of the WCAG would be a realistic and clear standard for the Courts to set as an initial

benchmark for DDA compliance (Sloan, 2001). Level A conformance means that all Priority One checkpoints in the WCAG are satisfied. Some Priority One checkpoints include providing text links for each active region of a server-side image map, providing an auditory description of the important information of the visual track of a multimedia presentation and providing a text equivalent for every non-text element (WCAG, 1999).

Watchfire, a company that provides online risk management software, has developed a program called "Bobby" to assist in helping websites to comply with WCAG standards. Bobby can test for compliance with either the WCAG or the U.S. Government's Section 508, and exposes problems and offers suggestions on how to fix them. The program currently costs approximately £150, but there is a free trial version that can be used that is available on the company's website (http://bobby.watchfire.com/bobby/html/en/index.jsp).

Another set of guidelines that we took into consideration were those issued by the Royal National Institute for the Blind (RNIB). These guidelines are called "See it Right" guidelines, and give details about website design features that make websites accessible to those with visual impairments. There is also a checklist that the RNIB provides for website designers to use to make sure they meet RNIB standards. The RNIB will audit websites if given enough time for a cost which varies by website and institution (Royal National Institute for the Blind [RNIB, 2004]).

Virtual Tours - Consistency with In-Person Museum Visit

Perhaps the most important thing that we considered when we made a virtual tour was how similar to a real, in-person museum visit the virtual tour could be. Although it is impossible to duplicate with a computer the same experience of visiting a museum, the technology available today is capable of producing a good representation. An epitome of this would be a booth that provided all of the sensory information that a fully-able-bodied person (should such a person exist) would experience while touring the museum. This, however, does not meet the previously stated requirement of being able to be available through the internet. We decided that virtual tour for the museum should contain sections for each of the most important exhibits in the museum. We thought that it would be

appropriate that after going through the virtual tour, the user should take away a very similar experience to someone who has actually visited the museum.

It should be noted that by using certain methods a virtual tour experience could have aspects that are richer and more interesting than an actual visit. These methods may include the use of professional voice actors, high quality audio, and providing virtual experiences that would not be available during an actual visit. Users may attain more information and a better understanding of the information presented as a result of the quality of this type of tour. However, it would not be as similar to an actual visit as we had decided that we wanted to make the tour we created, since our goal was to provide equivalent access to the museum.

In summary, because the Charles Dickens Museum is housed in one of Charles Dickens's former homes, the museum was previously not providing sufficient accessibility to those with mobility impairments. In order to make the experience of the museum available to an even broader audience, we took into account the museum's preferences (See Appendix A) and decided that a virtual tour available through the internet was an appropriate solution. This means that it would allow users of the tour to view the museum's exhibits and displays from any computer with internet access. The heightened accessibility due to the implementation of a virtual tour would mean that the museum would be compliance with the standards of the DDA.

3. Methodology

The goal of our project was to increase the accessibility of the Charles Dickens Museum for disabled persons. In our background research we explored several different methods of accomplishing this. Through this research, it became apparent that the best option would be a virtual tour. It was our group's opinion that the following questions need to be answered in order for our virtual tour to be effective:

- Which exhibits have patrons found the most interesting and enjoyable?
- What difficulties have visitors encountered, both in viewing exhibits and making their way through the museum?
- What type of virtual tour is the most effective in the areas of conveying information, keeping viewer interest, and ease of use?
- What would the total cost be to implement and keep up each type of virtual tour?

We used surveys and other research techniques to explore the answers to each question. In the following four sections we will detail how we gathered information about each of these questions.

Assessing Visitors' Needs and Concerns

We felt that when we created a reproduction of the Charles Dickens House Museum that it was important that we use it to duplicate the experience of the original as best as possible. Our virtual tour, we decided, should convey most of, if not all of, the information received during a full museum in-person visit. An emphasis was put on ensuring that the virtual tour included the best exhibits in the museum. To obtain knowledge about which of the museum's exhibits were the best, we assessed people's opinions about the museum. These assessments could have been done using a variety of options, including interviews, focus groups, or surveys.

In order for any of these techniques to have been successful in finding the best exhibit we had to first establish what qualities are present in a good exhibit. Different people may have different views on what constitutes a worthwhile exhibit. One

interpretation of a good exhibit may be one which stimulates an interest in the information being presented. Another opinion could be that a good exhibit is simply one which was enjoyable.

Difficulties Experienced By Visitors

Another set of issues that we needed to consider when designing a virtual tour were visitor concerns with the museum experience. Broadly speaking: what difficulties have visitors encountered, both in viewing exhibits and making their way through the museum? This was a question we needed to ask, and to find the answers to, if we wanted to address the problems using the virtual tour. Also, in asking this, we were able to advise the museum on how to improve the aspects of in-person museum visits, as well.

This question had a wide scope, because it applied to all visitors, disabled and non –disabled alike. It questioned the accessibility of the museum in general. What we were trying to discover is how the museum may have been falling short in its attempts meet the needs of the visiting public. These shortcomings could have included such things as items being placed either too high or too low for easy viewing, or items that were too small and out of sight to be effectively displayed. Also, items that were not well explained or understandable needed to be considered. In addition, mobility accessibility was an important factor. We felt that problems that non-disabled persons experienced should definitely have been explored, as well as problems mobility impaired patrons experienced.

Data Gathering – Visitors' Needs, Concerns, and Difficulties

We determined that the best way to gather the information about favorite exhibits and accessibility issues was through the use of a survey. Since we wanted to sample all patrons to the museum in both areas, questions about difficulties were grouped together with the questions for researching patrons' favorite parts of the museum to form a single survey. In the end, we hoped to have obtained a good idea of what troubles people may have been experiencing during their visit to the Charles Dickens Museum.

Semi-structured interviews with staff members were used to acquire further information about other highlights in the museum. A semi-structured interview involves a script for the interviewer to use, but also allows for any interesting responses to be expanded upon by the interviewer asking further questions not included in the script.

Although the virtual tour is primarily being designed to provide a way for disabled patrons to fully experience the museum, we attempted to receive survey feedback from many types of people visiting the museum. We asked 29 visitors the survey questions just before they left the museum and recorded their answers. We wrote a script to ensure that the survey administrators provide each visitor uniform prompts. The questions were focused enough so that visitors could answer thoroughly without having to give lengthy responses or dwell on the question. We made a map of the museum with an attached brief listing of all the displays available to the patrons in order to prevent the questions from being too difficult to answer (Fowler, 1993). The map and listing are Appendix C. Since we interviewed each of our subjects for the survey answers, we had the opportunity to control the percentage from each demographic area. The survey included questions pertaining to visitors' favorite exhibits as well as questions regarding accessibility issues, such as getting throughout the museum or being able to see the exhibits. These questions not only proved helpful to us in designing the virtual tour, but also may aid in improving on-site visits, as well. Additionally, we consulted previous results that came from previous surveys of visitors to the Charles Dickens Museum, and formed the opinion that surveying 29 visitors gave us enough information to confirm that the conclusions reached from the other surveys were still valid, as is discussed in the Analysis chapter.

The purpose of asking questions concerning accessibility was twofold. First, we could use the results to help the museum make changes to the way that visitors to the museum experienced it. If we had found that some exhibits were out of sight or difficult to understand, the museum could have made changes to improve the situation. Second, we were able to use this information to improve the virtual tour we were constructing. If an exhibit was found to be hard to see in person, then we would have needed to make sure it was visible in any pictures of the room, if we were to have implemented a

photographic virtual tour. This is especially true if we had used a panoramic tour. Also, if we had found that an important exhibit was not getting the attention it should have been, then we could have made sure that we paid special attention to it in the virtual tour.

The staff interviews consisted of members of our team interviewing a few members of the staff of the museum. We used these interviews to gain more knowledge about any past visitor complaints or suggestions, as well as inquiring about how the staff themselves feel about different exhibits and displays within the museum.

Survey Questions – Visitors' Needs, Concerns, and Difficulties

The first set of questions on the survey asked "Why did you want to visit the museum? Was there a specific exhibit or display you came to the museum to see?" This helped determine which exhibits attracted the most visitors. Another survey question was: "Which few exhibits did you find the most enjoyable and interesting during your visit?" It was possible to assess patrons' favorite exhibits and what displays we should have focused on in creating the tour by examining the answers given in reply to these questions.

A question asked in the survey pertaining to accessibility was: "Did you experience any difficulty in viewing any of the exhibits?" This addressed any problems with the setup of the museum and any difficulties with height or placement of objects. It was fairly to the point, and gave the participant the chance to answer "no", rather than come up with something just to give as an answer. If an answer of "yes" was given, the survey script then prompted the survey administrator to ask a follow up question about what the difficulties were.

Another question included as part of the survey was: "Were there any exhibits or displays that you feel could have been more clearly explained?" This question covered the topic of poorly represented items, and might have shed light on exhibits that we needed to pay special attention to and clearly explain in the virtual tour, depending on the importance of the item.

A separate question which focused on accessibility was: "Did you experience any difficulties walking around the museum, or in accessing exhibits?" By asking this, participants had the chance to mention any problems with mobility they might have experienced. These could have included tight stairways, small rooms, or exhibits placed in confined spaces. Since the museum is in an old house, all of these answers were very possible, and unfortunately we would not have been able to do much about them. We might have, however, found out about other problems that the museum was formerly unaware of that we could have fixed or made a note of to the museum. Also, it could have highlighted exhibits we needed to focus on in the virtual tour, particularly exhibits that were found to be difficult to view, but still deserved coverage on the web site.

The final question included in the survey was: "If a virtual tour was available on the web would you visit it, and would it affect whether you visit the actual museum?" This helped us to predict if there were going to be any effects on attendance to the museum due to our creation of a free virtual tour available on the Internet. If we had found results indicating that attendance would probably drop, we would have then performed further research to find if there would be any substantial financial problems. Seven questions was a reasonable length to ensure that the survey was completed in a reasonably short amount of time. (See Appendix B for the survey script.)

Interview Questions – Staff Opinions on Visitors' Needs, Concerns, and Difficulties

The general questions we used in our staff interviews are enumerated in Appendix C. The questions about past visitor complaints or suggestions helped us gain a better understanding of how visitors have reacted to the museum and its contents over a longer period of time. If, after analysis of the data, we had found that there were discrepancies between past complaints and the concerns we found in the surveys, it would have shown that using the results of our surveys would have be inappropriate, as our survey answers would have seemed to not apply for more than the visitors that provided them. The questions about the staff members' views about the museum helped us understand what exhibits the experts felt were most important, and why they felt that way. One of our questions asked about the person's relationship with the museum, either paid or

voluntary, and why he or she began working there to find out more about his or her prior exposure to the different aspects of Dickens's life and works. The different interests of the employees may affect their answers about what should be included in the virtual tour. For example, a volunteer who came to the museum as a scholar of the Victorian era with merely a passing interest in Dickens might have insisted that the rooms which were reproductions were the most important things to focus the tour around, while another worker might have said that the exhibits about Dickens's personal interactions were more important.   We wanted to take this into account in our analysis of their responses.

Data Analysis – Visitors' Needs, Concerns, and Difficulties

For the questions that pertained to visitors' favorite exhibits, we tallied the responses to find which exhibits or displays the people seemed most interested in. In constructing our final version of the virtual tour that we presented to the museum, we wanted to be sure to include at least the responses that appeared with the most frequency, as well as any responses that groups of people liked exclusively, if there had been any. Regarding the questions about accessibility issues, we wanted to pay special attention to any factors that are mentioned frequently. We also kept any staff responses about important exhibits or displays in mind when we designed the final product. The results from the survey and interviews helped us learn what to focus on when making the tour, both in content and format.

Virtual Tour Technology - Testing Tour Types

A poor way to try to solve the problem of accessibility to the museum would have been to create a virtual tour of the museum that bored users, poorly conveyed information, and made it nearly impossible to find anything. To prevent our tour design from having these flaws, we felt that it was appropriate to find out what type of virtual tour was the most effective at conveying information and keeping viewer interest, while retaining ease of use. We also thought that the level to which the visitor felt he or she

was immersed in the material was important. Combining this information with the information about the cost-effectiveness of the tours and resource limitations of the museum enabled us to make a better design for the virtual tour than we could have without it. After having decided which type of tour is best overall, we attempted to combine the information gathered about museum exhibits to make an effective virtual tour for the museum.

We decided to test user responses to prototypes of different tours to answer the question of which type of tour will best serve our and the Charles Dickens Museum's purposes. These include text-based, still picture, panoramic and video virtual tours. We allowed users to experience each type of tour, and after they were done have them rank the tours among themselves in five different categories. These categories were: ease of use, how well the tours kept the user's attention, how effectively and clearly they presented the facts and information, how effectively they immersed the user in the environment, and the overall impression the user had of the tours individually.

In order to ensure that the feedback was not biased because of tour-content we created four prototypes, making all of them about one location, all of which described the room and highlighted the same four objects present in that room. The room that we chose was the Morning Room, which is located on the ground floor. At the time of our creation of the prototype tours, it featured a "Family Exhibit" that conveyed a few facts about Dickens's children, his wife, and other members of his family. It also included a family tree that showed his descendants. We attempted to include the same information in all of the different media types so that the amount of information conveyed by each sample would differ only by the users' understanding of what each one was trying to communicate. Of course, after having seen or read about the same place several times, the users could have walked away with the mistaken feeling that the last type they encountered was the best at conveying information because they had already learned the information from the first few trials. To counter this difficulty we had the users experience the prototypes in random orders.

Depending on the length of time spent on each prototype, the randomization of order hopefully prevented all of the users from becoming bored with the same tour just

because it was the last one. The randomization prevented all users from experiencing the same order in tours, which should have evened out any loss of interest over time spent testing.

The four different media that we chose for the different prototypes were text-only, still photos with text, panoramic and still photos, and video. We did not include the option of an audio tour because the museum was already working on an audio tour, and also because audio files would be too large to be easily accessible on the internet in reasonable amounts of time. We did not include the option of a three-dimensional tour because it would also take a long time for someone to access from the internet.
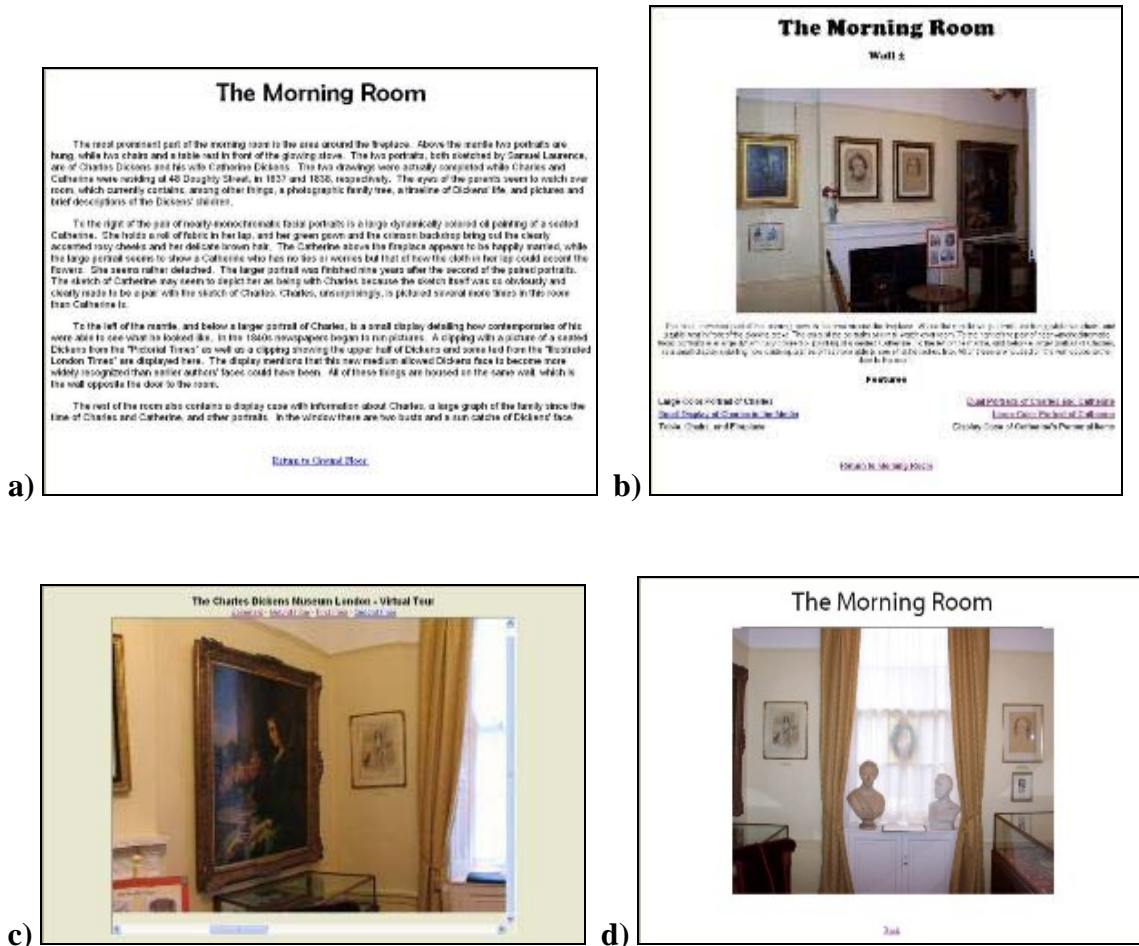

Figure 3.1 (a, b, c, d): Screenshots of Prototype Tours: a) Text Based, b) Photographic, c) Panoramic, and d) Video.

Going through the different prototypes that we made and ranking them was a time-consuming process, even though there were only four of them. That meant that we could not have expected casual visitors to the museum to participate. Instead, we decided to approach the volunteers and staff of the museum. This served another purpose, as those who volunteer and work for the museum had enough interest in the museum that they probably evaluated each prototype honestly, and possibly were able to consider how each type could be applied to the museum's other rooms. Going through the process of ranking the tours should not have been too much of an inconvenience to volunteers and staff because they should have already been familiar with the material.

We also contacted the Royal Association for Disability and Rehabilitation (RADAR) in an attempt to test responses from those suffering with disabilities. Only one representative from RADAR actually participated in testing the prototype tours. David Wright, Head of Information and Communication Technologies (ICT) for RADAR, filled out one of the feedback forms after going through the four tour types.

Once we had gathered the rankings for the tours we put them into a decision matrix to decide which tour type is the best in the areas of keeping user interest, ease of use, conveying information, immersion, and overall ranking. A decision matrix is a method of weighing the importance of each area to determine an overall score. The best tour in one area might not have been the best tour to use because of other factors, and the decision matrix allowed us to view the situation in a more holistic manner. It was also useful because it allowed us to compare each tour against the others in different categories.

The decision matrix we made to analyze the data from the prototype virtual tour rankings took five categories into account. The categories were ease of use, how well the virtual tour kept the user's attention, how effectively and clearly it presented facts and information, how effective it was at immersing the user in the environment, and a ranking based on the user's overall impression of the tours. Each category earned a point value based on the rankings users gave the tours. If the tour ranked first it earned four points, second place earned three points, third earned two points, and last earned one point. Each category was worth a certain percentage of the overall score.

If the tour we that we had decided to create had significant proportion of low responses to the "Ease of Use" question, we decided that we would create a tutorial. This would provide users with basic instructions on the operation of the virtual tour, hopefully clearing up confusion.

Assessing Virtual Tour Costs

One thing that we considered when choosing how to produce a virtual tour was the cost of producing a quality representation of the real tour. In some cases, virtual tours require specialized equipment that the museum would need to buy or rent. If we had decided on a virtual tour that exceeded the museum's budget, it would have been quite difficult to implement it, which is why it was important that we determined estimated costs and budget before we finalized our decision.

In order to estimate the costs of the various virtual tours, we needed to consider how much the equipment necessary to produce each type of tour costs, and how much the tours could cost to maintain. We needed to consider the cost to buy or rent various types of equipment, such as still cameras, video cameras, camera tripods, and microphones. In researching the various costs, we referenced product catalogs and stores. Also, we checked with the museum to see if they had any equipment that we could use, without having had to buy or rent.

In addition to equipment costs, it was important to include software costs in our estimates. Software existed that could have been used to assist in the creation in all of the types of tours that we considered. In some situations, the specialized software that could have been used to produce the tour would have made it relatively easy to update the tour in the future. That was an important consideration since we were only able to work with the museum for seven weeks. A computer program that was more user-friendly would have been a better option than another that was less user-friendly, because the less user-friendly program might require special training to use, which would then cost the museum in either time or money if they wanted to use the program to update the tour.

When we calculated the overall cost of each tour, it was important to include time and labor as well as the monetary cost. If one particular type of tour had cost little to implement, but was difficult to update in the future, it would not have worked in this situation. Similarly, if a tour was easy to create and update, but exceeded the museum's budget, it would also have been inappropriate. It was for this reason that when we calculated the cost of different virtual tour methods, we used an estimate of the overall cost, as opposed to the initial cost, and looked at factors other than just money.

4. Results - Visitor Surveys

After three days of taking surveys in the manner described in the methodology chapter, we were able to collect data from twenty-nine visitors to the museum. Because of the nature of the Dickens Museum, it does not receive the high volume of visitors enjoyed by many other museums. This is reflected in our relatively low sample size. We could have taken more data if we were unsure of the validity of the data, but the data matched well with data from previous surveys, so we were satisfied with the results. Using a Microsoft® Excel spreadsheet to examine our results, we noticed that the data showed clear trends. These trends were visible in that, even though we had surveyed people from many different societal groups, we were either getting consistent answers or widely varying answers, the varying answers varying even within the different groups. Additionally, we were given results from previous surveys undertaken at the museum which showed similar trends. This clearly indicated that if we were to take more surveys the additional data would not have helped us. We created a visual measure of the data by grouping the responses within each question into main categories. Figure 4.1 displays the number of respondents within each age and gender group. From this figure, it is clear that we surveyed more females than males, and also that we surveyed more young people than older people, but these results match up with previous surveys' results, as discussed later in this chapter.

For each of the questions, we placed the possible answers in different rows within the same column, then for each response we colored in a cell to the right of the corresponding answer. As an example of how a response was categorized, if someone mentioned they liked a specific portrait for the question relating to his or her favorite items within the museum, we grouped that person's answer with the answers from other people who had also indicated that their favorite exhibit was a portrait or set of portraits in the category of "Portraits." If, however, the person had indicated that his or her favorite items were a portrait and the restoration of the Drawing room, we would fill in a block in both the "Restorations" row and a block in the "Portraits" row. This
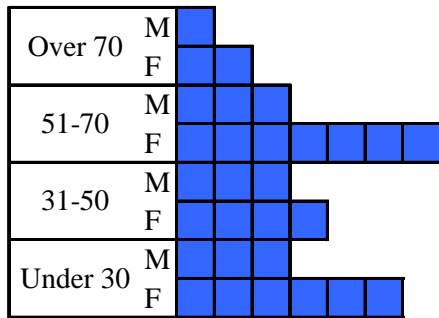
Figure 4.1: A frequency chart of the ages and genders of the persons who participated in our survey. Each box represents one respondent.

method of counting responses means that we sometimes have more than 29 blocks filled in for the question. This effect will not hinder the analysis of our data because we were more looking to find out what opinions people had, rather than who had those opinions. We noted the ages and genders of respondents, as stated in the Methodology Chapter, only for the purpose of making sure that we did not focus only on one or a few demographic areas.
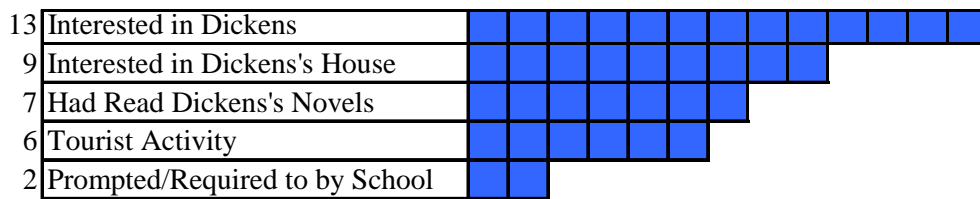
Figure 4.2 - Responses to Question 1, which was "Why did you want to visit the museum? Was there a specific exhibit or display you came to see?" The numbers to the left of the category names are the number of responses in those categories. Each block to the right of a category name represents one response.

The results of the first question of the survey are shown in Figure 4.2. The second part of the question is a memory prompt, not a second question. Several people gave

responses that fit into two or more categories, resulting in 37 blocks filled in instead of 29. The double-responses were from areas of people having both read the books and having been interested in Dickens's, as well as having come from people who had responded that they were interested in seeing Dickens's house combined with almost all of the other responses. A majority of the people who took part in our survey visited the museum because they were interested in Dickens. Comparatively few people visited if they were just visiting as a tourist activity rather than having an interest in Dickens or his work. Fewer still (only two people) visited because they were required or prompted by their school to visit.

11	Personal Effects	
7	Volunteer Help and Library	
6	Biography Video	
6	Family Exhibit	
6	Portraits	
6	Room Reproductions	
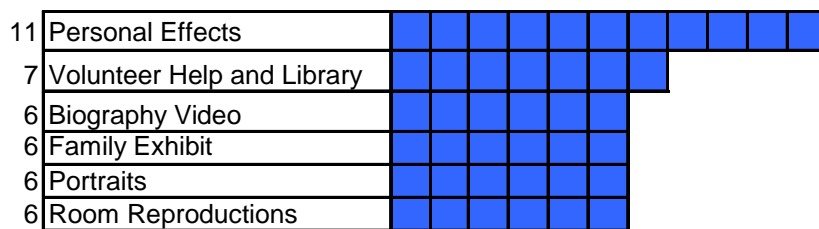
Figure 4.3 - Responses to Question 2, which was "Which few exhibits or displays do you find the most enjoyable and interesting during your visit?" The numbers to the left of the category names are the number of responses in those categories. Each block to the right of a category name represents one response in that category.

Looking at Figure 4.3, which displays the results from the second question on the survey, it becomes apparent that no one category of exhibits or displays really was the most enjoyable for everyone. Since the question asked for a few exhibits or displays, several respondents gave responses that fell into more than one category. One elderly respondent (over the age of 70) stated that she liked everything. Room reproductions are the rooms that have reproduction furniture and other items to make the room look the way it probably did while Dickens lived here. The category of "Portraits" encompasses all of the photographs and portraits in the museum. "Personal Effects", which seems to be the most popular category, describes anything which belonged to Dickens or anyone else in his family or in that era such as silverware, cups, or dishes. The "Biography

Video" spoken of is a video which is constantly playing in the basement that describes Charles Dickens's life. The "Volunteer Help and Library" category has a response counted for it whenever someone says that the library or discussing something with a volunteer was their favorite exhibit or display.

23	No	████████████████████████████████
2	No theme to rooms	██
2	Picture hung too high	██
1	Language Barrier	█
1	Small print in labels	█
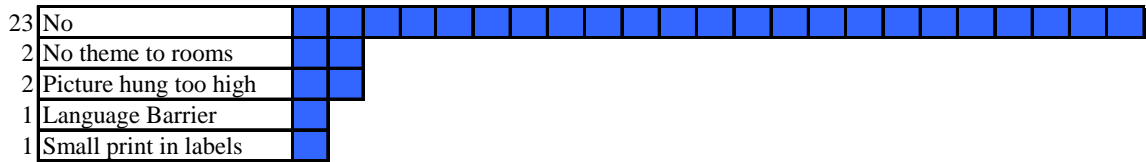
Figure 4.4 - Responses to Question 3, which was "Did you experience any difficulties in viewing any of the exhibits or displays? (If yes, what were they?)" The numbers to the left of the category names are the number of responses in those categories. Each block to the right of the category name represents one response in that category

We found that most people we surveyed did not experience any problems viewing any of the displays (Figure 4.4). A very small minority of people that we surveyed found a few pictures to be placed too high on the wall, or found print in the labels to be too small. Another two respondents thought that the museum would have been more easily viewed if there was more of a theme to each room. One respondent indicated that he experienced difficulty in viewing some of the displays because of his difficulty understanding English.

22	No	██████████████████████████████
3	Dickens's Life	███
2	Dickens's Works	██
1	Would like a guide	█
1	Language barrier	█

Figure 4.5 - Responses to Question 4, which was "Were there any exhibits or displays that you felt could've been been more clearly explained?" The numbers to the left of the category names are the number of responses in those categories. Each block to the right of the category name represents one response in that category.

When asked if there were any exhibits that could have been more clearly explained, most people gave a response of "No" (Figure 4.5). Two people indicated that they would like more of an explanation of Dickens's works, while three others mentioned that they would like more explanation about different aspects of Dickens's life. Additionally, one person suggested that a guide may have been useful, while another had a hard time because of English being a second language.
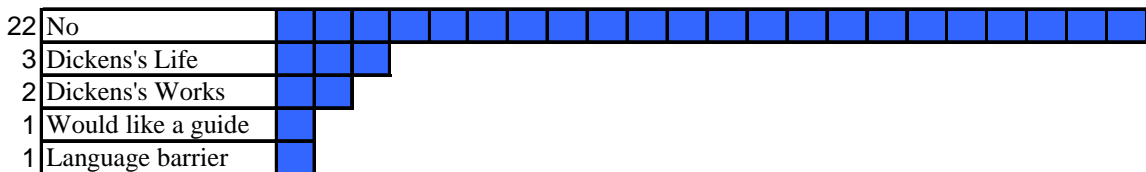

Figure 4.6 - Responses to Question 5, which was "Did you experience any difficulties walking around the museum, or in accessing exhibits or displays?" The numbers to the left of the category names are the number of responses in those categories. Each block to the right of the category name represents one response in that category.

As to how easily people felt they could navigate the museum, while the large majority of people said that they did not experience any difficulties, a few people said otherwise. Three individuals indicated that they would have appreciated either fewer stairs in the building or more seating to be made available on the different floors. The results of this question are displayed in Figure 4.6.

Figure 4.7 - Responses to Question 6, which was "If a virtual tour was available on the internet, would you visit it?" The numbers to the left of the category names are the number of responses in those categories. Each block to the right of the category name represents one response in that category.

The sixth question that we asked visitors if they would visit a virtual tour if one were available on the internet. The answers we received were mixed, but slightly over half said that they would visit the virtual tour. Most of the respondents who said "no"

volunteered the information that they did not have access to the internet. The results are shown in Figure 4.7.

Figure 4.8 - Responses to Question 7, which was "Would visiting a virtual tour affect whether you visit the actual museum?" The numbers to the left of the category names are the number of responses in those categories. Each block to the right of the category name represents one response in the category.

The results of the last question from the survey are displayed in Figure 4.8. As shown, only one person said that they would consider not visiting the actual museum if there were a virtual tour available on the internet.

Results of Previous Surveys

Between the early winter of 1994 and fall of 1999, a total of 5 separate surveys were carried out at the Dickens Museum. The total number of respondents to these five surveys was 1765. Although each survey had its own results and write up, there were a few conclusions that were based on the overall results. These were stated in "Annex 8.2 Visitor Surveys" of the museum's Mission and Operations Manual (MOM). Relating to our second survey question, the sixth conclusion listed in the Annex indicated that "people like personal relics, evocative reconstructions of domestic life, and pictures", and also that "a literary atmosphere… is favored" (The Charles Dickens Museum, MOM). Two of the five surveys did not record respondents' genders. In the studies that recorded genders, women respondents outnumbered men, indicating higher attendance from women. As mentioned previously in this chapter, we also found that there were more female visitors during the time we were taking surveys than male visitors (The Charles Dickens Museum, MOM).

Staff Interviews

Over the course of three days we interviewed six members of the staff of the museum. We selected the interviewees by asking only those who work at the museum at least once a week. These interviews can be seen in full in Appendix E: 1-6. The script of our interview is shown in Appendix D. Of the six people we interviewed four were paid employees and two were volunteers. The time each had been working or volunteering at the museum ranged from three weeks to seventeen years. Each had different reasons for taking their position, such as being referred to the museum by a friend or having an interest in Dickens. Four of the six staff members agreed that the drawing room was their favorite exhibit/display in the museum. The Drawing Room is a re-creation of Dickens drawing room with an elegant Victorian style, and as Florian Schweizer, curator of the museum, stated, "…you can imagine Dickens sitting in the room and spending time there."

Most of the staff agreed that the video biography of Dickens and/or the *Dickens's Dream* painting were visitors' favorite displays in the museum. *Dickens's Dream* is an unfinished painting with Dickens sitting in a chair surrounded by small figures of characters from his books. Also mentioned as favorite items of visitors were the windows taken from a house Dickens once occupied, the "Empty Chair" painting (which was done after Dickens's death) and the amusing letter Dickens wrote pertaining to his broken clock which is posted in the hallway. The staff agreed that not many visitors complained about problems with the museum, but they had seen visitors experiencing difficulties ascending and descending the many stairs.

None of the staff had received comments suggesting that visitors would like a virtual tour to be available online, but they all thought it would be a great addition to the current website. Curator Florian Schweizer, however, mentioned that he had received complaints from teachers when the museum reorganized website (located at http://www.dickensmuseum.com/) and pictures of the building and rooms that were previously available became unavailable. They complained because they had been previously using it as a teaching method in their classes. Each staff member mentioned different things they would like to be included on the virtual tour, but a few very

commonly mentioned ideas were that the virtual tour should work without errors, be easy to use, contain a floor plan, have large font, and use easy-to-read colors. A few interesting ideas brought up by staff members were that they would like the virtual tour to contain some items which are not always on display for the public, such as the items from the handling sessions in the library which are only available during handling sessions. Also, in order to increase the interactive aspect of the tour one member of the staff thought it would be interesting if users had the ability to flip through first editions of books while in the virtual library. The main reason disabled visitors seem to be discouraged from coming to the museum is the lack of lifts and ramps in the museum and the excess of stairs.

Prototype Virtual Tour Feedback

We had three of the six employees we interviewed try out each of our prototype tours (which are discussed in the Methodology Chapter) and complete a small feedback form after doing so. The form we used can be found in Appendix F. Also, we were able to get the agreement of a member of the RADAR organization to participate, and he also filled out the feedback form. The results of the ranking portion of these feedback forms are visible in Table 4.1. As discussed in the Methodology Chapter, each time a tour received a first place vote, it received four points. Similarly discussed, second place received three points, third place received two points, and fourth place a single point.

Using the raw totals as shown, a general idea of what users thought of the tours can be developed. As would be expected, the Text tour won the Ease of Use category, since it requires very little work to view. The remaining three tours only differed by 2 points in total. In the Attention category, Panoramic was the clear winner, followed by video. The next category was "Effectiveness", and again Text was several points ahead of the rest of the tours. Panoramic and Video Tours were closely matched in Immersion, with Video slightly ahead. However, both were several points ahead Still Photo and Text tours.

The comments portion of the feedback form resulted in our receiving several interesting suggestions from the member of RADAR, but the members of staff only gave

compliments. David Wright, the member of RADAR who tried the prototypes, included a few suggestions as to how we could improve upon the prototypes in the creation of the final tour, as well as a few compliments on the quality of the prototype tours. He mentioned brightening some of the pictures to make them easier to see, a steadier camera for the video, and to use multiple formats together for a full experience. His feedback results were taken into account with the others we received.

	Ease of Use	Attention	Effectiveness	Immersion	Overall
Text	13	4	14	4	4
Still Photo	9	8	9	8	9
Panoramic	10	16	8	13	16
Video	8	12	9	15	11

Table 4.1: Raw Totals From Feedback Forms

Researching of Cost Results

Through our creation of the virtual tour prototypes, we found that there was a whole spectrum of possible costs for creating and updating the virtual tour. All of the prototypes were created at zero cost to the museum. However, other features that could be added would require additional software. Also, renting equipment was considered as a possibility, and would have also have added to the cost. In order for a text-based tour to be effective, it would have to have been well-written and thoroughly detailed. Our text-based tour, while possibly not being well-written or as thoroughly detailed as could be desired, was written over the course of an hour. This demonstration only covered around a sixth of the Morning Room's contents. We therefore estimated that it would take a museum volunteer or staff member 4-6 hours to create a detailed textual description of each room and its exhibits. If the museum were to rearrange the room or add new objects, more time would be necessary to either rewrite or edit the old text. With the technology

that the museum already has, the text-based tour would not cost any money. Also, it only took up 16KB for the description that we did write, which would take a negligible amount of time to access from the internet no matter what the user's speed was.

The still-photo tour had the additional cost that photos generally take up more space on the web-server and take more time for users to download than text does. The total size of the prototype still photo tour was 692KB, which is still a very small amount of memory. If the still-photo tour had been decided upon, detailed description of the room could have been nice, but would not have been necessary. In creating the prototype tour we used our own digital cameras and editing software. If the museum did not have a camera available to use, then it would need to hire a photographer or acquire a camera that one of the volunteers or employees knew how to use in order to update it. The least this would cost would be the cost of buying and developing a few rolls of film and buying computer disks with the photos on them. A professional photographer would be far more expensive to just hire, and would also probably want to work in the day, which would cost the museum a day of at least lowered access to certain rooms for visitors. Separate from that cost, some pictures may be difficult to take because of the lighting situation present, so renting lighting was also something we considered. The price to rent a light setup would cost around £10 per day.

The panoramic photo tour could have incurred some of the same possible costs as the still photo tour. The size of our prototype panoramic photo tour was 964 KB, so it was slightly larger than the still photo tour. Panoramic photos capable of giving a 360-degree view of the room are easiest to create using digital cameras and software, which is what we did for the prototype tour. The software that we used was included as part of the camera package for two of our group members' cameras. If we didn't already own the software, it could have been bought for around £30. To create points in the photo that linked to different locations, we were able to once again make use of software that one of our group members already had. If we had used a different format for the picture, the picture could have been zoomed in on and zoomed out of rather than the user just being able to scroll around as they are with the file format that we used in the prototype tour, but zooming in did not improve the resolution with the zoomed state, making it almost

irrelevant. To create points in the QuickTime VR formatted panoramic photo the creator would have needed to buy software, the least expensive that we were able to find being approximately £200 (The Apple Store). The individual photos, in order to be combined into panoramas, must have been taken under uniform lighting conditions and with consistent camera settings. Once again, darker rooms may need to have better lighting than usually present, so renting lighting equipment may be useful. For staff to update the tour, they would need to have access to any software necessary, as well as knowledge of how to operate it. Additionally, a camera would be quite useful in taking the pictures.

Video tours can create several costs. Better sound quality that what we had in our prototype for the video tour would have been easier if we had rented or bought sound equipment, such as a microphone. To update a video tour a digital camera with video capabilities, software for editing the video, and knowledge of how to use those things would be required. There is also a cost of space, in that our video prototype took up 4.7MB, which meant that it took a considerable amount of time to download. Additionally, better lighting would need to be present than what currently exists in several of the rooms, so lighting equipment might need to be rented.

5. Analysis

After going through all the information we gathered and presented in the Results chapter, we reached a few conclusions through analysis of these results. The survey results helped us come up with general observations, and the prototype feedback gave us the foundation for making the final tour. Although all of the sample sizes were fairly small, they seem to support our decision to design the virtual tour using panoramic photography.

Visitor Surveys

The total sample size used when taking survey results was rather small at 29 people, but the demographics represented were quite varied. We surveyed many people aged fifty-one and older of both genders, and also managed to get many people of both genders aged below 30 and between 31 and 50. Also, since the results that we received seemed to match well with the previous survey results, the sample should be a fairly accurate representation of what the population feels. We therefore feel confident that the following analysis of our results from the survey should be applicable to the general populace.

From the first question, which asked why the visitor came to the museum, it appears that most people who visit the museum come because they have had some previous interest in Dickens. Also, since the only part of the museum that people had come just to see was the house itself, the atmosphere of the building should be recreated in the virtual tour as well as possible. The results for the second question revealed that the public as a whole found every type of display, item, and exhibit in the museum interesting. Our analysis of this result led us to think that in order for our virtual tour to be considered complete it must include all types of exhibits, displays, and items, as well as a sense of atmosphere of the building. At first we were thinking that this might not have been possible, but after our creation of the prototype tours we realized that the goal of a complete tour would be attainable.

Almost all of the respondents to our surveys said they had no difficulty in viewing the exhibits. This could have been because they felt embarrassed to admit they did, so it is possible that we could have rephrased the question. We were, however, worried that a less-direct question would yield results that didn't apply to the question we were trying to answer, and we hope that everyone answered honestly. Even though most people said that they did not experience any difficulties, some of the other answers were able to provide some insight into problems that could be fixed. Two respondents commented that there was no sequence between the rooms. Knowing this, we could have tried to create a loose sequence for visitors to the virtual tour to follow. We could have accomplished this by using a side menu during the entire tour so that visitors could just click each room in the order that the menu shows, which would ensure they see everything, and would also provide a sort of sequence. Another two respondents said that some pictures were hung too high on the walls. Although we cannot change this, we informed the Curator about this problem, in case the museum could do something to fix it. Lastly, a single response stated that the print on the item labels was too small for easy reading. On the virtual tour, we made sure that when an artifact was selected on the tour a larger image of the artifact was displayed along with a large font text description of the item. Also, from the RNIB's guidelines mentioned in the Background Chapter, we made sure that all text was easily resizable. This should help any visually impaired users to be better able to read the descriptions.

Question Four, which asked whether any exhibits could have been more clearly explained, was also answered with mostly "No" responses. Those who did give an answer shed some light on things we need to keep in mind. One respondent answered that she would like to see a guide included. This agrees with the earlier-mentioned answer to the third question about the museum seeming to lack sequence. Thus, the need for a guide should be addressed by the navigation system we tried to employ, as well as through explanations of the items currently being viewed. Also, we made a "guided tour" to navigate through the virtual tour, with a recommended order. One visitor remarked on the language barrier, but unfortunately there was little we could do to address this problem. Future work by the museum could make the site multilingual; however our

group lacks the resources and time to make an effective multilingual site. A total of five people remarked about changes they would like in the content of the museum, three saying they wanted more information about Dickens's life, and two saying they wanted more information about his books. Unfortunately, we cannot change the contents of the museum, but we can work to make better explanations of the various items, and to provide more information on all facets of Dickens in general.

Our next question related to accessibility in the museum, to see if we could target other people with access problems besides those that we already knew about. The results of this question also could have helped the museum understand how to improve access for visitors to the museum. We formulated this question in order to help museum staff determine whether people were having trouble getting around. The results, however, did not lead us to a further knowledge of problems getting around the museum, but we did inform the Curator of the museum about the visitors' concerns involving the seating availability. The feedback from the final two questions provided us with the responses we were hoping to see. Around two-thirds of those surveyed expressed an interest in visiting a virtual tour of the museum, and all but one said they would still want to visit the physical museum. This is a good thing because our aim is to expand the access of the museum to those who cannot enjoy an in-person visit, not to take away from the number of people who would normally visit.

After analyzing the survey results, we came to several conclusions. It appears that people would be interested in visiting a virtual tour, but for 96% of those surveyed it would not affect their desire to visit the museum itself. Also, we learned that we needed to include all exhibits in the museum on the tour, including the feeling of being in the house. As far as designing the virtual tour, we needed to form a sort of sequence between the rooms so that people would be able find their way through it, and not miss anything. Also, descriptions of objects needed to be clear and informative. These results provided some insight on what we needed to do to make an effective tour which recreates the feeling of an in-person visit to the Charles Dickens Museum.

Staff Interviews

Analyses of the results of the staff interviews were more informative in some respects than the visitor surveys. Since we were familiar with the staff members, they were more open with us in their answers, and also had a genuine interest in improving the museum. Also, they have observed many visitors, and heard feedback on what people like and don't like. Although the survey results are important because they showed how people felt after a first impression, the staff interviews showed more insightful observations.

The first and second questions combined to give us more of a feeling for what drew the staff members to the museum. The results of these questions, unfortunately, did not combine to give us any further information about best displays and exhibits, since none of them really had a reason related to the content of the museum for wanting to work or volunteer at the museum.

The first question that really gave results that we were able apply to the virtual tour was the question asking what the employee or volunteer's favorite display or room was. Regarding a favorite exhibit or display, the clear favorite was the Drawing Room, so we needed to be sure to pay special attention to the room as a whole, some respondents indicating that this was especially because of its Victorian atmosphere. Unfortunately the lighting in that room is not ideal for photography, especially a panoramic photo, so we had to work on photographing it in a clear way. Some individual displays or items were also noted as being favorites with the staff and visitors, especially the *Dickens Dream* painting. Knowing this, we tried to pay special attention to favorite displays or items when putting them on the tour, and be sure to include as much extra information about them as possible in their text descriptions.

Another response during the staff interviews was when Florian Schweizer, the curator, mentioned that teachers had asked why a previous version of their website had been replaced. The teachers had been using it as a teaching aid when discussing Dickens in their classes. Although the museum made a new website available, the previous version had included pictures, floor plans and other items that visitors had found helpful. The version which replaced it did not. That shows us that people, especially teachers,

had used the Dickens Museum website in the past, and would probably greatly benefit from and appreciate a virtual tour. Another response we found interesting was the idea of allowing visitors to see pages from old books and manuscripts. We thought that this approach would be both immersive and would work well as an added "bonus" to visiting the virtual tour, and would not be very difficult to include on the virtual tour. All we needed to do was scan a few pages in from the books we wanted to include, and then we inserted them into the web page the same way we inserted pictures of the other items.

Prototype Tours

Probably the most important and helpful part of our methodology was the creation and testing of prototype virtual tours. This let us show the staff what we were capable of making, and to see how they responded. Also, with the inclusion of the feedback form at the end, it allowed them to quantitatively compare the different prototypes based on factors we identified as being important in making a decision. As mentioned in the Results chapter, the panoramic tour received first place from all respondents for the "overall" impression they were given. However, we employed a decision matrix to the results in order to give different categories different weights.

The decision matrix applied weights to the scores in amounts that we felt were accurate to how important they were in building an effective tour. The categories of "Ease of Use" and "Attention" were each given 15% weights, and "Effectiveness" and "Immersion" were each given 20%, and "Overall" was given the final 40%. "Ease of Use" was only given 15% of the total score because although the relative ease of use of the tour is important, a tutorial could be provided to help show how to operate it. The category for "Attention" was also given only 15% because we felt that it was difficult to measure this. This is especially true since the user had to sit through the same tour four times, and could grow bored by the last tour. Also, measures could be taken in the final versions to make the tours more interesting. It was interesting to see how they rated each tour with respect to this criterion, though. The prototype tours only showed the bare minimum of what we were capable of making, and that is why we gave "Effectiveness" and "Immersion" the weights we did. They were given higher weights than the previous

two because it is much more important that the tour be effective in providing information and to make the user feel immersed in the experience. Finally, the "Overall" category was given such a great weight because it took into account all the things that weren't already covered, and shows the subjective feelings of the user.

To analyze the results, as mentioned previously in both the Results and Methodology chapters, we gave a first place result four points, a second place result 3 points, and so on. Then, that value that the tour had accumulated in that category was multiplied by that category's weight, and all the weighted values were added together. The total results of the four feedback forms are shown below in Table 5.1.

	Ease of Use	Attention	Effectiveness	Immersion	Overall Opinion	Results
Text	13	4	14	4	4	**7.35**
Still Photo	9	8	9	8	9	**8.65**
Panoramic	10	16	8	13	16	**12.9**
Video	8	12	9	15	11	**11.1**

Table 5.1: Decision Matrix with Final Results

As Table 5.1 shows, the Decision Matrix made it very easy for us to analyze the results we received on the prototype tours. With all the weighted scores, the Panoramic tour medium was the clear winner, with almost 2 points more than the closest competitor, Video. It is true that the video was of low quality, and featured poor quality audio, but these do not detract from the educational aspect of the tour very much. Also, to make the video web-friendly, the picture quality of the video would have to be rather low in order to make it a small enough file size. Both the Video and Panoramic tours were far ahead of the last two, Text and Still Photo. Panoramic did lose in one category, "Effectiveness". As mentioned, that is an important category in a virtual tour, so we need to be sure to improve that aspect of a panoramic tour. The reason for this result was probably because the panoramic prototype used the least text (or spoken text in the case of the video prototype) out of all the prototypes. To improve the effectiveness, we tried

to include more text explanations along with the photographs of the artifacts in the final product.

Cost Analysis

Although the Decision Matrix shows the results for many categories important to the creation of a virtual tour, it left out two important categories: memory usage and price. Aside from equipment already available, the only tour that would require the most extra equipment would be the video tour. As mentioned in the results chapter, in making a full video tour, we would have wanted to use a digital camcorder, not just a digital camera in video mode. This would have provided a better video, especially in terms of quality. Like the panoramic and photographic tours, it could also have required the use of additional lighting. Thus, factoring in price, the panoramic tour pulled farther ahead of the video tour. The same is true for memory usage. The completely text based tour would have taken up the least amount of room, of course, but the panoramic took up little more space than the still photo tour relative to the video tour. The only additional space required was for the single panoramic photo, which wasn't much larger than the still photos of the entire room. The video tour was the worst option in terms of memory. It would have required a lot of space to make full videos that included audio of every room. Considering that the tour was to be made accessible for sight impaired visitors the video would have had to be shown at an easily viewable resolution. Viewing a video tour though a dial-up modem would have been next to impossible and even broadband would have required a lot of loading time.

Overall Analysis of Prototypes

Taking into account both the feedback from the virtual tours and the cost of the different types of tours, a panoramic tour was clearly the best option, so we decided to use it as the primary style about which the rest of the tour was based. It was the top prototype in the results of the Decision Matrix, was able to be created for little to no money, and used a reasonable amount of computer memory. Although the virtual tour

was centered on panoramic photography, it made use of all the other tours in varying degrees. Text was used in explaining the individual items, partially since it was shown that this would increase the effectiveness of the tour in conveying information, but also partially since in-person visits experience the same text. Still photography was employed for zooming in on individual artifacts, so that the viewer could see each item alone. Finally, a couple of small sound files were provided to allow for a more immersive tour.

Final Tour Design

In this section, the basic design of the tour we made is explained. We will not discuss every individual part of the tour, but instead the basic template for the overall tour, as well as some specific standout examples. As stated in the previous section, the final design incorporated a mixture of panoramic and still photography, and text supplements.
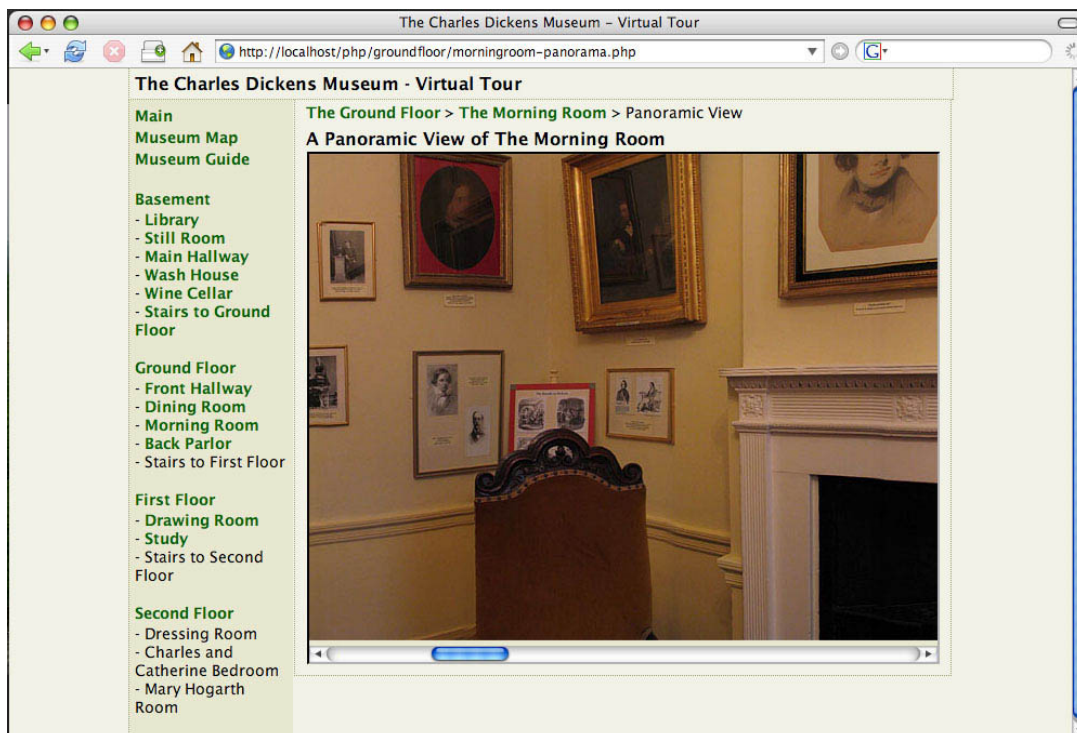

Figure 5.1: Screenshot of final virtual tour design.

The main navigation through the virtual tour is performed using links on the left side of the site. This, and the other features explained can be seen in Figure 5.1, above. This navigation panel (the slightly darker rectangle with text to the left of the screen) is always visible, regardless of what the user is doing inside of the tour. It lists and links to the different floors, and the rooms on each floor. It also lists and links to hallways and stairways, since they contain displays and objects. A secondary way of navigating through the tour is using an interactive floor plan we created. Using blueprints of the museum, we made simple line images of the museum floor plan, with the rooms labeled. From here, the user can simply click on the room he or she wishes to view. This allows the user to get a better feel for how the rooms are connected in real life. Without this, the user really doesn't know how the house looks as far as room placement. This can be very important to know because many visitors come to see what the house is like, and knowing the physical layout is a basic part of such an experience. A third method of navigation we included is found along the top of the viewing pane. It lists where the user is in relation to the rest of the museum, working from the biggest area and going smaller. For example, if you were viewing the Charles Painting in the Morning Room, the navigation along the top would list something to the effect of: "Ground Floor→Morning Room→Charles Painting". All of these words are linked to their respective places, so a user could go directly from there back to the morning room panoramic photo by clicking "Morning Room", or all the way back to the ground floor view by clicking "Ground Floor". By using three methods of navigation, it makes it easier to find your way through the virtual tour, as well as making the tour easier to navigate in general. This is very important since not all users are equally computer savvy.

After selecting a room from one of the navigation menus, the user is brought to a page that displays a small panoramic photo of the room and a text description of the room which includes links to all of the specific items that are displays or parts of displays in the room. These links are duplicated in the larger panoramic photo, which is discussed in the next few sentences. If the user decides to look at a larger panoramic photo of the room, they can click on the smaller panoramic photo. Using a scroll bar along the bottom, the user can scroll the view around the room. The photo is a high enough resolution to allow

the user to see everything quite clearly, and gives a very immersive feeling. We tried to take the photo at a level that includes as much of the room as possible since the user cannot scroll up and down. From here the user can click directly on an area of the panoramic photo that shows a specific item in the room. When the user does so, the view changes to a close up of that artifact or display, along with a text description. The user can further click on the photo to get an even larger image of the item, without text. To get back, the user can easily use one of the navigation methods.

Some items cannot be easily displayed with a photo alone. This includes some of the large display cases found in some of the rooms. To effectively portray these, we created another panoramic photo of the case itself. The cases contained numerous items, sometimes having more than ten items included. Making all of these further clickable would have made the tour rather confusing, so instead we inserted numbers next to each item in the photo. These numbers correspond to descriptions found underneath the photo. Since the panoramic photo here only contains the display case, it is easy to see all the items and further detailing isn't necessary.

To portray the stairs and hallways, which contain many pictures and items on display, we could not use panoramic photography. Instead we took still photos of the entire hall or staircase, using multiple if needed to show the whole area. On the tour, you can then look at each artifact more closely on its own page, just as you can with the panoramic rooms. We also used this technique on some of the smaller rooms, or those with few items on display, such as the Wine Cellar and Still Room.

As this brief description illustrates, we employed multiple styles of web design to present an engrossing and informative virtual tour. Panoramic photography forms the base for the individual rooms, and is further supplemented by text, still photos, more panoramic photos, and short sound files. By using several means of navigation, and making everything easily clickable to proceed, and by having text equivalents for the pictures, it makes for a very easy to use tour. A short tutorial has been included, as well.

5. Results and Conclusions

The completed virtual tour of the Charles Dickens Museum can be accessed online through http://www.dickensmuseum.com/vtour.htm by computers that have connections to the Internet. We were able to have David Wright of RADAR browse through the website, and he was able to give us some feedback. He was quite pleased with what we had done so far, but brought up a few interesting ideas for improvement. We also had a few ideas of our own of how the tour could be improved or updated.

Wright's suggestions for improvements included making keyboard shortcuts for the tour, warning users that some pictures may be dark with low contrast levels, and also that we should mention how users can do such things as change the size of text in the tutorial. We decided that the first suggestion was impossible to do during the time that we had left, but decided to include the other items that he had pointed out.

Even though the photos that are included in the tour are good quality for using a relatively inexpensive digital camera, we thought that a professional photographer may have been able to provide photos with even fewer flaws. The purchase of or renting of higher quality photographic equipment could also improve upon the quality of the photos used in the tour.

If in the future the museum needs to add items to the tour or if any rooms are significantly altered, the tour will need to be updated. Taking a picture of an artifact and typing in the description of it are easy enough. Creating a panoramic photo of an entire room could be done relatively easily as well, since we are leaving them the software that we used to create the panoramic photos.

Currently it cannot be expected that a majority of internet users would be able to access longer online videos and audio files in reasonably short amounts of time. In the future, however, the cost of higher-speed internet connections may have fallen to the extent that videos examining different aspects of the rooms or objects or a full-length audio tour of the museum could be made available on the Internet.

Also, in the future more interactive features, as were suggested by one of the staff members during their interview could be added to the tour. We were going to include

one where the user could page through a book, but we ended up running out of time before we could implement that.

Another issue that could be addressed in the future would be testing the Term C 2005 CAE Group's IQP, and looking into whether or not that template agrees with the course we took for the Charles Dickens Museum's virtual tour.

Appendix A: Organization of The Charles Dickens Museum

Since 1923, the house at 48 Doughty Street in London has been preserved by the Dickens Fellowship, and is currently a registered charity and museum known as the Charles Dickens Museum. As stated on their website, the mission of the museum is "to protect and preserve 48 Doughty Street, with its museum collections, in order to develop it as a national educational centre, serving a range of audiences, for the appreciation of the life and work of Charles Dickens" (Charles Dickens Museum London [CDML], 2004).

Many of the exhibits, along with the house itself, are artifacts of things that directly affected Dickens' life. The lone window of a childhood attic bedroom of Charles' is preserved there (Becker, 1940, p.20). Three of the rooms were reconstructed to appear as they did when he lived at 49 Doughty Street, since almost a century had passed between the times that Dickens lived there and when it was acquired by the Fellowship. A visit to the Charles Dickens Museum can sometimes include a variety of activities. Displays, reproductions, and other exhibits can be found throughout the museum, but there are other opportunities for visitors including attending readings of Dickens' works by professionals, and occasional lectures by Dickens specialists. Several days during the week volunteers come in to the museum and are on hand for visitors to ask questions of and have discussions with. Additionally, teachers may request that the Education Officer of the Museum visit their school, free of charge. Workshops around the time of Christmas are pleasant diversions for families and children. The museum can be rented for parties, tours for small groups, and even to take footage for films. A unique experience that the museum makes available is the opportunity to handle some historic items, including a quill Dickens once used (CDML, 2004). There are also tours of the city through the "London Walks" organization which take visitors through London as Dickens or one of his characters would have experienced it (http://london.walks.com/).

The Board of Trustees is a body that governs over the museum and its dealings. Its members are elected by the Dickens Fellowship as well as by corporations and businesses that deal with the museum. The Trustees mostly make the large decision for

the museum, and set goals for the coming year. Many of the smaller decisions are handled by the director and curator.

The museum is staffed by a handful of salaried and volunteer workers. The paid employees include a curator, museum director, custodian, and store clerk. Volunteers handle such things as the handling sessions, as well as sometimes managing the door and gift shop. Researchers are also present on some days of the week. The primary liaison that our group dealt with was the curator, Florian Schweizer. However, all of the employees helped us by providing input or answering questions on at least one occasion.

The museum's main sources of income are from admission fees (£5.00 per person), store revenue, and payment from renting the adjacent building. As a non-profit organization, most of this income goes into paying for utilities, salaries, and replenishment of the store inventory.

The project of creating a virtual tour of the museum, especially one aimed at expanding the museum experience to those with disabilities, is definitely related to the mission of the museum. The mission statement clearly states that they want to serve a range of audiences, and the inclusion of those with disabilities is important. Also, they charge themselves with educating people about Dickens, and with expanding the appreciation of Dickens. Leaving out a group of the population is not in line with such goals. The original problem statement and our objectives are below.

The results of this project will provide the museum with an operational virtual tour, available on the internet to interested viewers. Through this, more people than ever will be able to see what the museum is like, and what artifacts are on display. Disabled persons who were previously unable to visit the museum will now be able to see the inside in an accurate and somewhat immersive way. In addition, anyone with internet access will be able to visit. Those who are unable to visit London and see the museum in person will be able to now. The virtual tour could promote the museum in new ways, and get more people interested in visiting the physical building after seeing what is offered online.

Problem Statement and Objectives

The United Kingdom's Disability Discrimination Act (DDA) requires that public places such as museums provide access to people with limited mobility. Since the building that houses the Charles Dickens Museum was once his home, it can not be modified architecturally without destroying some of its historic value. This project seeks to design and implement a thoughtfully designed virtual tour that captures the important experiences of a visit to the Museum, thereby assisting it in complying with the DDA.

Appendix B: Survey Script

Visitor Questions

Hello and thank you for visiting the Charles Dickens Museum. I am a member of a group working with the museum to create a virtual tour. I would appreciate it if you could answer a few questions about your visit which would help in our designing of the virtual tour. It should not take any more than five minutes of your time.

> {Note Age}
> {Note Gender}

For any questions about specific displays you may consult this map of the museum.*

1. Why did you want to visit the museum? Was there a specific exhibit or display you came to the museum to see?

2. Which few exhibits or displays do you find the most enjoyable and interesting during your visit?

3. Did you experience any difficulty in viewing any of the exhibits or displays? (If yes, what were they?)

4. Were there any exhibits or displays that you feel could have been more clearly explained?
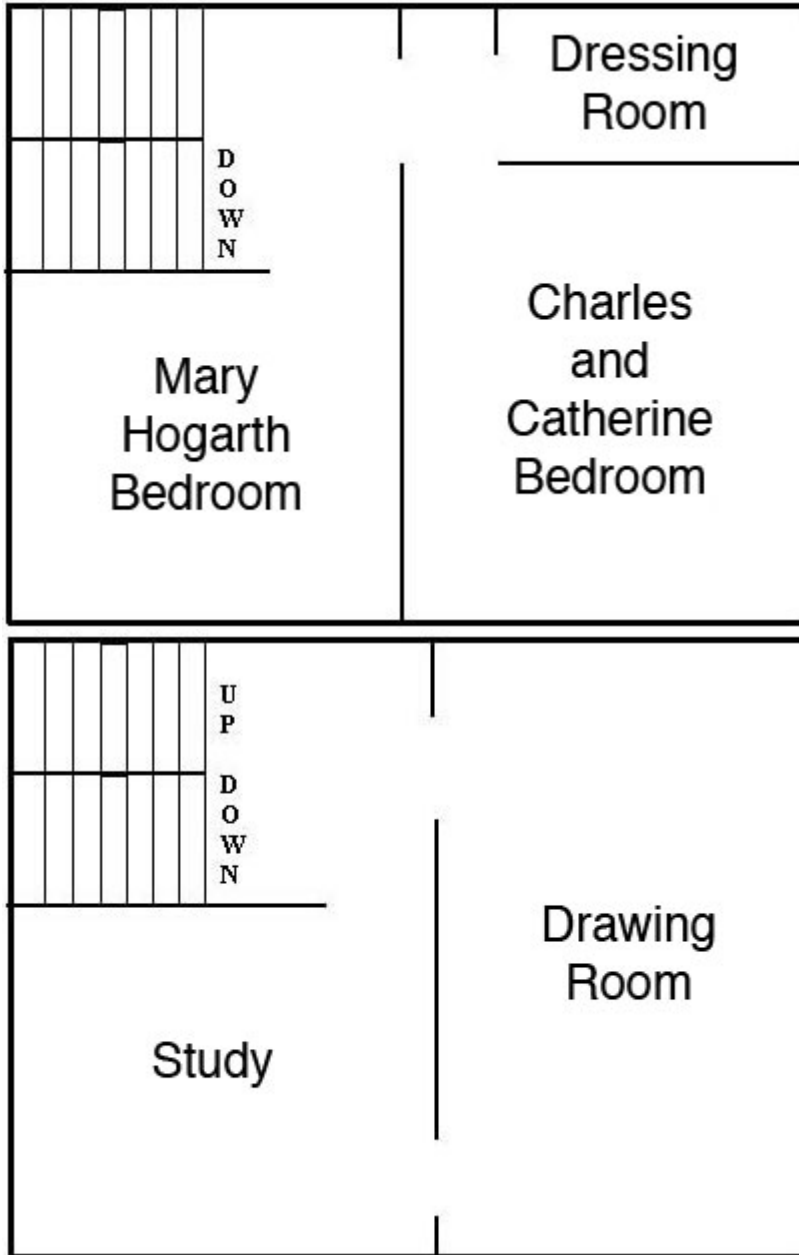
5. Did you experience any difficulties walking around the museum, or in accessing exhibits or displays?

6. If a virtual tour was available on the Internet would you visit it?

7. Would visiting a virtual tour affect whether you visit the actual museum?

* The map of the museum and description of the contents of different rooms in Appendix C are posted near the place where people are surveyed.

Appendix C: Map of Museum and Description of Displays/Contents

Back Parlor
(Gift Shop)

DOWN

UP

Front Hall

Morning
Room

Dining
Room

WC

UP

Wash
House

Kitchen

Wine
Cellar

Still Room
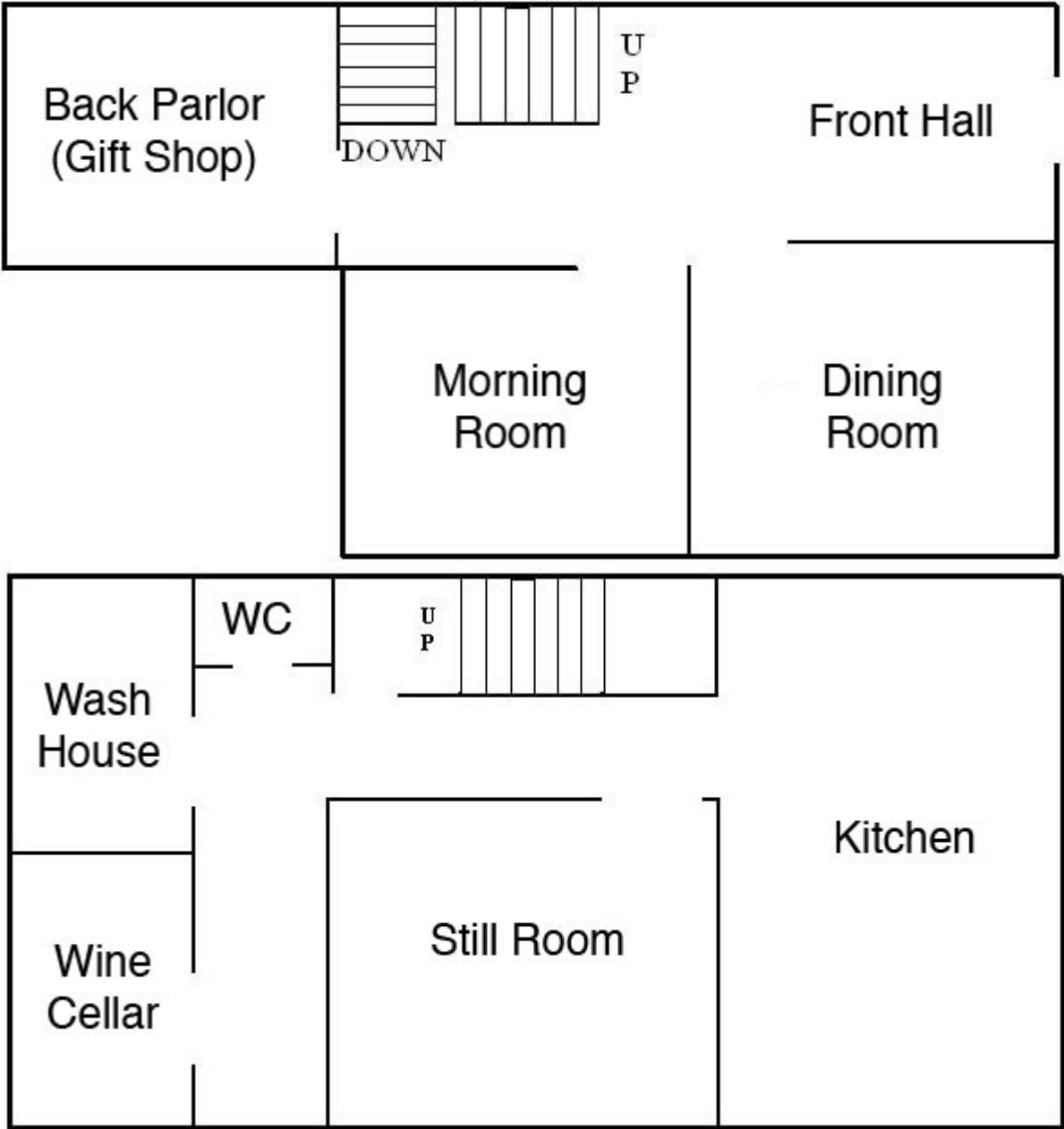
Second Floor

Charles and Catherine Dressing Room
- Diorama Including an Original Reading Desk

Charles and Catherine Bedroom
- Reading Tour Artifacts
- Map of Reading Tour Stops

Mary Hogarth Room
- Backdrop
- Mary Hogarth Paraphernalia
- Playbills
- Artifacts

Ground Floor

Dining Room
- Artifacts of Dickens's, mainly personal
- Grandfather Clock
- Two Busts, one of Charles, one of an Illustrator, Portrait

Morning Room
- Family Portraits
- Fireside Display
- Family Tree
- A Few of Catherine's Belongings
- Biographies of Dickens and Dickens' Life in Pictures

Front Hall and Staircase up from Ground Floor
- Clock
- Timeline of Dickens's Life
- Pictures, Figurines, Other Artifacts from Literature

- Window from one of Dickens's childhood house
- Pictures of Dickens Memorial in Westminster Abbey

Back Parlour
- Gift Shop

First Floor

Drawing Room
- Restoration

Study
- Items from Studies
- Books
- Writing Implements
- Marble Bust of Dickens
- Non-traditional/Artistic Portraits of Dickens
- Items Surrounding Dickens's Death

Basement

Stairs to Basement from Ground Floor
- Dickens Fellowship Paraphernalia

Kitchen
- Library

Still Room
- DVD Display

Hall
- Marshalsea Grill

Washhouse
- Restoration

Wine Cellar
- Restoration

Appendix D: Staff Interview Script

Staff Questions

{Record name}

1. Are you a volunteer or a paid employee?

2. What made you interested in the position?

(Can expand on)

3. How long have you been working/volunteering here?

4. What are your favorite rooms/displays/objects in the museum? (Why?)

5. What do visitors seem to like the most or least?

6. Have you (personally) observed anyone having any difficulties or received any complaints?

7. Have you received any feedback indicating that people would like an online virtual tour to be made available?

8. What would you like to see available on a virtual tour?

9. Do you know of any possible factors present in the museum that may discourage those who are disabled from coming or that may prevent them from fully enjoying the experience of a museum visit?

Appendix E: Staff Interviews

1.

Name: Andrew

1. I am a paid employee.
2. I am an archaeology major and working at a museum provides the best pay.
3. I have been working here for ten years.
4. My favorite room is the library. I like the Samuel Lawrence portraits of Catherine and Charles and also the Dickens Dream painting.
5. I think the visitor's favorite thing in the museum is the video and the Dickens Dream painting. I think that visitors dislike the condition of the hallway and it needs to be restored.
6. I have received no complaints from people, but have seen people experiencing issues with the stairs.
7. I have received no feedback indicating that people would like an online tour.
8. I would like the virtual tour to include items not on display to the public, such as items from the handling sessions in the library.
9. There are no lifts or ramps in the museum preventing those with disabilities from accessing the upper and lower floors. The house is not very close to any tube stations and is located in a non-residential area, making it hard for some people to get here.

2.

Name: Don

1. I am a paid employee.
2. I knew the old curator of the museum and he asked me to come and work for him.
3. I have been working here for seventeen years.
4. My favorite room is the drawing room because it is restful to look at.
5. I think the visitor's favorite thing in the museum is the video. Visitors are disappointed in the lack of a bedroom in the museum.

6. I have received no complaints from people, or seen anyone experiencing difficulties.

7. I have not received any feedback indicating that people would like a virtual tour.

8. I would like Dickens's bust in the hall to be included in the virtual tour.

9. There is no access for invalids in the museum. The stairs prevent anyone in a wheelchair from getting past the ground floor.

3.

Name: Florian

1. I am a paid employee.

2. I was interested in the intellectual challenges, the subject matter and the opportunities the museum provided. Dickens had not been my specialty prior to working here but I had been thinking about doing my PhD on him.

3. I have been working here for three years.

4. My favorite room is the drawing room because it is the most elegant room. You can imagine Dickens sitting and spending time in there. I also like the library.

5. I think the visitor's favorite thing in the museum is the Dickens Dream painting, the "empty chair", the two windows, and the story of the clock in the hallway. I usually don't get any negative feedback but some people mention they do not understand the Star Wars and Madonna references.

6. I have received complaints that people cannot walk up or down the stairs. Also, there are sometimes blind visitors and they don't get much out of the current set up of the museum. Lastly, lighting conditions could be better in some places.

7. When the museum took the floor plan and images down from the website some people complained because they had been previously using it as a teaching method in their classes.

8. I would like to see a floor plan, easy navigation, big font, and easy-to-read colors on the virtual tour.

9. People may be discouraged from visiting the museum due to the stairs and the absence of a lift. Old-fashioned showcases do not allow easy access to displays. Some font sizes are too small, while some signs have too much text. There is no disabled toilet.

4.

Name: Gail

1. I am a paid employee.
2. I wanted to work here because it was different than my previous job.
3. I have been working here for five years.
4. My favorite rooms are the drawing room and library. I like the Dickens Dream painting.
5. I think the visitor's favorite thing in the museum is the video.
6. I have received no complaints from people, or seen anyone experiencing difficulties.
7. I have not received any feedback indicating that people would like a virtual tour, but people use the website so adding to it can only help.
8. I would like the library, morning room, and drawing room to be included in the virtual tour. I would also like it if you had the ability to flip through first editions while in the virtual library.
9. The stairs pose a problem for people visiting the museum. Some people can get to the basement but are unable to get to the first and second floors. I would like to see the touch-screen moved to the ground floor so those with limited mobility will be able to use it

5.

Name: Kristen

1. I am a volunteer.
2. I am an art history major.
3. I have been working here for three weeks.
4. My favorite room is the drawing room and I like the paintings.

5. I think the visitor's favorite thing in the museum is the Dickens Dream painting and Dickens's personal items.

6. I have received no complaints from people, but have seen people experiencing issues with the stairs.

7. I have received feedback indicating that people would like a guide for the museum, but no feedback regarding an online tour.

8. I would like the virtual tour to work well and not freeze.

9. There are no lifts or ramps in the museum preventing those with disabilities from accessing the upper and lower floors.

6.

Name: Mary

1. I am a volunteer.

2. I had retired and wanted something interesting to do. I had learned to appreciate Dickens and had been attending Dickens fellowship meetings when a friend suggested to work here.

3. I have been working here for eighteen months.

4. My favorite room is the library since I do all of my work in there.

5. I think the visitor's favorite thing about the museum is that they get to have some sort of contact with the person whose books they have read.

6. I have received complaints from those who do not understand the English language that there are no signs in their native language.

7. I have received no feedback indicating that people would want an online tour, but I think it would be a good idea to have one.

8. I would like the virtual tour to include the study where he wrote, the Mary Hogarth bedroom, the sitting room with some information on the visitors Dickens may have received there, the dining room, Pickwick's Clock, and the china monkey Dickens always kept on his desk.

9. Stairs prevent those with disabilities from accessing the upper and lower floors. Also, blind people would not get much out of the museum.

Appendix F: Prototype Tour Feedback Form

A) Please rank the tours in order of ease of use (1 being the easiest):

        Text [ ]   Photographic [ ]   Panoramic [ ]   Video [ ]

B) Please rank the tours by how well they kept your interest/attention (1 being the most interesting):

        Text [ ]   Photographic [ ]   Panoramic [ ]   Video [ ]

C) Please rank the tours in how clear they were in presenting the information (1 being the clearest/easiest to understand and remember):

        Text [ ]   Photographic [ ]   Panoramic [ ]   Video [ ]

D) Please rank the tours in how well they immersed you in the environment, meaning it made you feel like you were there (1 being the most immersive):

        Text [ ]   Photographic [ ]   Panoramic [ ]   Video [ ]

E) All things considered, how would you rank the tours (1 being your favorite, the one you would want to see implemented):

        Text [ ]   Photographic [ ]   Panoramic [ ]   Video [ ]

F) Please write any additional comments:

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