



The Use of Digital Technologies for Learning at the Victoria and Albert
Museum

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Abstract

The Victoria and Albert Museum in London wants to evaluate the use of digital technologies in facilitated and un-facilitated learning environments. Museums are integrating digital technologies as a way to increase visitor learning and enhance the museum-visitor relationship, but little research has been done on the use of technologies in non-science museums. Using tracking, surveys and interviews, the project team ascertained that within both environments digital technology is well liked, and has a longer holding power its non-digital counterparts, but is not widely used by most visitors.

Authorship

This paper is the product of collaborative work done by all members of the project team, consisting of John Andrews, Melissa Gavarny, Nicole Lounsbury, and Andrew Silvia. Editing and revising was conducted by all four members after sections were written. The effort that went into this paper was shared equally amongst all project members.

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Executive Summary

Non-science museums are looking to digital technologies as a way to enhance the museum-visitor relationship and to increase visitor learning. The Victoria and Albert Museum, V&A, has been at the forefront of non-science museums in this respect, by integrating many different digital technologies into both the museum galleries and the Sackler Centre, which is the V&A's art education center. The V&A has long been dedicated to engaging and teaching its visitors, as well as encouraging the exploration and creation of British design. Constructed a few years ago, the Sackler Centre provides a unique experience for its participants in that the programs and courses focus on integrating the educational subject matter with the vast collections of the V&A. The incorporation of digital technology into the structure of the programs and courses provides the opportunity to examine the more traditional elements of what the V&A has to offer from a new point of view. However, there has been little research on the use of digital technology in both learning environments in non-science museums.

The goal of our project was to evaluate the use of digital technology in both the galleries of the V&A and the programs and courses offered in the Sackler Centre. To accomplish this goal, we tracked and surveyed visitors in three rooms, chosen by the project team and our sponsor, which incorporated interactive digital technology and surveyed participants in programs and courses which used digital technology in the Sackler Centre. Furthermore, we interviewed relevant staff at the V&A as well as other museums in both London and Worcester, Massachusetts. These methods were designed to evaluate how the digital technology was used and what visitor responses to it were in both environments.

The major findings of our research were that visitors who did use the digital technology in both settings liked it and thought it was well-designed. Visitors of all types, including all age ranges and self-rated proficiencies with technology, did use the digital technology. The digital technology in the Jewellery Gallery is in a high traffic area, as every visitor that we tracked passed through the area surrounding the digital technology, but in both Rooms 9 and 63 of the Medieval and Renaissance Gallery, there was less traffic around the digital technology. Despite the low usage compared to traffic within the

galleries, all of the digital technologies had a long ‘holding’ power, with most users staying much longer at the digital technology in comparison to other non-digital exhibits within the rooms.

However, many visitors did not utilize the technology. In the galleries, numerous visitors passed by the digital podium and said that they had not seen it. In addition to this, some visitors noted that they would not have known what was happening in the Sackler Centre had they not stumbled upon it. The ideal role of technology though is to be there for visitors to use it, if they would like, but to not be discordant or stand out in relation to the rest of the art (Fritsch, personal communication, April 9, 2010).

In order to maximize the effective use of digital technology in the V&A and other non-science museums, we have made a few recommendations. Digital technology placed in better traffic locations would allow more visitors pass by the technology in all of the rooms, increasing its usage and ability to teach, and enhance the experience of the visitor. Also, the Sackler Centre programs should be better advertised, perhaps in the main entrance to the museum, as the only visitors who enter through the Sackler Centre are those that come into the museum through the tunnel. Lastly, a more unified approach of communication between departments among the staff of the V&A to integrate digital technologies would allow them to work more effectively. Furthermore, the implementation of a unified system of digital technology would benefit the museum, allowing them to stay contemporary with the development of technology.

These conclusions and recommendations have been created with thought towards the V&A’s desire to enhance visitor learning and experience through the incorporation of digital technology as a complement to the more traditional galleries. Most revolve around the relocation of the existing digital technologies. Although they may seem minor, such changes can significantly increase the visitor’s use of the digital technology. Modifications such as these are also within the scope of the V&A’s FuturePlan directive. Application of these recommendations will allow the Victoria and Albert Museum to fulfill their commitment to engaging a wide range of visitors and encouraging their exploration of innovative British design, while helping all visitors to learn.

Table of Contents

Abstract	i
Authorship	ii
Acknowledgements	iii
Executive Summary	iv
Table of Contents	vi
List of Tables	viii
List of Figures	ix
1. Introduction	1
2. Literature Review	3
2.1. Museums	3
2.1.1. <i>The Development of Museums</i>	3
2.1.2. <i>Types of Museums</i>	4
2.1.3. <i>Recent Shift in Museums</i>	5
2.1.4. <i>Learning and Motivation in Museums</i>	6
2.2. Learning	7
2.2.1. <i>Theory of Knowledge</i>	7
2.2.1. <i>Theory of Learning</i>	8
2.2.3. <i>Types of Learning Styles</i>	9
2.2.4. <i>Adult vs. Child Learning</i>	9
2.2.5. <i>Types of Learning Environments</i>	10
2.2.6. <i>Educational Theory</i>	10
2.2.7. <i>Theory of Teaching</i>	13
2.3. Digital Learning	15
2.3.1. <i>What is Digital Learning?</i>	15
2.3.2. <i>Assessment of Digital Learning</i>	16
2.3.3. <i>What Constitutes Effective Digital Learning?</i>	18
2.3.4. <i>The Future of Digital Learning</i>	20
2.4. The V&A and Digital Learning	21
2.4.1. <i>The Use of Digital Technologies in the Museum</i>	21
2.4.2. <i>The Sackler Centre</i>	23
2.4.3. <i>The Future of Digital Technologies at the V&A</i>	25
3. Methods	27
3.1. Evaluating Digital Technologies in the Galleries	28
3.1.1. <i>Interviews</i>	28
3.1.2. <i>Tracking Studies</i>	29
3.1.2. <i>Surveys</i>	32
3.2. Evaluating Digital Technologies in the Sackler Centre	33
3.2.1. <i>Interviews</i>	33
3.2.2. <i>Surveys</i>	34
3.3. Evaluating Digital Technologies in Other Museums	35
4. Data Analysis and Findings	38
4.1. Demographics of Tracking and Surveying	38
4.2. Tracking Studies and Traffic Flow	41
4.3. Holding Power vs. Number of Visitor Stops	48
4.4. Visitor Recollection and Observations	56

4.5. Demographics of Digital Technology Usage	58
4.6. Observations on Child and Family Usage	63
4.7. Visitor Proficiencies with Digital Technology	64
4.8. Findings from Gallery Interviews	65
4.9. Sackler Centre Findings	67
4.9.1. <i>Survey Findings in Sackler Centre</i>	67
4.9.2. <i>Findings from Sackler Centre Interviews</i>	68
5. Conclusions and Recommendations	70
5.1. Conclusions	70
5.2. Recommendations	72
References	75
Appendix A - Museum Interview Questions	80
Appendix B - Other Museum and Sackler Centre Supplementary Questions	81
Appendix C - Map of the V&A	82
Appendix D - Key for Tracking Maps	85
Appendix E - Labeled Map of the Medieval and Renaissance Gallery Room 63	86
Appendix F - Labeled Map of the Medieval and Renaissance Gallery Room 9	87
Appendix G - Labeled Map of Jewellery Gallery Rooms 91-93 (Lower Floor)	88
Appendix H - Gallery Tracking: Medieval and Renaissance Room 63	89
Appendix I - Gallery Tracking: Medieval and Renaissance Room 9	90
Appendix J - Gallery Tracking: Jewellery Gallery Rooms 91-93 (Lower Floor)	91
Appendix K - Gallery Survey	92
Appendix L - Sackler Centre Classroom Survey	93
Appendix M - Sackler Centre Program Survey	94

List of Tables

Table 1: Annual Average Visitation by Museum Type-----	4
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List of Figures

Figure 1: Spectrum of Learning -----	11
Figure 2: The Types of Digital Technologies in Museums -----	17
Figure 3: Style Guide Interface Photos -----	22
Figure 4: Missal Viewer & Audio Bench Interface Photos -----	22
Figure 5: Design a Ring Interface Photos -----	23
Figure 6: Lower Floor of Sackler Centre: View from Café Entrance-----	24
Figure 7: Sackler Centre Digital Studio -----	24
Figure 8: Age Ranges and Genders of Gallery Visitors Tracked-----	39
Figure 9: Age Ranges and Genders of Gallery Visitors Surveyed -----	39
Figure 10: Age Ranges and Genders of Sackler Centre Participants Surveyed -----	40
Figure 11: Traffic Map of the Jewellery Gallery -----	42
Figure 12: Traffic Map of Room 9 -----	43
Figure 13: Traffic Map of Room 63-----	44
Figure 14: Traffic Flow in the Jewellery Gallery-----	45
Figure 15: Traffic Flow in Room 9-----	46
Figure 16: Traffic Flow in Room 63 -----	46
Figure 17: First Stop of Visitors in the Jewellery Gallery-----	47
Figure 18: First Stop of Visitors in Room 9-----	47
Figure 19: First Stop of Visitors in Room 63 -----	48
Figure 20: Total Visitor Stops of Visitors in the Jewellery Gallery -----	49
Figure 21: Total Visitor Stops of Visitors in Room 9-----	49
Figure 22: Total Visitor Stops of Visitors in Room 63 -----	50
Figure 23: Average Dwell Time of Visitors in the Jewellery Gallery (In Seconds) -----	50
Figure 24: Average Dwell Time of Visitors in Room 9 (In Seconds) -----	51
Figure 25: Average Dwell Time of Visitors in Room 63 (In Seconds)-----	51
Figure 26: Construction Area in Room 9-----	52
Figure 27: Time Spent at the Digital Exhibits Compared to Non-Digital Exhibits in the Jewellery Gallery-----	54
Figure 28: Time Spent at the Digital Exhibits Compared to Non-Digital Exhibits in Room 63-----	54
Figure 29: Time Spent at the Digital Exhibits Compared to Non-Digital Exhibits in Room 9 -----	55
Figure 30: Dwell Time in Rooms in Reference to Digital Technology Usage -----	56
Figure 31: What Visitors Who Did Not Use the Interactive Digital Technology Recalled or Observed -----	57
Figure 32: What Visitors Who Used the Interactive Digital Technology Learned or Observed -----	58
Figure 33: Map of Areas within Line of Sight of Digital Technology in Room 63-----	59
Figure 34: Map of Areas within Line of Sight of Digital Technology in Room 9 -----	59
Figure 35: Map of Areas within Line of Sight of Digital Technology in the Jewellery Gallery -----	60
Figure 36: Use of Digital Technology among Visitors Who Were Near Its Location in the Jewellery Gallery -----	60

Figure 37: Use of Digital Technology among Visitors Who Were Near Its Location in Room 9 -----	61
Figure 38: Use of Digital Technology among Visitors Who Were Near Its Location in Room 63 -----	61
Figure 39: How Proficient Visitors Who Used the Interactive Digital Technologies Consider Themselves with Technology -----	64
Figure 40: How Proficient Visitors Who Did Not Use the Interactive Digital Technologies Consider Themselves with Technology -----	65
Figure 41: How Proficient Participants Consider Themselves with Technology -----	67

1. Introduction

While museums were created for the purpose of displaying artwork and artifacts, their focus has now shifted to engaging visitors and providing them with a truly educational and worthwhile experience through their galleries and exhibitions. However, it is difficult to determine what it means for a visitor to be truly engaged with an exhibit and even what learning is. Museums are constantly looking to provide answers to these questions, in order to have an optimal museum-visitor relationship. The Victoria and Albert Museum (V&A), in particular, was founded in order to inspire British design, educate the working class, and to allow everyone to view the museum's collection. The museum remains committed to engaging visitors and encouraging their exploration of innovative British design and looks to be a "schoolroom for everyone" (*A brief history of the museum*, n.d.). As the digital revolution has become a part of everyday society, museums have begun to incorporate digital technologies into their galleries and classrooms in order to stay relevant and engage their audiences. These technologies often include computers, handheld devices such as cell phones and personal data assistants (PDAs), audio guides, other multimedia, and the internet. Technology has the promise of making information more available to visitors and thus enhancing visitor learning and experiences. Science museums, in particular, have developed many unique ways to enhance the visitor experience using these technologies. In contrast, non-science museums are starting to incorporate some digital technologies, but have found resistance from some in the expert community, and among some visitors who wonder if such technologies may detract from the emotional and intellectual experience of viewing art. In addition, there has been little research on the use of digital technologies in non-science museums. The Victoria and Albert Museum is one non-science museum that has embraced the use of technology and is engaged in an ongoing effort to evaluate the effects of digital technologies on learning, and how visitors are using and responding to these technologies. In order to achieve these goals, the museum has been steadily incorporating digital technology, though the process is ongoing and cautious.

The goal of our project is to help the V&A determine the best way to use digital technology to increase visitor learning and enjoyment. The V&A has been incorporating digital technologies both in its galleries and its recently constructed Sackler Centre.

However, while both environments use technology as a tool for learning, there has been no research on how these environments, being both facilitated and un-facilitated, can use this technology more effectively. The V&A is looking at how the technology in the structured environment of the Sackler Centre programs and the “free-form” environment in the V&A’s main galleries can be improved. Our objectives for this project were to first evaluate the current usage and visitor response to the interactive digital technologies in selected galleries in the V&A, through interviews with pertinent V&A personnel, tracking studies, and surveys of museum patrons. Secondly we evaluated the usage of, and the participants’ responses to, interactive digital technologies in both the structured classes and the “drop-in” sessions provided in the Sackler Centre, by interviewing program designers and surveying participants. Finally, we examined how and why other art museums have been trying to incorporate interactive digital technologies. This was accomplished by interviewing relevant museum employees at the Worcester Art Museum in Worcester, Massachusetts, and the British Museum in London, as well as informal visits to other museums both in Worcester and the United Kingdom. Through the completion of these objectives, we were able to evaluate the effectiveness of interactive digital technology within the Victoria and Albert Museum in both facilitated and un-facilitated learning environments. In both environments, the technology is well-liked by visitors who use it but is often ignored by others.

2. Literature Review

Although museums began as collections of art, historical objects, and other artifacts, the digital revolution in society has spurred a shift towards greater use of digital technologies in galleries and programs¹. Museums hope that including these technologies will provide all visitors, regardless of learning style and interests, with the opportunity to learn equally well and enjoy their visit. Although many positive aspects to using digital technologies have been found, some community members are still concerned about the purpose and role of technology in non-science museums. The V&A, however, looks to lead non-science museums into the future by incorporating digital technologies into both their galleries and the facilities and programs offered in the new Sackler Centre.

2.1. Museums

2.1.1. *The Development of Museums*

The International Council of Museums (ICOM) defines a museum as "a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment" (*ICOM definition of a museum*, 2008). Museums exist not only as a way to showcase items but, more importantly, to give their patrons the ability to view and learn about these items and, in the process, gain a greater understanding of themselves and the world around them.

Most museums started out as private collections of artworks and historical artifacts acquired by wealthy individuals displayed in their homes as a symbol of wealth and eminence. It wasn't until the 17th century that museums began shifting out of homes and private rooms, starting with the Basel Museum and the Ashmolean Museum in Oxford. This prompted a massive expansion of museums during the 18th century, eventually leading museums to become more open and accessible to the public (Alexander & Alexander, 2007). During the late 19th century, museums began to focus more on educating their audiences and becoming centers of learning and knowledge

¹Although our focus lies in galleries and programs, museums are also incorporating digital technologies in all sectors of their operations including financial management, research, security, web development, etc.

(Hein, 1998). Currently museums use a variety of methods to expand their reach, through temporary exhibitions, quest exhibits in other locations, websites, programs with schools or libraries, digital technologies, interactive elements, and multiple institutions.

2.1.2. Types of Museums

There are many different types of museums. George Burcaw divides museums into three broad types: art, history, and science. Art museums are where items are kept for their value as a piece of artwork, which varies depending on the type of art museum. History museums usually showcase items from a specific culture or time period. Finally, science museums display items that demonstrate the applications of sciences and technology, as well as samples and historical information about scientific artifacts (Burcaw, 1997). Museums however are not strictly delegated into these three types and other authorities categorize museums differently. For example the Association of American Museums tracks visitation among eleven different types of museums (Table 1).

Table 1: Annual Average Visitation by Museum Type

Arboretum/Botanic Garden	106,235
Art Museum	59,822
Children's/Youth Museum	78,500
General Museum	43,500
Historic House/Site	16,000
History Museum	10,750
Natural History/Anthropology	62,803
Nature Center	52,850
Science/Technology Museum	244,589
Specialized Museum	20,000
Zoos	440,502

Retrieved from <http://www.aam-us.org/aboutmuseums/abc.cfm>

The Victoria and Albert Museum, V&A, sets itself apart from these categories; its mission is “promoting the practice of design and increasing knowledge, understanding and enjoyment of the designed world” (*Reports, plans & policies.*; n.d.). Its focus is on the content, methods of creation, and artists or designers of what is displayed in their collections and programs; rather than statically displaying the museums’ artifacts. The V&A has four main objectives:

- **Access and Audiences:** To provide optimum access to collections and services for diverse audiences, now and in the future
- **National and International:** To be acknowledged and respected as the world's leading museum of art and design
- **Creative Design:** To promote, support and develop the UK creative economy by inspiring designers and makers, and by stimulating enjoyment and appreciation of design
- **Efficiency and Effectiveness:** To operate with financial and organizational efficiency

(*Reports, plans & policies.*, n.d.)

The museum’s objectives and mission statement demonstrate the desire to create a museum that is more focused on using its collections to create a “conversation” with its audiences and to improve not just the experience in the museum but to extend the “conversation” or experience after the visit and beyond the museum walls. This interaction with audience and focus on design has led to an increase in the incorporation of new technologies at the V&A.

2.1.3. Recent Shift in Museums

“In recent years museums have changed from being predominantly custodial institutions to becoming increasingly focused on audience attraction. New emphasis is placed on museum-audience interactions and relationships” (Gilmore & Rentschler, 2002). Museums have restyled the types of exhibitions, programs, and outreach efforts in response to changes in public expectations, competition for visitors (due largely to

massive expansion of museums), and changes in educational theories. The incorporation of digital technologies in galleries and programs is a continuation of these changes stemming from the societal acceptance of technology into daily life and recognition of the applications that digital technology can provide to learning.

Despite this major shift towards a more “audience wants” approach, museums are still largely a learning environment. They desire to better not only the audiences’ experience at the museum but to increase their knowledge as well. The problem most non-science museums deal with today is trying to enhance the overall visitor experience without appearing too flashy or showy in the process and deterring those who visit the museum to acquire knowledge. With constant changes in programs, workshops, and, naturally, the integration of digital technology, museums are still deeply rooted in the ideals of the 19th century as a center of learning.

2.1.4. Learning and Motivation in Museums

A significant aspect of museum learning is based on what Csikszentmihalyi and Hermanson call “flow” in their book *The Educational Role of the Museum*. Flow is ascribed to a natural state of learning in which a person is so engrossed in what they are learning that they are more out of contact with the world, but are learning at higher rate. Flow factors into museum learning in terms of motivation, both intrinsic and extrinsic (Hooper-Greenhill, 1999).

Most museums have, in essence, an intrinsic type of motivation. Intrinsic motivation asserts that learning does not come from a desire to reach a definite goal ‘i.e. get a good grade, fulfill order’, but a desire to better oneself (Hooper-Greenhill, 1999). This can be seen in programs and courses that museums commonly offer outside of the realm of their galleries. For example, there will be a difference in what a person learns from a photography class if they attend the course at a university hoping to get a degree or if they attended a free session on photography for an hour or two and decided it was something they would continue to work on. While it’s not really known which method is “better”, this dynamic is an evolution of museum learning that museums must face.

2.2. Learning

“What is learned in museums and how learning takes place is more than a matter of intellectual curiosity. Learning in the museum and understanding visitors’ learning has become a matter of survival for museums” (Hein, 1998, p. 12). The educational approach adopted by a museum will have a substantive impact on gallery design and interpretation, as well as the nature of the educational programs offered. Evolving educational theories in academia have guided museum philosophy from a relatively ‘stiff’ didactic approach to a more ‘flexible’ constructivist approach to education. Museums today utilize elements from both techniques, as there are a variety of learning styles to which museums must cater. The debate about the role of the museum and the most appropriate educational approaches continues within the museum community (Hein, 1998). Theories of education, which incorporate theories of knowledge, learning and teaching, have influenced how museums design galleries and portray information (Hein, 1998).

2.2.1. Theory of Knowledge

A theory of knowledge is a statement created with the goal of describing how a being acquires information and understanding. These theories are divided into two extremes: realism and idealism. Realism states that the “real” world and knowledge about the world exists independently of what ideas humans may have about it. Idealism states that knowledge only exists within the human mind and does not necessarily correlate to anything in the “real” world, meaning “[t]here can be no ideas, no generalizations, no “laws of nature” except in the minds of people who invent and hold these views” (Hein, 1998, p. 17).

The content and delivery of the material a museum displays can be strongly influenced by which theory of knowledge a museum adopts. If a museum follows a more realist approach, the content of the exhibit is controlled by the subject itself and the nature of the subject, not by the meaning the viewer might gather from it or with regard for the viewer’s interest. Conversely, in following an idealist philosophy, the content of the exhibit is guided mainly by the viewer’s interest and the meaning they may take from the material which flows from their own interpretation of the subject. A museum

subscribing to idealist theory is more likely to show various viewpoints to allow visitors to draw their own conclusions about the subject (Hein, 1998).

Museums, however, may have elements of both approaches. This may be due to differences between the departments of a given museum or within the museum community at large. It may also reflect a shift in the museum's approach over time. Many museums have older exhibits that the current designers and curators would like to remove, but these changes take time and money. Consequently, some exhibits are vestiges of an earlier period.

2.2.2. Theory of Learning

A statement that attempts to describe how a being learns is defined as a learning theory (Baumgartner, Lee, Birden, & Flowers, 2003). Learning theory falls under the branch of modern psychology, but its roots are in philosophy, stemming from “the analysis of knowledge (how we come to know things), and the analysis of nature and the organization of mental life” (Hilgard & Bower, 1975, p. 2). There are two extremes on the learning theory spectrum: transmission-absorption learning, which states that people learn incrementally, and participant learning where a person actively constructs knowledge in their mind. Transmission-absorption is a step-by-step process, slowly adding small individual pieces of information at a time to a person's large “stockroom” of information. Participant learning counters this, stating that “the process of learning is not a simple addition of items into some sort of mental data bank but a transformation of schemas in which the learner plays an active role and which involves making sense out of a range of phenomena presented to the mind” (Hein, 1998, p. 22).

Museums must take into account these two theories when they create and present their collections and information. They must either place their primary focus on the subject and breaking down what they present in small incremental units, catering to the transmission-absorption theory, or concentrate on the learner, providing more interactive and engaging elements to draw in the person, following the participant learning theory. The participant learning theory must take the typology of the learner into consideration, paying attention to their learning style, age, and in which environment the individual learns best (Hein, 1998).

2.2.3. Types of Learning Styles

The amount learned from a certain exhibit or museum program varies from person to person. So how can museums best maximize both the acquisition and retention of knowledge (Hilgard & Bower, 1975)? Many studies emphasize the need to cater to an individual's learning style as a way to improve the potential for learning (Yilmaz-Soylu & Akkoyunlu, 2009).

Learning style, formally called *The Nature of Intellectual Styles*, is a fairly common theorem within learning studies. This theorem was created by Zahng and Steinburg and holds the seemingly uncomplicated idea that different people learn in different ways. There are usually three or four styles of learning and there is often debate over what each one entails (J. R. Anderson, Reder, & Simon, 2000). Meryem and Buket state that the four styles are Accommodator, Diverger, Assimilator, and Converger. They give the optimum learning environments as follows: (Yilmaz-Soylu & Akkoyunlu, 2009):

- Accommodator: learns best when they are taught using active experimentation, such as implementing decisions or setting goals, and concrete experience, such as participation and communication
- Diverger: learns best when they are taught using concrete experience and reflexive observation, such as gathering data or information and listening
- Assimilator: learns best when they are taught using reflective observation and abstract conceptualization, such as testing or working with theories or concepts
- Converger: learns best when they are taught using abstract conceptualization and active experiments

Though within the field of learning studies there is still debate over how to define these models, the Accommodator, Diverger, Assimilator, and Converger models are the most commonly used (Lalley & Gentile, 2009).

2.2.4. Adult vs. Child Learning

How an adult learns and the information an adult obtains given certain percepts varies greatly from that of a child. According to Jensen “[t]o children experience is external, something that happens to them; to adults personal experience has defined their

individual identity. Because adults have a richer foundation of experience than children, new material they learn takes on heightened meaning as it relates to past experiences”(Jensen, 1999, p. 112). Furthermore, children tend to learn by teacher direction whereas adults learn on an individual and independent basis, finding educational material, classes, or programs to answer their own questions. Adults look to education for answers to immediate questions, to acquire skills for immediate use, or to cater to personal interests, whereas children see education as information to be used in the future. Because adults take a personal responsibility for their own learning, they are more likely to expect excellence in educational programs (Jensen, 1999).

2.2.5. Types of Learning Environments

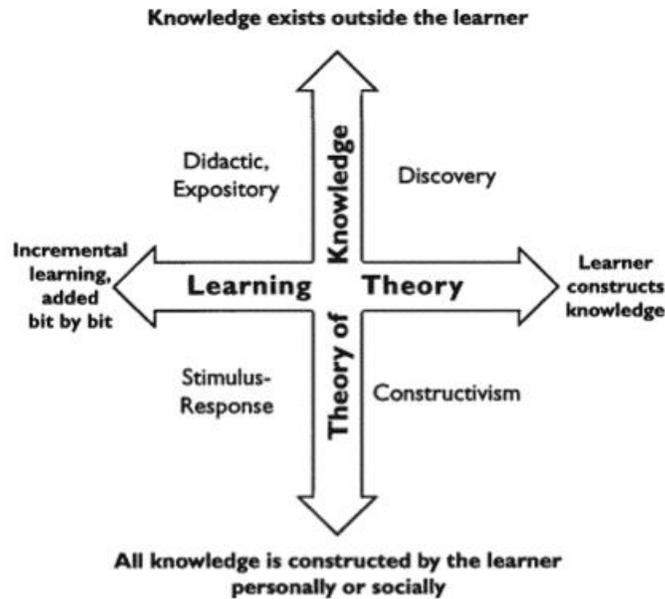
Learning environments exist in both formal or “facilitated”, and informal or “un-facilitated” settings. Although there is debate, formal learning environments are often viewed as places that “teach a specific, hierarchical curriculum, and they usually have rules about attendance, time spent in classes, classmates, and requirements for successful completion” (Hein, 1998, p. 7). Informal learning environments, in contrast, often “do not have a set curriculum that progresses from lower to higher levels, usually do not require attendance, and do not certify mastery of specific knowledge at the conclusion of a visit” (Hein, 1998, p. 7). Many museums offer both facilitated learning settings, such as structured classes or programs, and un-facilitated learning settings, such as those available in the museum galleries. Having a combination of the two allows the visitor to decide how they want to learn, whether they wish to be guided through their learning experience or to learn freely on the gallery floor.

2.2.6. Educational Theory

The two spectrums representing the theories of learning and the theories of knowledge can be juxtaposed upon each other to create four quadrants, each describing a particular type of educational theory (Figure 1) (Hein, 1998). These four types are didactic or expository, stimulus-response, discovery, and constructivism. Each theory takes a position on each of the theories of knowledge and the theories of learning. Over the years, museum culture has shifted generally from more didactic approaches to more

constructivist approaches, although there is a wide range within the museum world, and even within individual museums (Hein, 1998).

Figure 1: Spectrum of Learning



(Hein, 1998)

The didactic or expository theory of education states that learning is incremental and added bit by bit and that knowledge exists outside the learner. Didactic exhibits will tell a themed story with a start, middle, and an end and will claim that this story being portrayed is true and correctly models the way things are in the real world. Therefore, they would not state that this is only one interpretation or suggest other ways to interpret the exhibit (Hein, 1998). Hein states that:

Museums organized on didactic, expository lines will have:

- exhibitions that are sequential, with a clear beginning and end, and an intended order;
- didactic components (labels, panels) that describe what is to be learned from the exhibition;
- a hierarchical arrangement of subject from simple to complex;
- school programs that follow a traditional curriculum, with a hierarchical arrangement of subject from simple to complex;

- educational programs with specified learning objectives determined by the content to be learned.

(Hein, 1998, p. 27-29)

The stimulus-response theory states that learning is incremental and added bit by bit and that knowledge is constructed by the learner. Stimulus-response exhibits will engage the learner and reward correct responses such as providing a positive response, either in a verbal or written format or on a computer screen, when the visitor pushes the correct button or completes a task correctly (Hein, 1998). Hein states that:

Museums organized on stimulus-response lines will be characterized, as are didactic, expository exhibitions, by:

- didactic components (labels, panels) that describe what is to be learned from the exhibition;
- exhibits that are sequential, with a clear beginning and end, and an intended order for pedagogic purposes.

(Hein, 1998, p. 29)

On the other side of the theory of learning spectrum, the learner becomes the focus of attention in addition to, or instead of, the subject matter. The discovery theory states that knowledge exists outside the learner and the learner constructs knowledge. It is accepted by discovery education that learning is an active process and that learners interact with the information they are learning instead of simply absorbing it. Discovery theory states that learning is more than just absorption of incremental facts, but that the facts being absorbed change our store of information as our knowledge is expanded. Discovery exhibits may also be organized linearly with a beginning, middle, and an end. If the exhibit is meant to help the learner reach a specific conclusion, placement is vital when arranging the components of an exhibit (Hein, 1998). Hein states that:

Museums organized on discovery learning lines will have:

- exhibitions that allow exploration, probably including going back and forth among exhibit components;
- a wide range of active learning modes;
- didactic components (labels, panels) that ask questions, prompt visitors to find out for themselves; some means for visitors to assess their own interpretation against the “correct” interpretation of the exhibition;

- school programs that engage students in activities intended to lead them to accepted conclusions;
- workshops for adults that offer expert testimony and other forms of evidence for contemplation and consideration, so participants can understand the true meaning of the material.

(Hein, 1998, p. 33)

The constructivist theory states that knowledge is constructed by the learner either socially or personally. This theory best allows the incorporation of technology into museum galleries because technology permits the learner to take their own path through the material and construct their own truths about the information presented. It also supports multiple viewpoints, while allowing the learner to create their own views. The constructivist approach allows the learner to assemble their own knowledge about the material and validates their conclusions whether they match those of the people creating the exhibit or not. Hein states that a constructivist exhibition:

- will have many entry points, no specific path and no beginning and end;
- will provide a wide range of active learning modes;
- will present a range of points of view;
- will enable visitors to connect with objects (and ideas) through a range of activities and experiences that utilize their life experiences;
- will provide experiences and materials that allow students in school programs to experiment, conjecture, and draw conclusions.

(Hein, 1998, p. 35)

2.2.7. Theory of Teaching

Theories of teaching state how the educational theories are put into practice. Each theory of education above has a method of presenting the information in order to further learning. Expository-didactic education focuses exclusively on the subject and states that the best way to teach is to analyze the essential parts and structure of the subject, and then present it in incremental units that can be learned. Stimulus-response (S-R) education has the same incremental steps as expository-didactic education, but the focus in S-R is the

method of teaching. Only the teacher has a clear idea of what should be learned. S-R is used to instill uniform behavior in learners without encouraging questions or the challenging of authority. In the museum this teaching theory includes descriptions of exhibit contents focusing on linear structure with specific learning objectives which are reinforced. Discovery education requires hands-on *and* minds-on opportunities and allows learners to manipulate, explore, or experiment. Activities must challenge ideas, produce uncertainty, and stretch the previous beliefs of the learner. The challenge for discovery education is to provide the opportunity for learners to ascertain information on their own, while structuring the atmosphere to guide the learner to a desired conclusion. Constructivism education provides an environment where the learner can make any conclusions and draw connections between previous knowledge and the exhibit. Constructivist exhibits allow visitors in museums to choose what they would like to learn and in what order. Constructivism lends itself to the use of technology because with technology the learner can choose their own path through the information easily (Hein, 1998).

The science museum community in the US and UK has been at the leading edge of the movement to incorporate discovery and constructivist approaches in galleries and programming, with the inclusion of interactive, hands-on activities and an emphasis on the role of social, cultural, and physical context in meaning making (Falk & Dierking, 2000). Increasingly, science museums are using interactive digital technologies to engage visitors. Non-science museums have been slower in the adoption of such approaches in general, and the use of digital technologies in particular (Fritsch, 2007). According to Fritsch, “[i]nteractives in gallery and exhibition space are often still viewed as difficult or unusual in non-science museums by those working on gallery and exhibition development, and most particularly in art and design museums”(Fritsch, 2007). Many non-science museums continue to struggle to find an appropriate balance between the more formal emphasis on objects with expert interpretation and more constructivist approaches that try to accommodate visitor observations, perceptions, and contributions (Fritsch, 2007).

2.3. Digital Learning

2.3.1. *What is Digital Learning?*

Digital learning involves learning through any of the various forms of existing digital technologies. The numerous digital technologies available for use in museums include “simulations and models”, “microworlds and games”, “computer mediated conferencing”, “streaming digital audio and video”, “presentation technologies”, “visualization tools”, multimedia, and the internet (Hawkey, 2004, p. 8). Many of the several different technologies that can be used in museums can be seen in Figure 2.

The use of these technologies has become widespread in museums as they look to remain at the forefront of the field. From visitors being able to make a video of themselves interacting with a virtual tornado to pretending to run an imaginary country, museums use many types of technologies to keep people engaged. Through un-facilitated digital learning, people can choose what they want to learn, thereby keeping them actively absorbed. Museums can also help facilitate visitor learning by providing a variety of ways to learn, allowing them to reach out to all learning types (Gammon & Burch, 2008).

The types of digital technology available can mimic the real world and interest people more than traditional galleries (Gammon & Burch, 2008). When the technologies imitate the real world, people can gain experiences that are unlikely or too expensive to occur in real life. Effective digital learning has been said to “situat[e] the experience within the broader context of the lives, the community, and the society in which visitors live and interact” (Falk & Dierking, 2008, p. 27). Digital technologies don’t just help people learn, they also “help to weave a cognitive-emotive tapestry around the artworks that invites and structures engaged inquiry” (Samis, 2007, p. 30). People may learn differently, but ultimately, those who use the digital technologies feel that the exhibits in the museum mean more to them, allowing the visitor to feel more connected to the museum. Well-made digital technologies which get people thinking about the exhibits can help to accomplish this (Samis, 2007).

2.3.2. Assessment of Digital Learning

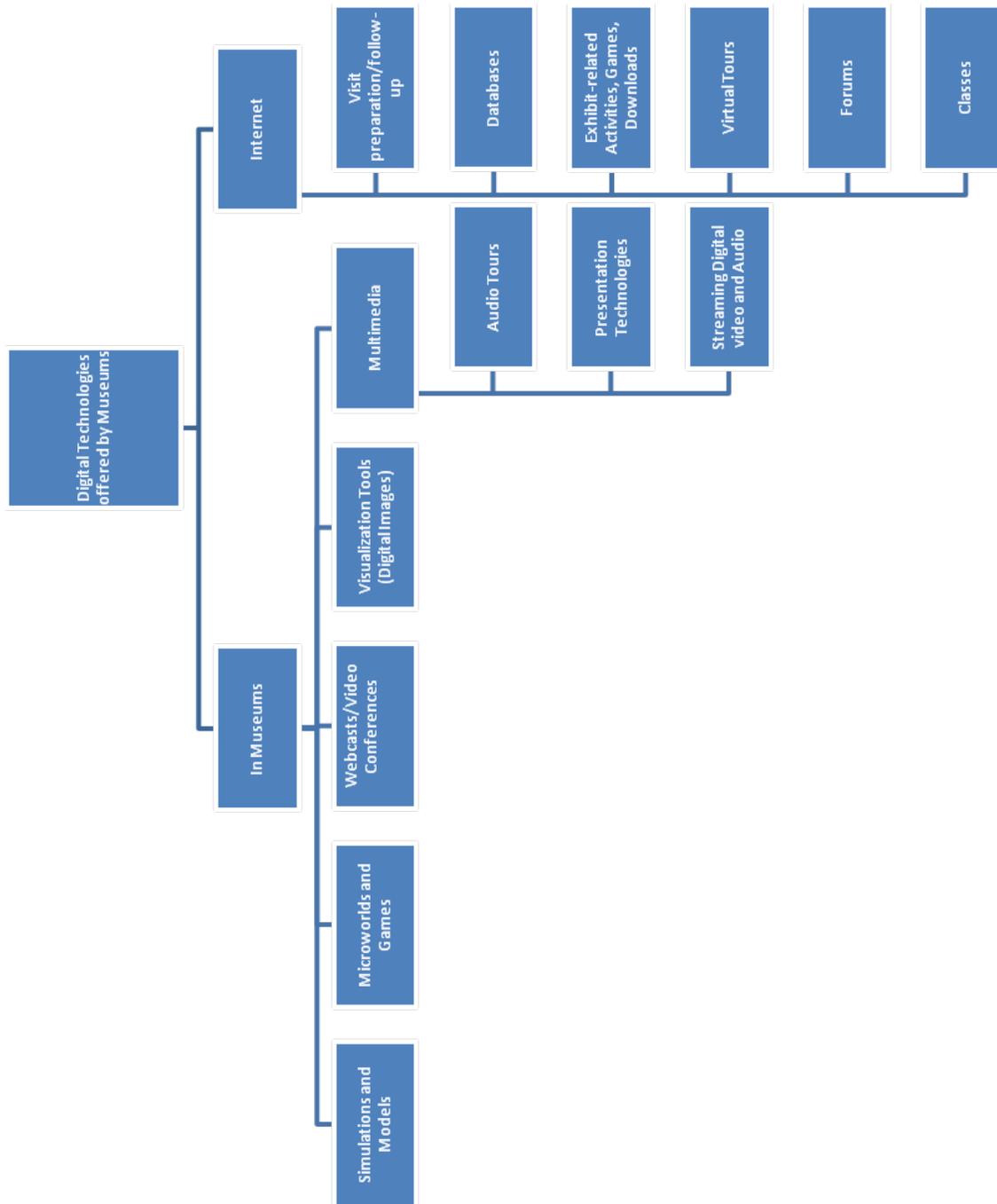
Digital learning has many advantages. Gammon and Burch have said that the benefits of digital technologies are that they “connect users with other learners, to provide opportunities to explore and construct models of real-world systems, and to represent data in many different forms” (Gammon & Burch, 2008, p. 36). While many museum staff worry that digital technologies might limit visitors’ social interactions with other members of their group or other museum patrons, the very social interactions that some studies say are crucial to learning, research indicates this is not the case. Gammon and Burch reference multiple studies (Gyllenhaal and Perry, 1998; Heath, vom Lehn and Osborne, 2005; vom Lehn and Heath, 2005) that find people can share technologies, like computers, among groups and still interact with others (Gammon & Burch, 2008; vom Lehn & Heath, 2005). To ensure this, museums should design digital technologies so that they are effortless to use within groups, which may be easier with large touch-screens than computer terminals (vom Lehn & Heath, 2005). Also, contrary to expectations, several studies have shown that technology may actually enhance visitors’ interactions with the objects on display. While using computers in the Science Museum in London, for example, many visitors would spend longer and interact deeper with the exhibits when the exhibits incorporated a technological interface (Gammon & Burch, 2008). Similarly, a study at the Speed Art Museum in Louisville, Kentucky found that

Children who had visited the interactive gallery twice or more were more likely than students visiting the gallery for the first time to engage in higher-level inquiry skills (e.g., moving from simple naming and identification to comparison, analysis and interpretation) in the tour of the permanent collection. In addition, those students familiar with the interactive gallery were more likely than the first-time student visitor to remember works of art in the permanent collection.

(Adams & Moussouri, 2002, p. 5)

Vom Lehn and Heath assert that to allow this interaction, technologies should have pauses in the material presented where visitors are encouraged to regard the exhibit and

Figure 2: The Types of Digital Technologies in Museums



(modified from Hawkey, 2004)

that technologies should facilitate conversation about the exhibit (vom Lehn & Heath, 2005). Another positive aspect of digital learning is that people can get a real world experience which would be nearly impossible otherwise. An example is a game that allows users to see what it would be like to be the minister of energy of an imaginary country, which is a position few people will ever hold (Gammon & Burch, 2008).

However, research at the San Francisco Museum of Modern Art has found that people preferred videos and print on the wall to computers, because the computers prompted memories of work or seemed to be “too much effort” (Samis, 2007, p. 28). This idea is referred to by Hornecker and Stifter as “techno-fatigue” (Hornecker & Stifter, 2006, p. 5). David Anderson, Director of Learning and Interpretation at the V&A, was critical of the digital learning available in museums in 1999, saying it was “imaginatively, aesthetically, symbolically and educationally impoverished” (D. Anderson, 1999, p. 21). However, he said in the next sentence that this would most likely change in the future (D. Anderson, 1999). There is also worry that the professionals who work with the technologies in museums are in charge of their use instead of museum leaders, or even educators (Hawkey, 2004). Josie Appleton, of the Institute of Ideas in London, is concerned that unlike traditional exhibits, where visitors are left alone to think their own thoughts, “[t]he machine limits the associations you can make, it asks you questions, takes you down particular paths.” (Appleton, 2002, p. 6). Appleton has also stated “[t]he most valuable museum experiences are those when something happens that you didn’t expect – not when you interact with a standardized, pre-programmed exhibit.” (Appleton, 2002, p. 7). Appleton says, in addition, that while she has had profound emotional experiences while looking at art, she doubts this could happen with a computer or other technologies (Appleton, 2002). Therefore, it is clear that many experts in the museum community disagree about the use and effectiveness of digital technologies.

2.3.3. What Constitutes Effective Digital Learning?

There are many ways to make digital technologies effective. As Tim Benton, an art historian, said, he would like to be able to use the digital technology in the V&A to “interrogate the artefact, have [his] questions answered, and to accumulate [his] own observations in a two-way process” (D. Anderson, 1999, p. 57). Technological exhibits

should therefore be “minds-on”, not just “hands-on”, which increases visitor learning (Hawkey, 2004, p. 23). Similarly, Hornecker and Stifter found that the most effective digital exhibits are those that allow the visitor to be creative or those that provided a challenge for the visitor (Hornecker & Stifter, 2006). The digital technologies must, in addition, have some positive effect on their users, whether this is increased knowledge, or an emotional or social experience, in order to truly engage visitors. Digital technologies that are part of exhibitions should be “geared to multiple ages and more thought has to be given to subduing excess noise and physical activity, since some visitors will not choose to engage with the interactive experience” (Adams & Moussouri, 2002, p. 7). A study at the Austrian Technical Museum Vienna reinforced that digital exhibits should appeal to all ages when they found that senior visitors would visit traditional exhibits more often and would tend to pass by the digital technologies (Hornecker & Stifter, 2006). To be useful to another distinct demographic, children and their harried parents, it must be obvious how to use these digital technologies, so that these visitors do not have to spend a lot of time reading long instructions (Adams & Moussouri, 2002).

Interestingly, a study at the San Diego Natural History Museum discovered that “people came to the museum to see dinosaurs and specimens; they did not come to work on computer terminals. The visitors felt that information intended for an electronic format would be more useful to them on a website, so that they could use it for pre- and/or post-visit exploration” (Adams & Moussouri, 2002, p. 16). The museum found that to physically attract visitors, they must have unique exhibits which could not be found anywhere else (Adams & Moussouri, 2002). These exhibits also must be unique in that they should be able to catch visitors’ attention, as there are many other exhibits in the museum. Thus, exhibits must appeal to the visitor in the first ten seconds of interaction (Hornecker & Stifter, 2006). Of course, museums have found that they must not allow visitors to have a huge selection of information to choose from and the technology must not be too complex, otherwise visitor learning may be hindered. It may be impossible to try to cater to everyone’s learning styles and desires, so museums may find it useful to have different technologies to cater to specific divisions of learning styles or age groups (Gammon & Burch, 2008). Anne Fahy asserts that “whilst we only remember ten percent of what we read, we remember ninety percent of what we say and do” (Hazan, 2007, p.

143). Therefore, there is the possibility that, if the technologies are well designed and implemented, active learning through digital technology could help visitors to remember information long after they have departed from the museum.

2.3.4. The Future of Digital Learning

As for the future of digital learning, some see the incorporation as the loss of some of the authority of curators (Parry & Arbach, 2007). Although many worry that perhaps visitors will stop coming to museums, digital technologies can and do increase visitor interest in the relevant exhibits, as stated above. In the future, to improve the reach of digital technologies, perhaps more people will become skilled in both the professions of learning and technology, fields that most people don't pursue simultaneously (Dunmore, 2006). As Roy Hawkey of King's College says, the future for museums involves new concepts, including "learner input in development", "pathways rather than packages" and "signposts rather than tracks" (Hawkey, 2004, p. 38). Hawkey therefore suggest that perhaps digital learning should be more un-facilitated and the technologies involved should gently guide people, not force them to learn every single piece of information in a given order (Hawkey, 2004). In a similar manner, David Anderson says that the future of digital learning is "Wireless, ubiquitous, content rich, learning rich, multi-platform, inter-institutional. With opportunities for creativity on the part of the users, which are more than simply replication or cutting and pasting" (D. Anderson, personal communication, March 19, 2010). The Department for Education and Skills in the United Kingdom states that the future of digital learning involves its capacity to "transform teaching [and] learning,' to provide 'more motivating ways of learning and more choice about how and when to learn' through an 'open accessible system' 'to improve personalise [sic] support and choice'" (Hawkey, 2006, p. 116). When people can govern how, what, when and where they learn, then they will learn better (Hawkey, 2006).

There is still much debate about whether digital technologies belong in non-science museums, and because of this, they have not been widely incorporated. Nevertheless, the V&A looks to be at the forefront of non-science museums by designing appropriate digital technologies into their galleries and using them in the Sackler Centre.

They feel that digital learning is not something that can be separated from museum learning and have various plans on further implementing and integrating with digital technologies.

2.4. The V&A and Digital Learning

With the increase in computer literacy amongst the general populace, the incorporation of technology into the museum helps to engage all visitors to the museum, including the younger generation of patrons, as well as providing a more in depth store of knowledge and information that can be tapped into by anyone. Though some museums see this change as a burden, the Victoria and Albert Museum, sees this as an opportunity to increase visitor learning. Through their website, the resources of the Sackler Centre, and the digital supplements to their existing galleries, the V&A provides a significant digital offering to complement the more traditional nature of their galleries. By embracing the opportunities that come with an overall increase in digital technology throughout society, the V&A is simply utilizing the modern tools available in order to uphold the ideals of providing a complete experience for the visitors rather than just presenting an object.

2.4.1. The Use of Digital Technologies in the Museum

In order to provide a more interactive experience within the galleries of the main museum, the Victoria and Albert Museum has taken great strides toward providing digital elements that complement the objects on display. When compared to other similar institutions the V&A is rather accepting of the use of personal digital technology, such as mp3 players, cameras, and phones, in that there are audio tours for the museum that can be downloaded and most galleries permit photography. The museum subscribes to the position that, “it would be very hard to prevent its use, so why not capitalize on this fact and show how digital media can enrich their experience with the institution in ways that they might not have expected” (D. Anderson, personal communication, March 19, 2010).

The digital interfaces currently implemented by the V&A can be analyzed based on the level of user interaction required by the visitor to achieve a quality experience. With this categorization, the current applications of digital technology in the galleries can

be put on a scale from those permitting the least amount of visitor interaction to the installations that illicit the most visitor interaction. Constantly running videos in the galleries would represent an application at the non-interactive side of the digital technologies; they require no input from the visitors and allow for no choice as to the information being presented. The next type of technology available in the galleries are those that allow for the visitor to choose what he or she wants to listen to or read but no further interaction. The remaining digital technologies available to the visitors are those that require and allow for high levels of user interaction (pictures of the technologies can be seen in Figures 3-5).

Figure 3: Style Guide Interface Photos

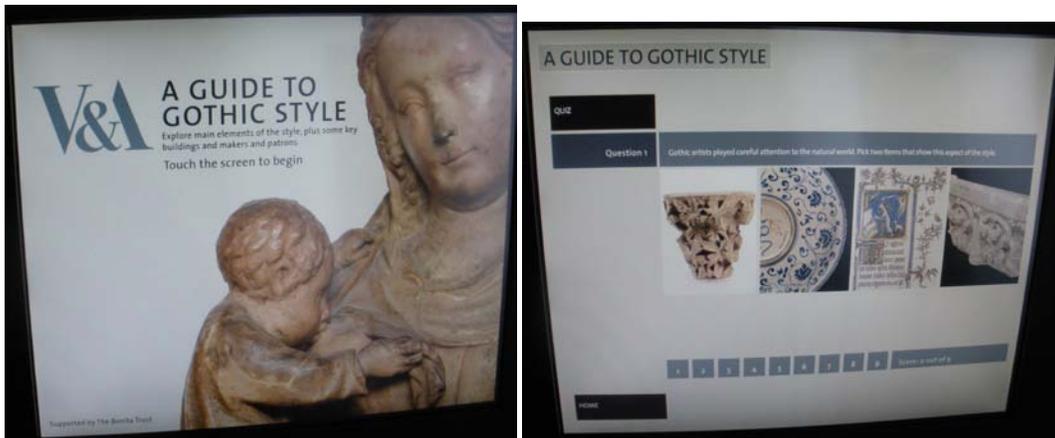
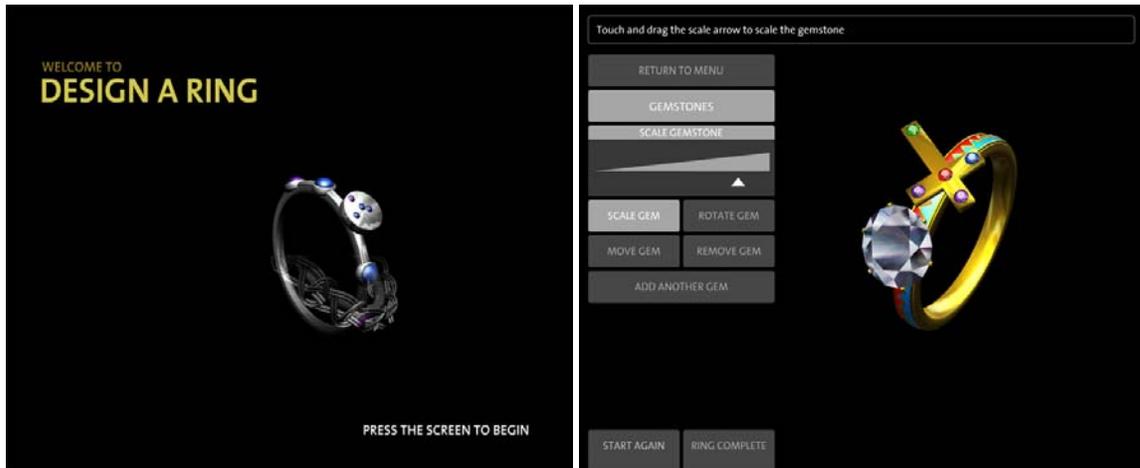


Figure 4: Missal Viewer & Audio Bench Interface Photos



Figure 5: Design a Ring Interface Photos



2.4.2. The Sackler Centre

Most of the educational programs at the Victoria and Albert Museum are offered through the museum's most prominent addition to their grounds, the Sackler Centre. The center was built in 2008 "for public learning through creative design and the arts" (*Sackler Centre for arts education at the V&A*, 2009). In addition to providing studios for resident artists, some of the signature features of the Sackler Centre are its digital studios for design work and workshops. The Sackler Centre provides a space where patrons can creatively express how the museum has influenced their ideas (*Sackler Centre for arts education at the V&A*, 2009). A collection of classrooms, meeting spaces, and residency studios, the new space allows for a flexible environment within the museum for a more facilitated approach to learning. Figures 6 and 7 show the lower floor of the Sackler Centre and its Digital Studio.

Figure 6: Lower Floor of Sackler Centre: View from Café Entrance



Figure 7: Sackler Centre Digital Studio



In the spectrum of education, the V&A has both un-facilitated and facilitated environments in which visitors can learn. The un-facilitated learning environment of the galleries allows patrons of the museum the freedom to experience what they desire by the

method they choose. The technology in the galleries is used to aid in the learning process by making information more accessible and relatable, but not by shaping the path that the learner chooses to follow. To complement this, the more facilitated environment of the Sackler Centre provides a more structured avenue for learning. By offering workshops in everything from clothing design and photography to programming and Photoshop, a student can be guided through steps to learn a new skill or gain a deeper understanding of an existing one (*Digital courses*, 2010).

The programs offered in the Sackler Centre are all designed to take advantage of the vast collections of the V&A rather than simply learning a skill. If an individual wanted to learn more about digital photography, they could acquire this expertise at a traditional learning center, such as a community college, instead of at the museum. However, by combining the instruction on how to use a camera with the exploration of the galleries for a subject of the photographs, the V&A can offer a truly one-of-a-kind experience (O'Brien, personal communication, April 7, 2010). By using the most up-to-date equipment and software available, the V&A designs programs offered in the Sackler Centre have the potential to engage the participant in a unique way and to create an experience that is as rewarding as it is educational.

2.4.3. The Future of Digital Technologies at the V&A

The applications of digital technology for education are vast and can be overwhelming in an environment such as a non-science museum. It is through the incorporation of this technology that the Victoria & Albert Museum plans to become an example for other non-science museums. To ensure this outcome, the V&A is interested in how effective its educational endeavors are in increasing patron learning, both in the galleries and structured programs. The current Head of Gallery Interpretation, Evaluation, and Resources, Juliette Fritsch, has been promoting the objectives of the V&A since the beginning of the current renovation of the museum's galleries and programs in 2007. In a presentation at King's College of London in March of 2007, Fritsch addressed the challenges of incorporating digital technology into the non-science museum experience. The foremost of these issues is the need to ensure that the technology is supporting the object and not overpowering it, rather than the object helping to illustrate a concept that is

being presented by the technology (Fritsch, 2007). The specific goals of the V&A for the use of digital technology include increasing the digitization of their collection and expanding the methods through which patrons learn about the V&A and its collections (*Strategic plan 2007–2012 2009/10*, 2010)

Fritsch asserts that the relationship between the visitors and the exhibits goes far beyond the actual visit to the museum. In order to present the information that the visitor is looking for, the museum needs to not only touch upon the individual interests and previous knowledge related to the content of the galleries, but to address how these characteristics of the patron were acquired (Fritsch, 2007). By designing the interactive elements that complement the exhibits, the V&A is trying to link the pieces being presented in the galleries to the visitor in a more personal manner in that the visitor is using the available digital technology to shape his or her own experience. This objective is mirrored in the design of the programs for the Sackler Centre in that they allow the visitors to utilize the technology not as an end, but as a means through which a deeper connection with the collections of the V&A can be established. To ensure that this goal is achieved, the V&A is making a concentrated effort to evaluate all of the available technologies and how they affect the learning experience of their visitors. By evaluating their existing interactive elements, the V&A will be better able to design the digital technology to be integrated into the museum's overall presentation to their patrons. This information will be invaluable to the V&A in order to meet their goals of enhancing the gallery experience of visitors, as well as being the forerunner of the incorporation of digital technology into non-science museums.

3. Methods

The Victoria and Albert Museum (V&A) has been dramatically upgrading its galleries and programs with the incorporation of interactive and engaging technologies as part of an ongoing plan that began in 2001 (*FuturePlan video*, 2009). The addition of the new Sackler Centre, which offers classes that incorporate digital technology, has been a great educational complement to the main museum. The V&A has expressed interest in comparing the effect that the digital technology in the Sackler Centre, and the galleries, has on visitor experience. The goal of this project was to evaluate the use of digital technologies in the facilitated learning courses of the Sackler Centre and in the galleries of the main museum and to analyze the visitor usage and perceptions of these technologies from the two types of digital applications. Our objectives were:

- to evaluate the current use of digital technologies in selected galleries in the V&A;
- to evaluate the use of digital technologies for facilitated learning in the Sackler Centre; and,
- to characterize the use of digital technologies in other art museums.

To assess the incorporation of digital technologies in selected galleries in the V&A, we interviewed a curator, designer and interpreter of the exhibitions that utilize technology. In addition to this, we tracked, observed, and surveyed visitors to determine their responses to the museum's incorporation of digital technology. To evaluate the use of digital technologies in the Sackler Centre, we interviewed program designers and also surveyed program participants. To characterize the use of technologies in other museums in the United States and United Kingdom, we interviewed relevant staff and evaluated the use of digital technology in their respective museums by visiting them in person. Through the completion of these objectives we evaluated how digital technology is being used for facilitated and un-facilitated learning at the V&A.

3.1. Evaluating Digital Technologies in the Galleries

To gain an understanding of un-facilitated learning environment of the galleries, we interviewed museum staff and conducted tracking studies of visitors accompanied by exit surveys.

3.1.1. Interviews

We conducted interviews to gain a fuller understanding of the purpose and meaning behind the galleries' usage of interactive digital technologies. Based on our initial conversations with our sponsor, we identified multiple V&A staff including the heads of the Learning and Interpretation department, the On-Line Museum, and the department of Gallery Interpretation, Research and Evaluations. We conducted four semi-formal interviews, in-person, between March 19th and April 21st in order to assess why and how the galleries' digital interfaces were structured the way they are, and how the digital technology complements the artifacts. Each interview was conducted by a designated member of the group. This group member recorded the interview and produced selective transcripts shortly after each interview. If any pieces from the interview were to be quoted or paraphrased in our document, we would also refer back to the original sound file for clarification and to ensure accuracy. He administered the interviews either in a neutral conference room or the interviewee's office. Our group member recited to the interviewee a short preamble explaining how the information would be used and the procedure involving off the record comments; a written version of this preamble and the standard questions asked are provided in Appendix A. Questions that were outside of the standard set of interview questions, such as those created in response to a certain individual's position before or during the interviewing process, are provided in Appendix B.

The interview questions were piloted at the Worcester Art Museum, during an interview with Christopher Whitehead, the Manager of Youth and Family Programs, and Katrina A. Stacy, the Assistant Curator of Education. From these interviews we developed the questions used in interviewing staff at the V&A.

In questioning the various directors and managers of departments, we were interested in several pieces of information. The interviews provided us with insight into

how learning and digital technology is viewed within their respective departments, and how this factors into the design and format of the galleries and programs at the V&A.

Our questions were grouped into the following categories:

- Background of the interviewee (i.e. position, role, exhibits involved with, etc.)
- Overall goal/philosophy of technology in museums
- What process the V&A uses to determine how and what technologies to incorporate
- What evaluations/other feedback reveal about the success of technologies
- What the greatest obstacles to introducing technology are (i.e. staff opposition, visitors, maintaining/improving digital technology)

Understanding the reasoning behind the designs of the gallery interactives as well as the Sackler Centre programs, and how these designs are implemented in the V&A, allowed us to determine the correlation between how the technologies were intended to be used and how the visitors are actually utilizing them.

3.1.2. Tracking Studies

In the main museum, we employed tracking studies to observe visitors, and to evaluate the digital technologies in the three selected rooms. These tracking studies allowed us to observe and analyze visitors' reactions to the galleries and the digital technology that they contain. We modified previous works on tracking studies to not only fit the V&A, but to allow us to focus on digital technology as well. To analyze the actions of visitors with respect to digital technology, we created maps of the selected rooms, labeling the various exhibits, digital technologies, and other features of the room (see Appendices E-G for maps). We conducted the tracking studies, along with the surveys, at different times during the day, on both weekdays and weekends, for 1.5-2 hour sessions, with a maximum of two sessions per day. We conducted a total of 268 tracking studies in all three rooms. All three rooms were tracked at the same time, with one team member per room. The protocols for tracking were developed in consultation with our sponsor.

We performed two days of pilot tracking within the rooms, to be sure the maps were correct, easy to use, and we had enough traffic flow within the selected rooms. We conducted the tracking studies in Rooms 9 and 63 of the Medieval and Renaissance

Gallery and the lower floor of the Jewellery Gallery (see Appendix C for a map of the V&A highlighting these rooms). Our team selected these rooms in consultation with our sponsor based on volume of visitor traffic, quantity of interactive and non-interactive digital interfaces, and ease of tracking. Both rooms in the Medieval and Renaissance Gallery offer a Style Guide, where visitors can learn about the artistic style featured in the room and take an interactive quiz. Room 63 also contains an audio bench, which is a bench with integrated audio tracks, and Room 9 has an audio bench and a digital book viewer (although the audio bench was inoperable during the period of tracking). The lower floor of the Jewellery Gallery contains many digital technologies including videos on how pieces of jewelry are made, computers to search the museum's jewelry collection, and a computer which allows visitors to design a virtual ring. The quiz element of the Style Guide and the Design a Ring interface were the digital technologies chosen by the team to study due to their high levels of interactivity.

For tracking, we observed until a visitor entered the room. To eliminate bias, and keep the samples random, we tracked the first person to enter the room regardless of demographics or grouping. We chose to exclude individuals who would “walkthrough” the room, based on the fact that the limited time they spent in the room would not provide any useful information. We, therefore, did not track anyone who spent less than one minute in the room. Also, according to the discussions with our sponsor, we excluded individuals who appeared to be under the age of 16 so that there would be no risk of infringing upon the rights of a minor. It would have been beneficial, however, to determine how visitors under the age of 16 interact with technology, as they have different attitudes towards technology than adults.

Using a clipboard containing a map of the room (created on-site by our team), we recorded if the person was in a group, marking the gender and estimated age of the individual we were tracking along with the gender composition of the rest of their group, if applicable. Although we only tracked one member of the group, we recorded observations about the remainder of the group, both adults and children. Although it would be useful to understand group interactions, especially when using digital technology, we could physically only track one visitor at a time. We then marked the path the individual visitor followed in the room. Aside from simply recording the path the

visitors followed, we recorded on the map actions such as where they stopped, or if they used a digital interface (the video, quiz, design programs, etc.). We recorded the time spent at all of these stops, including those at the digital technologies, using a stopwatch. Labeled maps are provided in Appendices E-G. Also provided in Appendix D is a list of elements and how the symbols and colors we designated on a map relate to the elements of the museum's rooms.

Specifically we recorded:

1. Current Date and Time (Wall-Time) as well as the tracking number (to match with the surveys) and the name of the investigator.
2. The path the visitor took through the entire room, and the total time spent in the room.
3. If the visitor stopped, we recorded the position on the map and the start/end time of the viewing in relation to the entry time (i.e. entered room at 00:00:00, looked at artifact starting 00:03:04, ending 00:06:23).
 - We recorded the times in the relevant fields below the maps. If a digital technology or stairs in the Jewellery Gallery were used, we marked a D or ST, respectively, next to the stop number.
4. The comment section was also used to record any comments the investigator had during the tracking session.
5. In addition to these comments, we also checked off some basic demographics of the visitor, including approximate estimated age, gender, and groupings (number of adults, children, males, and females).
6. Finally we recorded whether the tracking is “complete”, meaning that the tracked visitor also completed a survey.

If a visitor rushed out of the room, we attempted to follow him or her and ask if he or she would take a survey. If we could physically not reach the patron in time, then we made a note of this. We aimed to interact with those we were tracking as little as possible; however, none of the tracked visitors approached us during tracking. We found that we were expected to approach visitors in the Jewellery Gallery, informing them that they are not allowed to use cameras. In the case of a tracked visitor using a camera, we

resorted to waiting for other personnel to inform him or her so that the visitor's first impression of us would not be negative.

In order to analyze the data that we obtained from tracking, we entered all of the data except for visitor paths into a Microsoft Excel spreadsheet. For the paths that visitors took, we drew these in a digital format in Adobe Photoshop, and overlaid the paths within the rooms in order to create a layered traffic pattern.

3.1.3. Surveys

After creating the survey in consultation with our sponsor, we piloted our surveys and tracking studies for two days. We conducted these pilot runs in order to ensure that the questions were worded correctly, so visitors understood the questions, and that we were obtaining all of the necessary data. We then revised the survey in order to clarify the questions as much as possible.

When the tracked visitor exited the room, we approached him or her asking if he or she would be willing to complete a brief survey. If the visitor refused, we coded the tracking sheet appropriately, also recording in the comments section why he or she refused if known (such as the patron was in a rush, could not speak English, or refused to do a survey). If he or she agreed to participate, we read a short preamble (Appendix K) explaining the nature and purpose of the survey. We then administered questions and recorded the visitor's responses on the survey sheet.

During the surveying process, we marked down current date and time, investigator, the survey number in relation to tracking, and the gallery and room from the tracking, as well as visitor demographics including gender and grouping. We recorded the patron's level of fluency with English based the level of repetition needed to complete the survey. The categories we used for fluency in English were: the patron is fluent in English, needed a little repetition, a lot of repetition, or could not finish the survey due to language barriers. We then asked a few questions to gain additional demographic information such as what age bracket he or she fell in and how often the patron visits the V&A per year.

We designed the survey to elicit a variety of information, including the self-reported reasons for coming to the museum, what visitors recalled, and visitor use and opinions of the available digital technologies. The survey we used for the gallery tracking is provided in Appendix K. In order to analyze the data from the surveys, we entered all of the responses into a spreadsheet in Microsoft Excel. We grouped together responses to open-ended questions into categories and analyzed them both by their category and within their category.

3.2. Evaluating Digital Technologies in the Sackler Centre

3.2.1. Interviews

In order to better understand the use of digital technologies and the purposes for which they are used in the Sackler Centre, we conducted interviews with relevant personnel, based on with the advice of our sponsor, including the head of the Digital Programs, Lorna O'Brien, as well as the rest of her team consisting of digital program managers and coordinators. The interviews included a variety of questions designed to assess why digital technologies were used in this setting and what the interviewees hoped to gain from its use. A designated member of our team conducted four semi-formal interviews in-person between March 25 and April 15. He administered the interviews in a neutral conference room or the interviewee's office and recorded the interview and selectively transcribed the conversation soon after. If anything mentioned was to be quoted or paraphrased in our document, we would also refer back to the original sound file for clarification and to ensure accuracy. Our team member read the interviewee a short preamble giving him or her the right to review any quotations used in our report and informing him or her that the interview material would be kept confidential if he or she did not want to be quoted (Appendix A). We gave all interviewees this right to review, such that if his or her quote was used before publishing we gave that person a copy of the document specifying these quotes, and if he or she had any issues they would be addressed. General questions as well as specific questions for certain individuals are provided in Appendices A and B.

In interviewing the coordinators and managers of the digital courses, we were interested in several pieces of information. We designed the interview questions to elicit

details about the structure and purpose behind the programs offered in the Sackler Centre, and how digital technology is being used to enhance the learning experience of the participants. The questions are similar to those used for staff regarding the galleries of the main museum, and aside from those geared towards certain interviewees, they contained:

- The background of the interviewee
- The goals of using technology in the programs or courses
- How the V&A determines the subject of the programs and courses to offer and which technologies to use in those classes
- What existing evaluations or other feedback reveal about the classes
- Any obstacles faced regarding the implementation of technologies.

The results of these interviews provided us with a way to determine why the V&A is offering programs that use digital technologies and allowed us to gauge the effectiveness of the use of these technologies in the classes. They also presented us with some outlook into future plans for the Sackler Centre and other research going on within the center.

3.2.2. Surveys

We created two similar but distinct surveys in order to gather information from the variety of offerings in the Sackler Centre. One survey was for participants in drop-in programs, while the other was for participants in courses. Drop-in programs are offerings that are free, take place during one day, and attendees can come and go as they please. Courses are offered over multiple sessions, usually have a fee and participants are expected to attend all of the sessions offered for the full period. Taking into account that most participants tend to leave quickly after the completion of a class or program, we made the survey as short as possible while gathering the information we needed. Similar to the gallery surveys, we first recorded the current date and time, the investigator, the survey number, how fluent the participant was in English, the program or course name and run time, and the participant demographics (gender, age grouping). We piloted the surveys during one program, the Decode Drop-In, to be sure that visitors understood our questions correctly and that we received all of the pertinent data.

We designed the surveys to determine why the participant attended the course or program, if he or she liked it, and how much the attendant felt he or she learned relative to other courses or programs. The main difference between the two surveys was that the program survey only asked for a participants' self-measured level of proficiency in technology while the course survey asked for participants' self-measured levels of proficiency in technology before and after the course, as courses are typically offered over a longer period of time (See Appendices L and M).

Over the course of our research we were able to survey three different programs offered at the Sackler Centre. The first was a drop in program for the Decode exhibition; this program was free and mostly consisted of conversing with a digital artist and asking questions. The second program we surveyed was the final class in an 8-week course about digital photography. This program was ticketed and cost £240; it consisted of learning everything one needs to know to get started as a digital photographer, from picture taking techniques to photo-editing. The final program, Digital Quilt Design, was where most of our data came from. It was a free drop in program which was offered over four days. This program tasked participants to take a camera out into the galleries, take pictures of an object as well as two patterns, come back to the digital lab and, with the help of an instructor, edit his or her photos to produce a digital quilt square and include it in a large digital quilt. While the first two courses were more adult-based, this course was heavily geared towards both families, and those visiting the Quilts exhibition, which coincided with this program.

We entered the data from these surveys into a Microsoft Excel spreadsheet. Similar to the surveys from the galleries, we placed responses to open-ended questions into similar groups and analyzed by groups and within groups. We recorded the program design and contextual information in order to properly analyze the smaller number of surveys.

3.3. Evaluating Digital Technologies in Other Museums

We visited and interviewed key personnel in learning and technology departments at museums in both the greater Worcester and London area in order to assess how digital technologies are used in other museums, and to compare this to their use in the V&A.

Within the United States, we visited the Worcester Art Museum in Worcester, Massachusetts. We chose this museum because it is an art museum that is starting to incorporate digital technologies, because we had contacts with staff in the museum, and because of its proximity to Worcester Polytechnic Institute. Within London, we were only able to conduct an interview at the British Museum but we visited the British Museum, Tate Britain, Tate Modern, National Gallery, and the Museum of Scotland and Scottish National Portrait Gallery in Edinburgh. We chose these museums because they are non-science museums which are using, or starting to use, digital technologies in their exhibits and public programming. We conducted semi-formal interviews to allow for flexibility in the order in which we asked the questions, and also to allow the interviewee to freely expound on a topic as well as allowing the member of our team conducting the interview to probe for additional information on particularly pertinent points. Our team member conducted these interviews in person while he wrote notes and any relevant quotations. Each interview lasted between 30 and 60 minutes. We informed the interviewee of their right to review any quotations used in the report and that if he or she did not want to be quoted, all material would be kept confidential (Appendix A).

We conducted a pilot interview and a pilot visit and observation to the Worcester Art Museum and the Higgins Armory, respectively. From these, we began to develop and shape the questions that we would ask other museums and the questions that we would ask of staff at the V&A.

The key categories of these interviews were similar to the categories of the V&A interviews (Appendix A) and include:

- The background of the interviewee
- The goals of using technology in the museum
- How the museum chooses what technologies to use and how these technologies are implemented
- Any obstacles faced regarding the implementation of technologies

Our team member also asked the interviewee for information the museum has found regarding digital technologies, as well as what they currently offer. In addition to

the interviews, we explored the museums in question to determine on our own what digital technologies are being used and how these enhance visitor experience. We conducted these visits informally and focused on observations as both a visitor to the museum and a researcher on the use of digital technology in museums. Our informal observations also provided context for what the interviewee's response to digital technology was and how it is being implemented within the museum. These visits and interviews were a means for us to obtain a framework of how other non-science museums operate. The results from these interviews and visits gave us the information we needed to compare the V&A to other museums in terms of digital technologies available to the visitor and how these technologies are being used for learning.

Through the use of surveys, interviews and tracking, we were able to determine the effect of digital learning in the facilitated environment of the Sackler Centre as well as the un-facilitated environment of the main museum galleries on the learning experience of the visitor. After analyzing the data from these methods, we found many interesting results regarding digital learning and the use of digital technology in the V&A; mainly that most visitors do not use the digital technology but it has a longer holding power than non-digital exhibits.

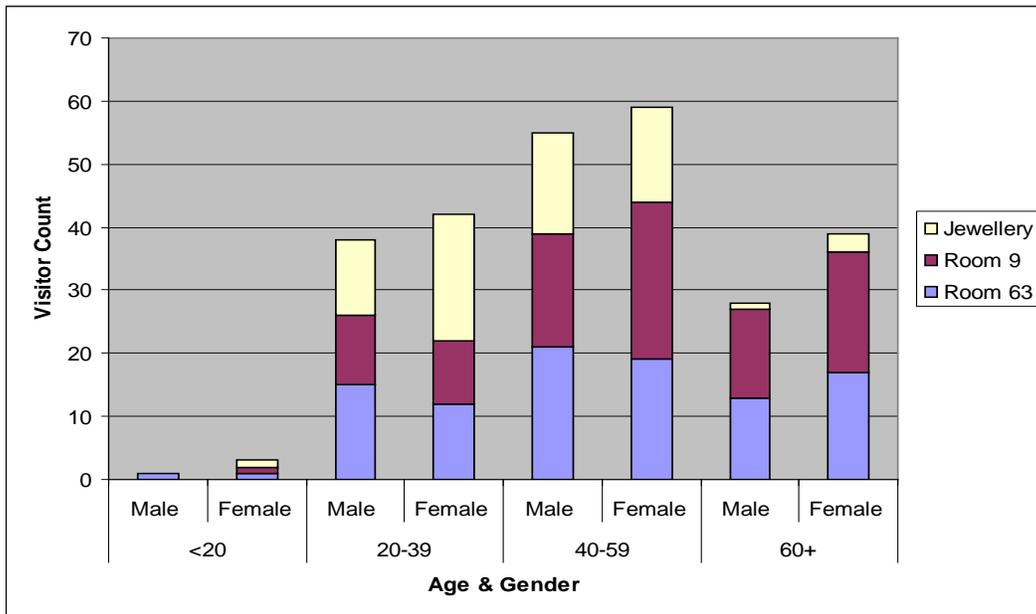
4. Data Analysis and Findings

After collecting data through the methods of tracking, surveying and interviewing, we found that many visitors passed by the digital technologies, especially in the Jewellery Gallery. We also found that although few visitors overall used the digital technologies, visitors of all age ranges and self-rated proficiencies with technology did interact with the digital technologies. Many visitors may not have used the technology available, but those who did use it really enjoyed it.

4.1. Demographics of Tracking and Surveying

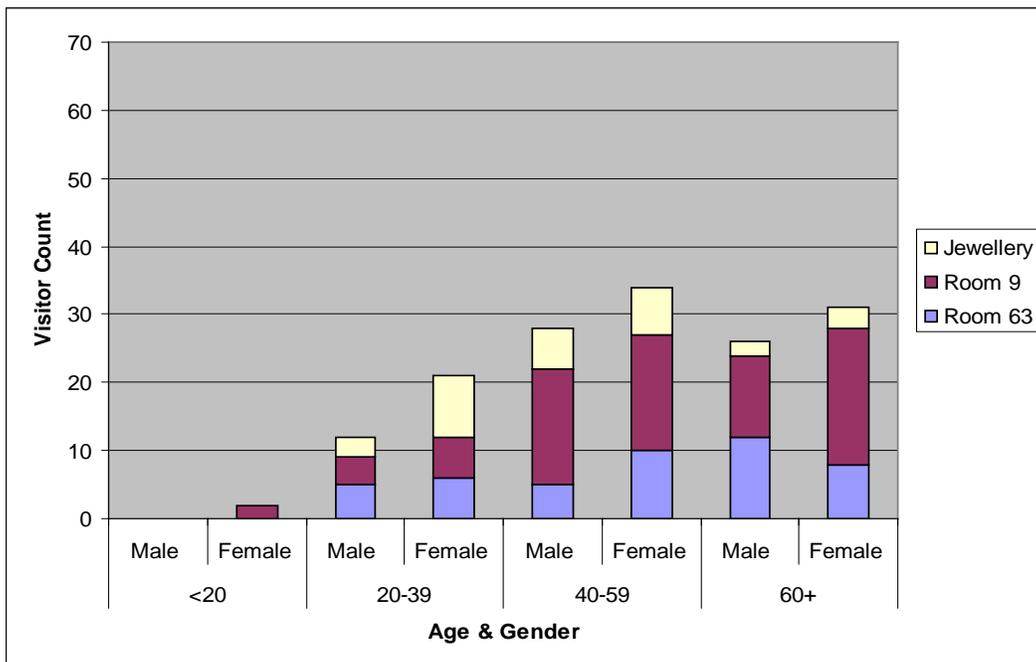
During the course of our data collection, we tracked 268 museum visitors; 99 visitors in the Medieval and Renaissance Gallery Room 9, 99 visitors in the Medieval and Renaissance Gallery Room 63, and 70 visitors in Rooms 91-93 (lower floor) of the Jewellery Gallery. These rooms will henceforth be referred to as Room 9, Room 63 and the Jewellery Gallery, respectively. Selected by the project team and our sponsor, these rooms showcase varying differences to provide a fuller view of the galleries. The Jewellery Gallery is self-contained within a single room with a lower and upper floor. Meanwhile, the two rooms in the Medieval and Renaissance Galleries show rooms on different floors with varying uses of digital technology and traffic, but still a consistent theme of the gallery. Although we tracked visitors for the same amount of time in each of the rooms, the number of tracking studies is lower in the Jewellery Gallery because many visitors spend a longer time, on average, in this gallery than the other two rooms. Figure 8 shows the age ranges and genders of those we tracked. The age ranges of the tracked visitors are estimated unless the visitor took the survey, as the survey asked for the visitor's age range.

Figure 8: Age Ranges and Genders of Gallery Visitors Tracked (N=268)



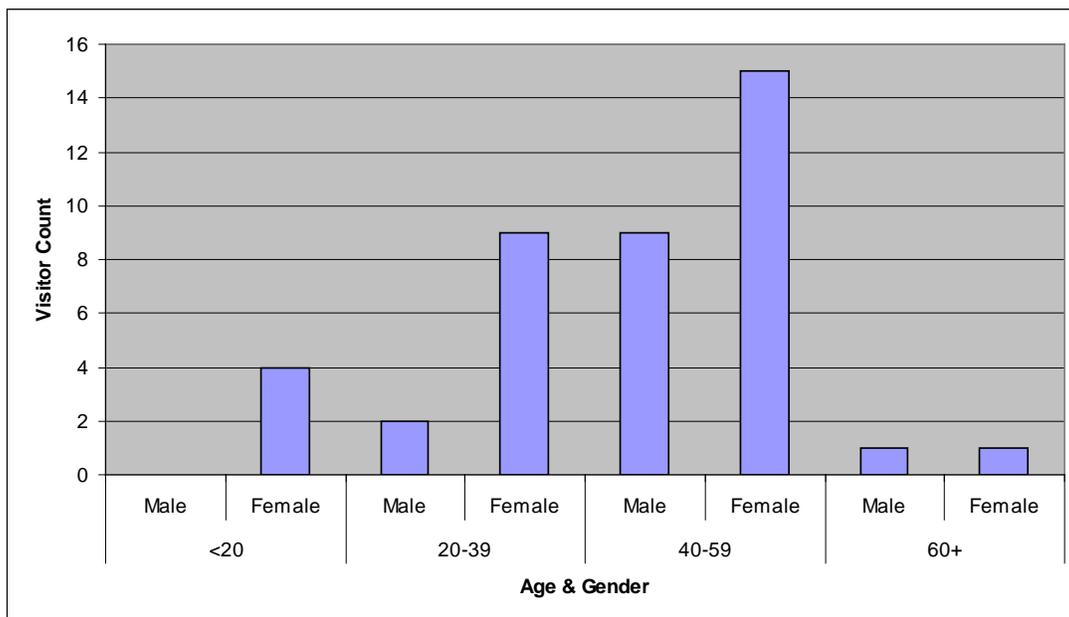
One hundred and fifty-four (154) visitors took our survey in the galleries; 78 in Room 9, 46 in Room 63, and 30 in the Jewellery Gallery. The age ranges, which are visitor reported, and genders of visitors who completed the survey can be seen in Figure 9.

Figure 9: Age Ranges and Genders of Gallery Visitors Surveyed (N=154)



In the Sackler Centre, 41 participants were surveyed. Figure 10 shows the age ranges and genders of the surveyed participants. Due to the program schedule of the Centre during the time of our research we were only able to survey participants from three separate digital programs. The three activities that ran during this time period were a Decode Drop-in Afternoon, the final session of a course titled Introducing Digital Photography, and Digital Quilt Design. The Decode Drop-in Afternoon consisted of a setting in which participants had the opportunity to converse freely with a digital artist. The second program was a structured course that ran for eight weeks providing instruction on taking digital pictures as well as image manipulation. The majority of our survey sample, 83%, came from the final program during our time spent at the V&A. This program, Digital Quilt Design, was a drop-in activity in which participants of any age manipulated photos taken in the galleries in order to create a digital quilt square. This final program took place during the course of the Easter Holiday break for the British schools and had the highest participation of the programs we surveyed, especially with regards to family participation since the other programs were mostly catered to adults.

Figure 10: Age Ranges and Genders of Sackler Centre Participants Surveyed (N=41)



Visitors come to the V&A for a variety of reasons. Unprompted, many survey respondents said that they came to see a specific gallery (22%) or exhibition (7%), with

18% of visitors alone coming to see the Medieval and Renaissance Gallery and 1% visiting to see the Jewellery Gallery, or that they just wanted to see the V&A (22%). Other visitors gave various reasons, including that they came on a group trip, they were in the area, the weather was bad, they were on holiday or they like museums in general.

Attendees in the Sackler Centre gave many reasons for participating in the programs. Many visitors said, unprompted, that they attended the program because either a parent wanted their child to (20%) or the child wanted to (20%) or because they were interested in the subject of the program (18%). The other reasons given include that the participant likes the V&A, the program was happening while they were here, the program was related to the participants' research hobby or work, or the participant was interested in an exhibition related to the program, such as Decode or Quilts.

The reasons for attending programs in the Sackler Centre are much more group specific, such as parents or children wanting to attend, than the reasons for visitors visiting the V&A. Most of the people that we surveyed in the galleries were just coming to see a gallery or the museum in general, so most reasons are related to galleries and the V&A in general. In the Sackler Centre though, some participants may have come specifically to participate in the program. Six visitors did mention though that they came to the museum and saw that the program was going on so they then decided to attend.

4.2. Tracking Studies and Traffic Flow

From the tracking studies we conducted on patrons of the V&A we have compiled an overall map of the traffic within the selected rooms. These maps, which are a digital recreation of the paths drawn by hand when observing a visitor, are overlaid as a transparency. These maps showing all of the paths and stops of the visitors we tracked are shown in Figures 11-13.

Looking at the rooms as both a whole and separate entities, we can see patterns in how people move within them. In the Jewellery Gallery, for example, the lines are darkest around the edge, while the other areas show different paths. Every single visitor does not follow the outer rim of the room though. The flow of the gallery depicts that from where a visitor enters, he or she either begins to walk around the outer edge

Figure 11: Traffic Map of the Jewellery Gallery

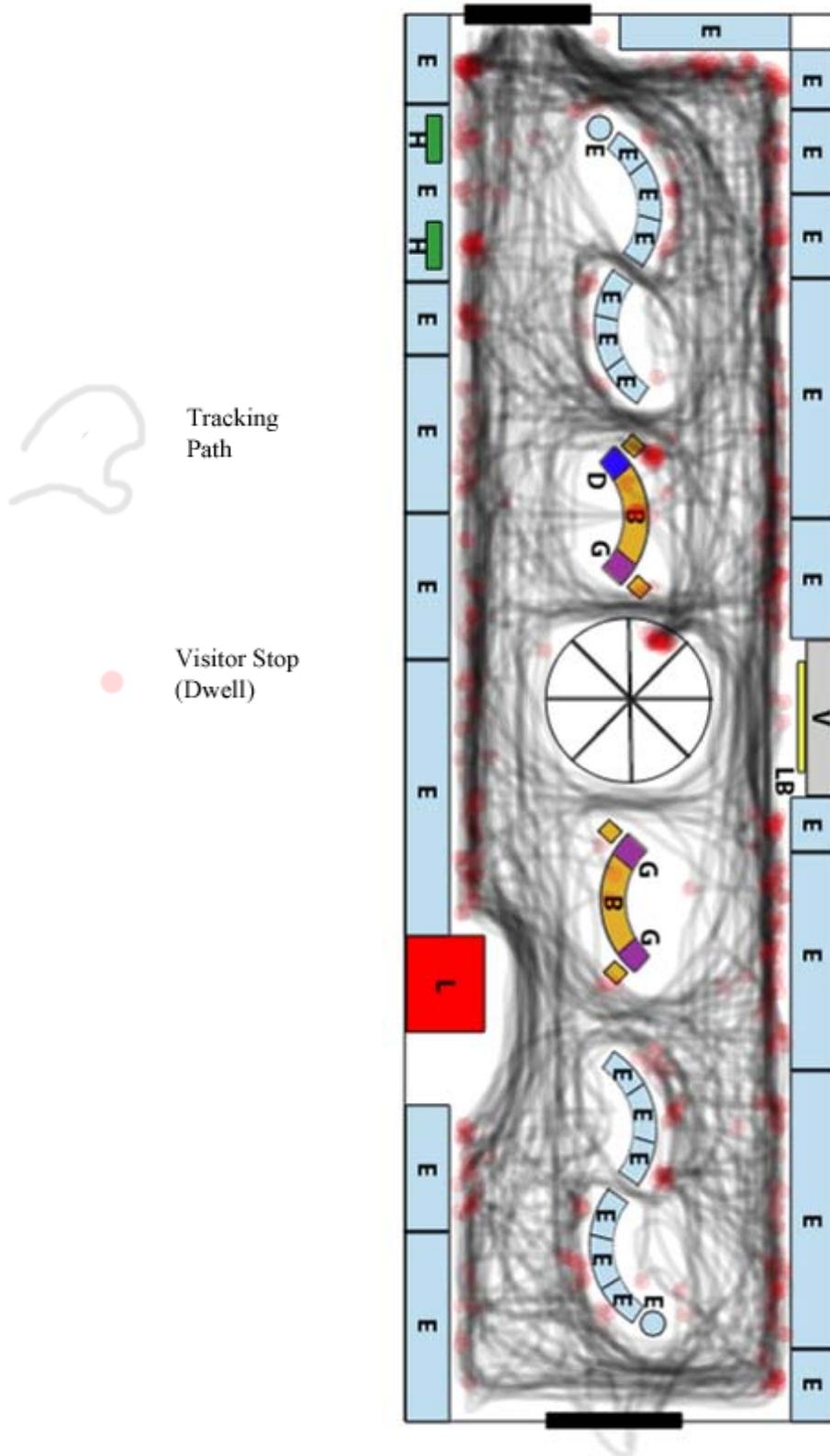
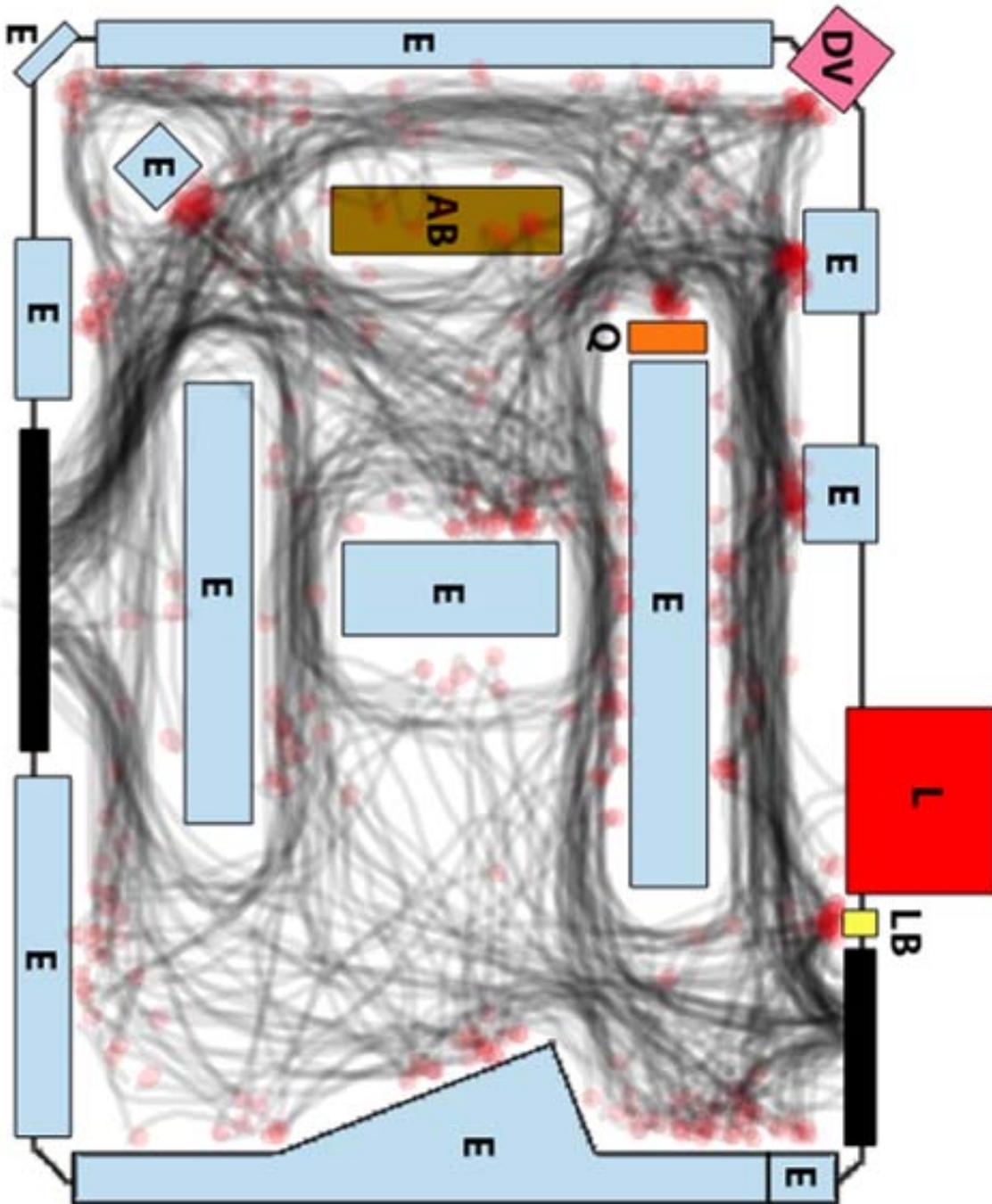


Figure 12: Traffic Map of Room 9

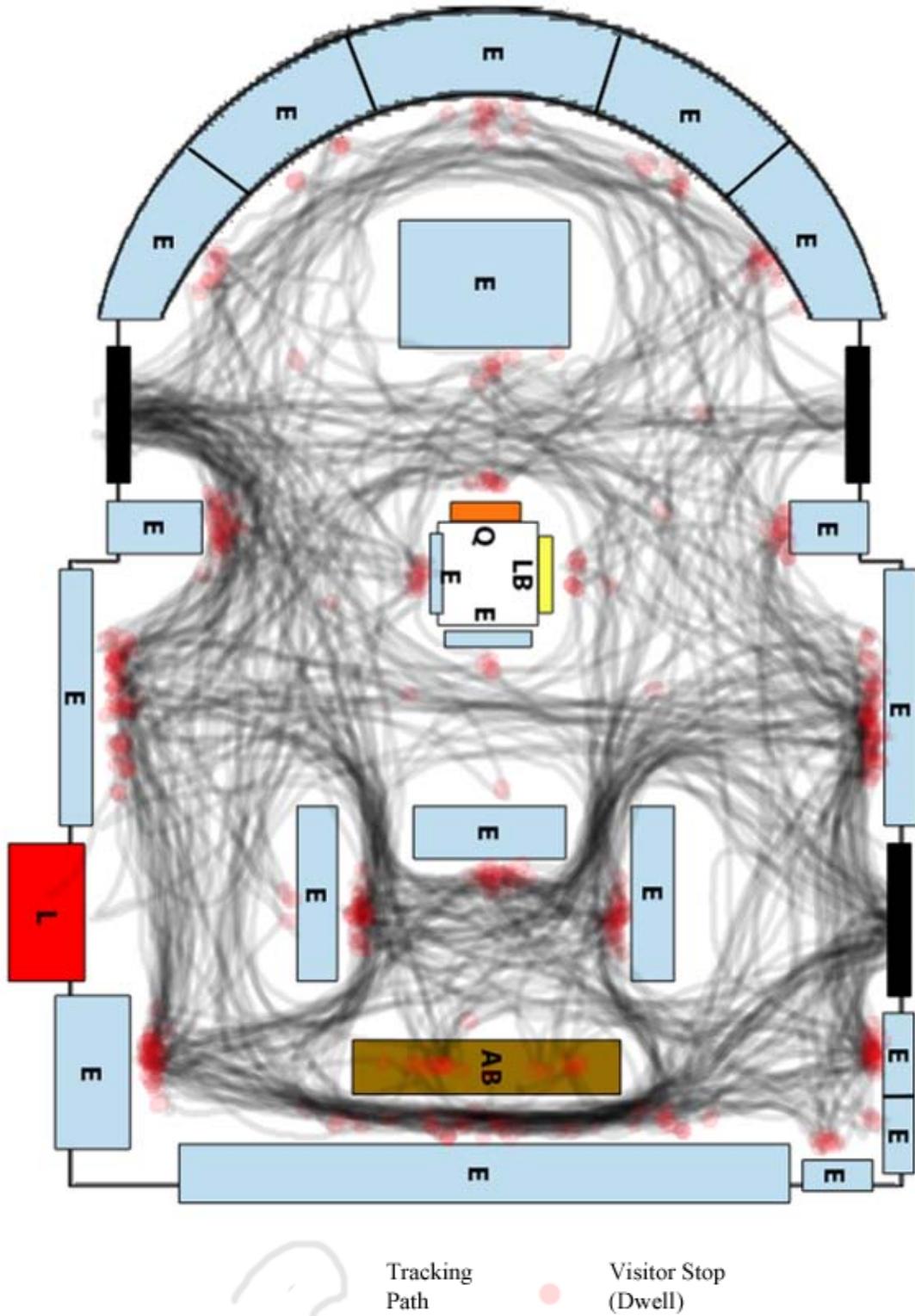


Tracking Path



Visitor Stop (Dwell)

Figure 13: Traffic Map of Room 63



clockwise or sometimes counter-clockwise, occasionally deviating from the rim to see the objects inside the center of the room.

This concept of how people move within the room is important in order to understand the usage of digital technologies. While some visitors are drawn to the available technology immediately and quickly move to use it, most people walk along, and upon seeing it they begin using it. From the traffic of the rooms it can be seen that the digital technologies in Room 9 and some digital technologies in the Jewellery Gallery rooms are in higher traffic areas than those of Room 63 and the other technologies offered in the Jewellery Gallery. Whether these technologies are the cause of the high traffic, or if the technologies are simply in high traffic areas, is later analyzed by looking at dwell times and usage of those who pass by the device. Figures 14-16 show the direction visitors take in the main areas sectioned off in the room (the key in Appendix D and the labeled maps in Appendices E-G show the exhibits and layout of the maps).

Figure 14: Traffic Flow in the Jewellery Gallery

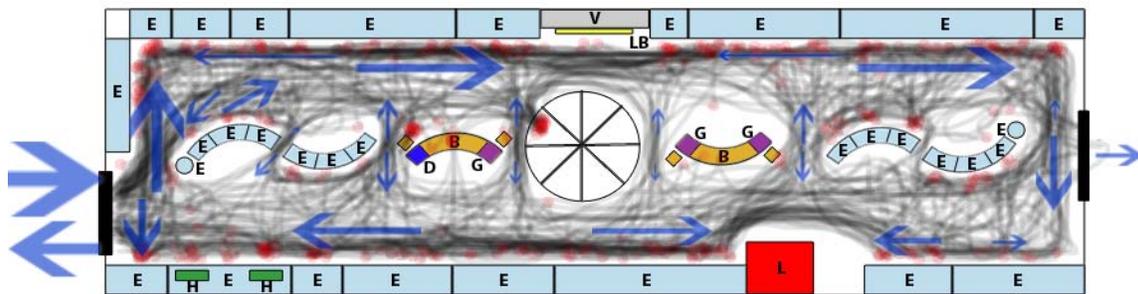


Figure 15: Traffic Flow in Room 9

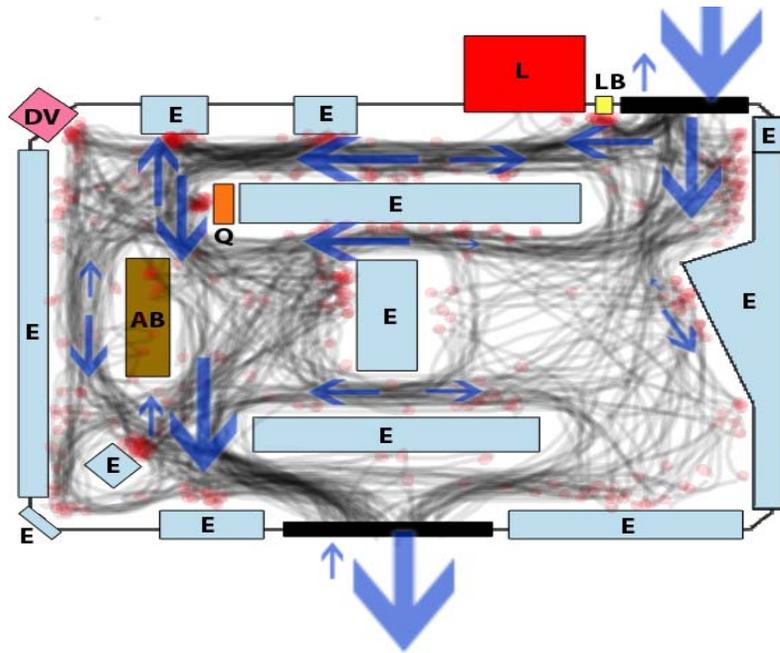
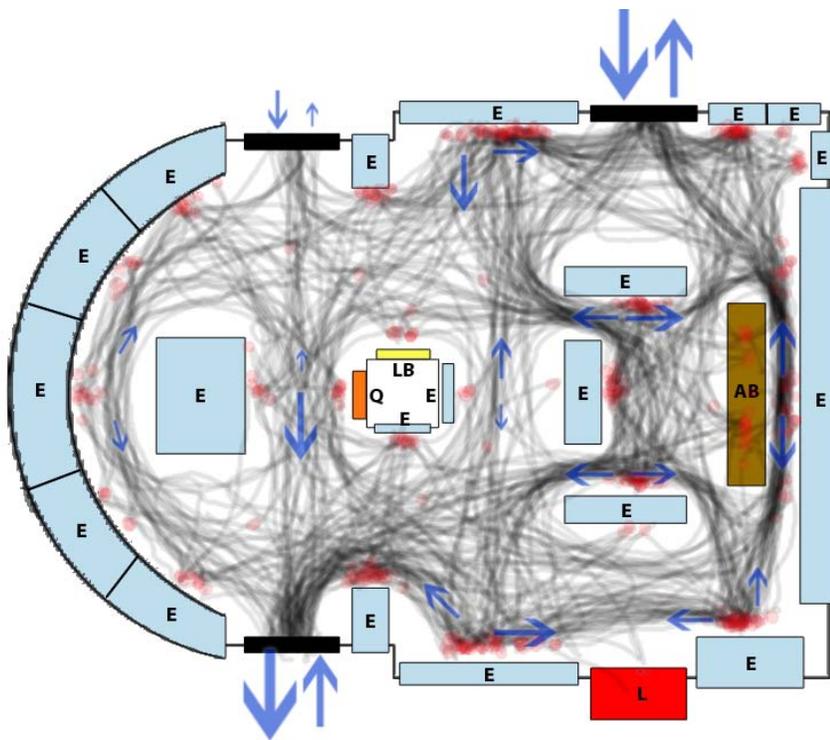


Figure 16: Traffic Flow in Room 63



While this flow shows us the major traffic areas within the room, especially those around the digital technology, they fail to show the draw of an exhibit. The following

figures 17-19 show on the map where visitors first stopped when entering the room (as well as the numbers of visitors who entered/exited through each of the doorways and the lift). While most of these figures show a favoring to items that are right by the doorway (first thing you see) some of the numbers suggest other more drawing exhibits (the key in Appendix D and the labeled maps in Appendices E-G show the exhibits and layout of the maps).

Figure 17: First Stop of Visitors in the Jewellery Gallery

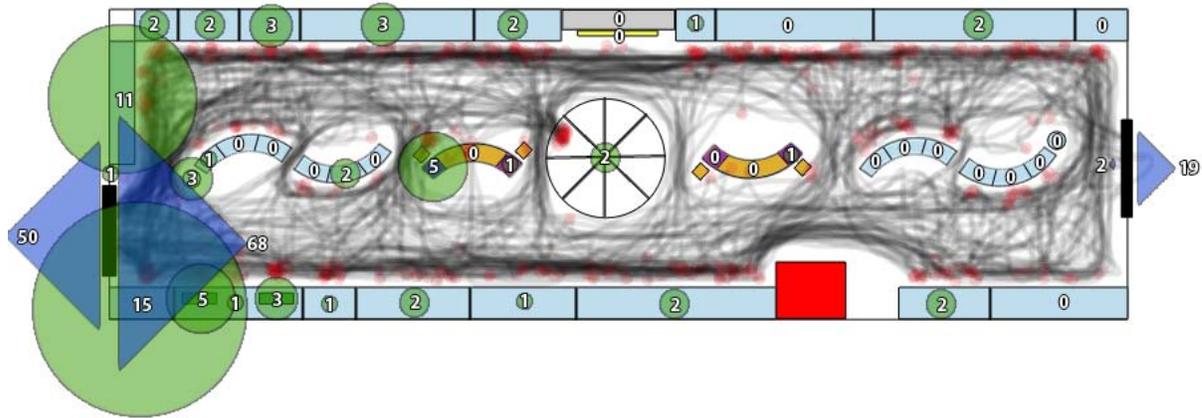
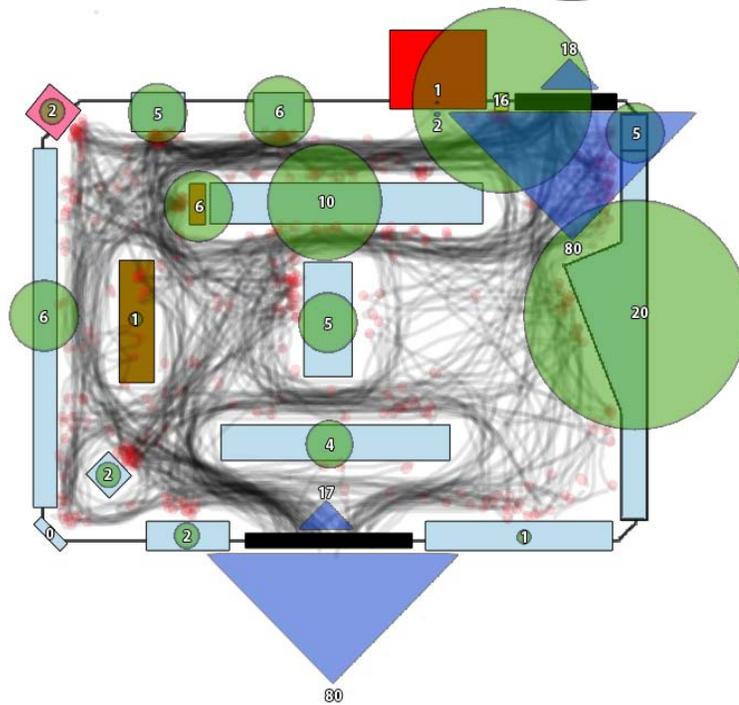


Figure 18: First Stop of Visitors in Room 9



accommodates for the lack of visitors stopping there, by having an average time significantly higher than other exhibits.

Figure 20: Total Visitor Stops of Visitors in the Jewellery Gallery

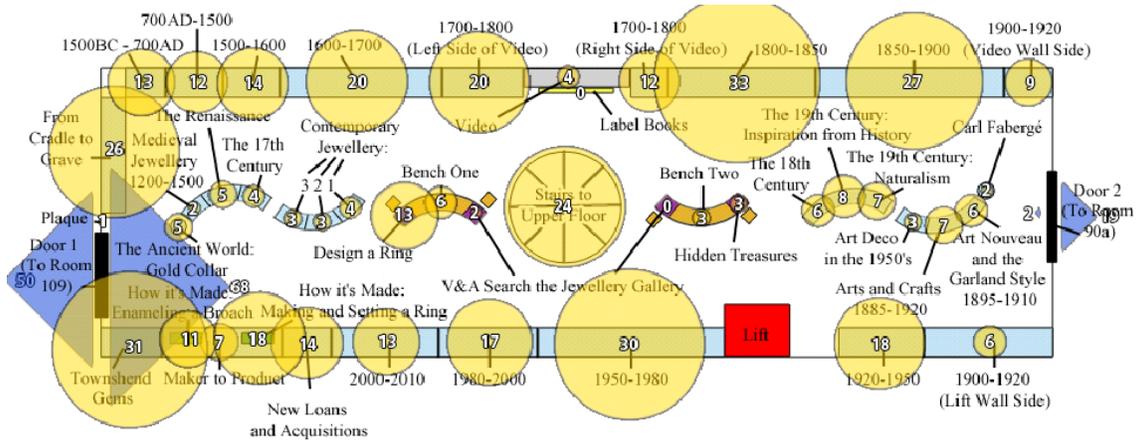


Figure 21: Total Visitor Stops of Visitors in Room 9

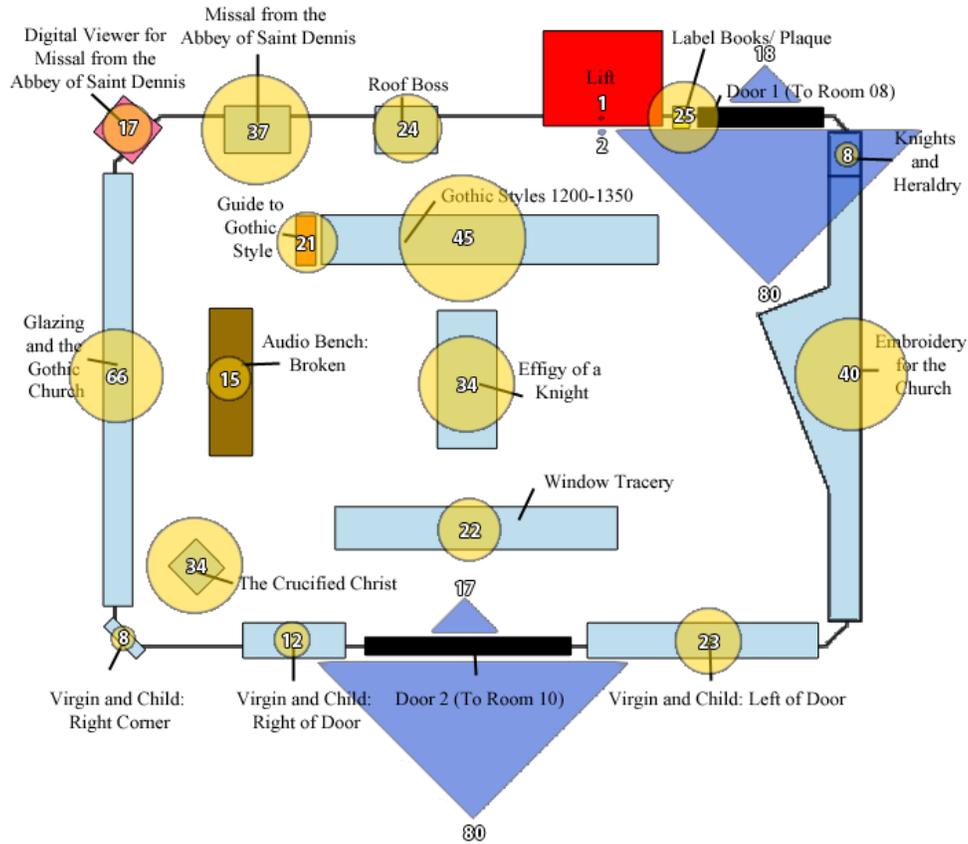


Figure 22: Total Visitor Stops of Visitors in Room 63

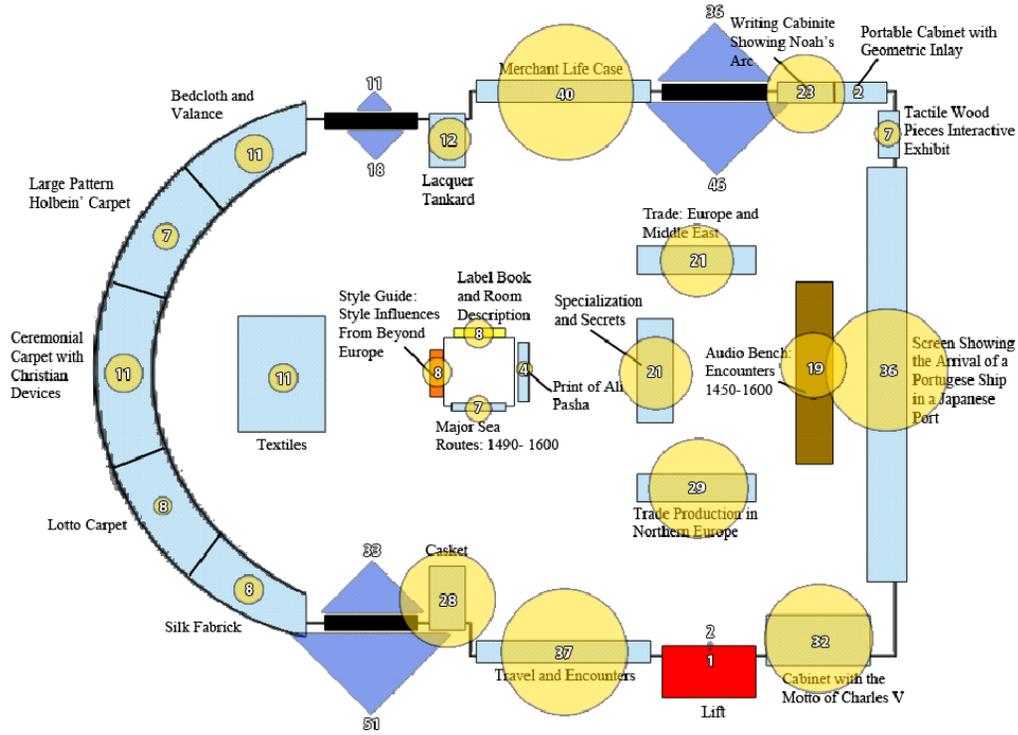


Figure 23: Average Dwell Time of Visitors in the Jewellery Gallery (In Seconds)

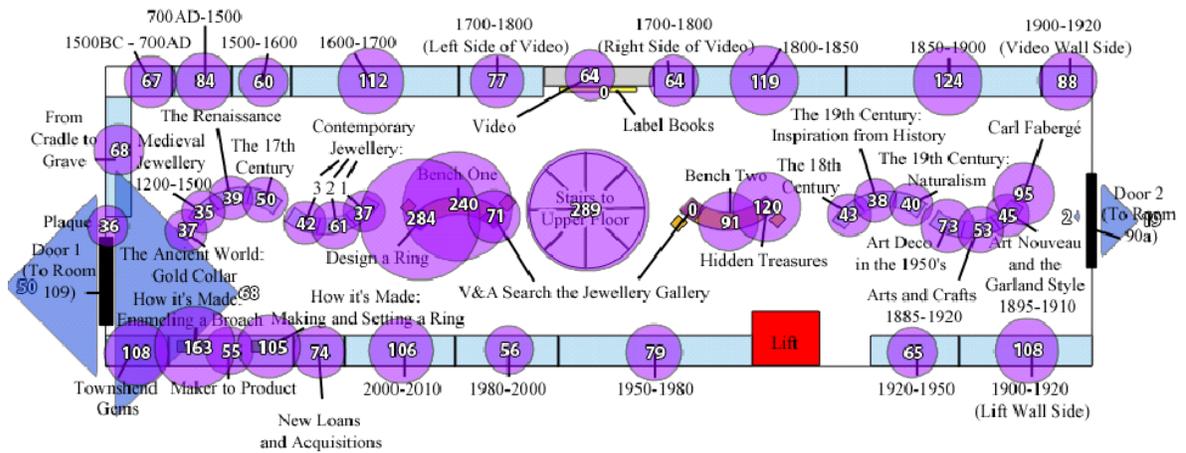


Figure 24: Average Dwell Time of Visitors in Room 9 (In Seconds)

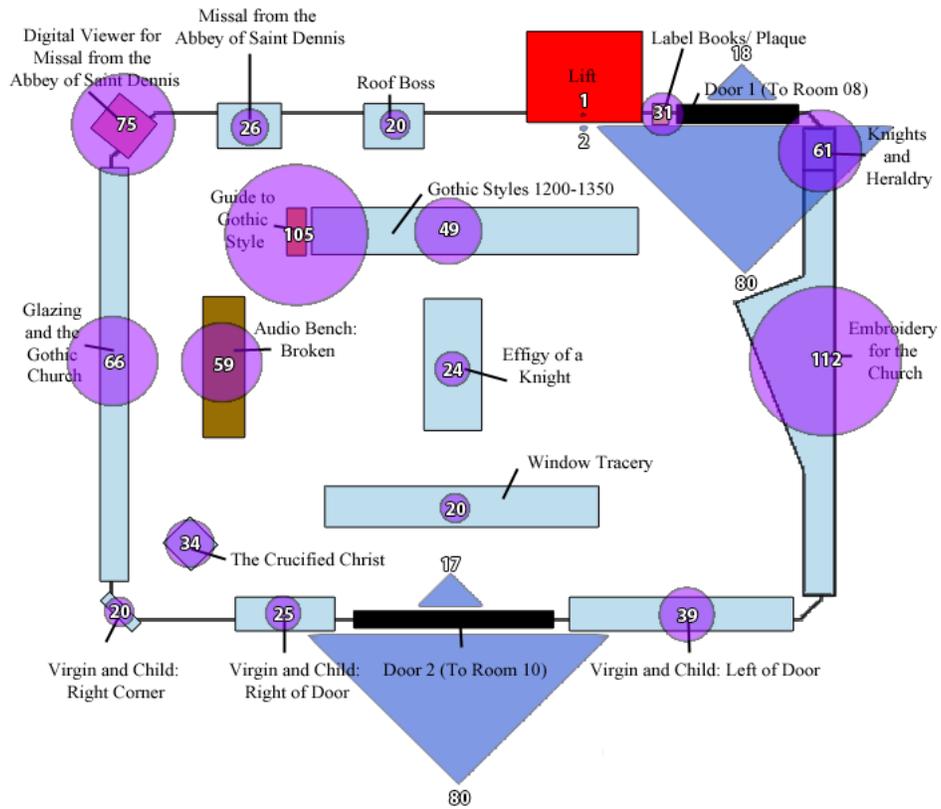
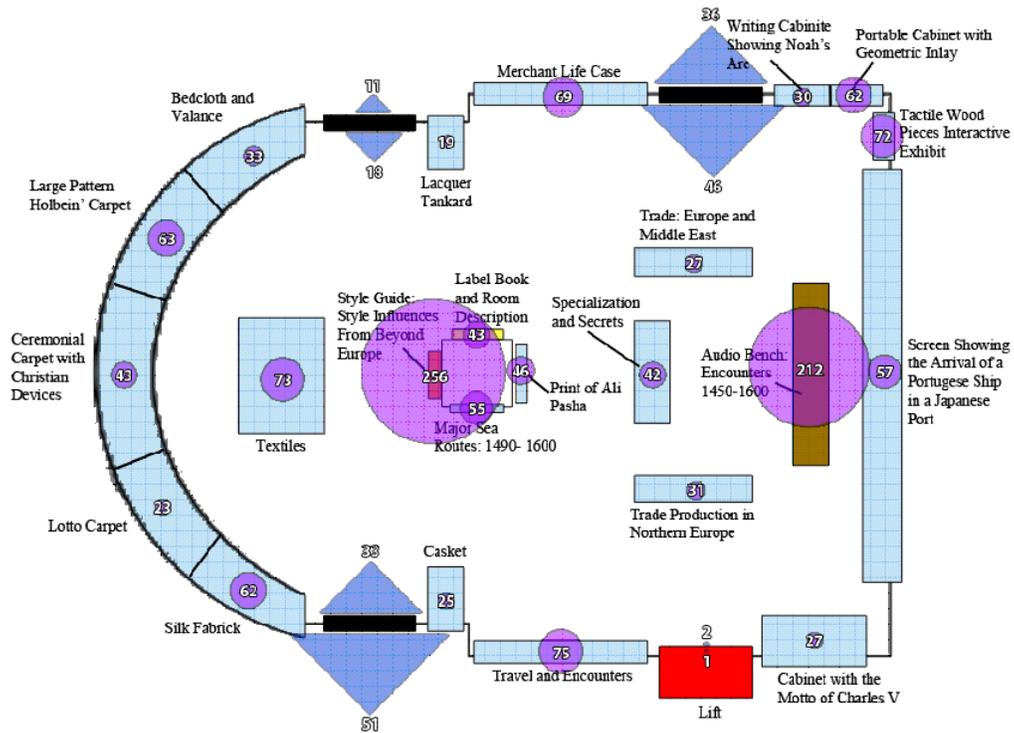
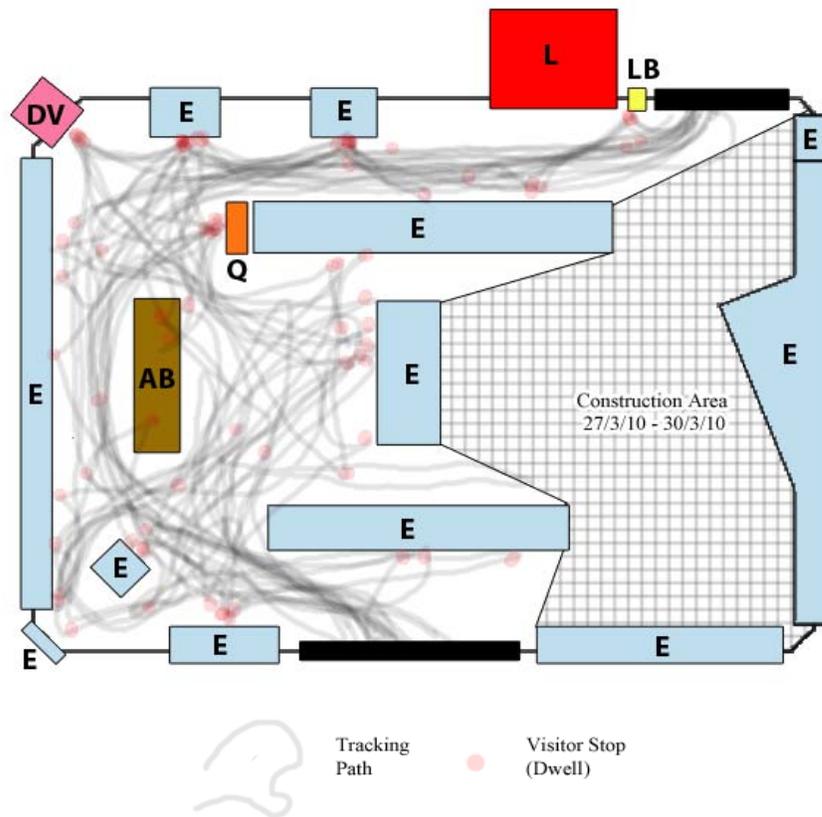


Figure 25: Average Dwell Time of Visitors in Room 63 (In Seconds)



Between March 27 and 30, part of Room 9 was roped off due to construction, although we only tracked visitors on the 27th and 28th. With no other trail to follow, the visitors were guided down a path past the digital technologies. From the tracking patterns and observations we recorded during this time period, we noticed that a higher percentage of visitors used the digital technology. The usage was still high prior to construction because traffic tended to flow towards the technology, but the technology was more likely to be utilized during this period in which the visitor was guided right past it. Figure 26 shows the area sectioned off during the two days construction took place in room and the traffic during this time of construction.

Figure 26: Construction Area in Room 9



While we did not record the progress of walkthroughs (those who stayed in a room for under 1 minute), we did record notes when there was a significant number of walkthroughs. Most commonly, these occurred in Room 63, which, including the lift, has 4 exits and entrances and is near a staircase to other levels. These walkthroughs are important in regards to traffic and digital technology usage. Most walkthroughs in Room

63 walked right next to the Style Guide and though a large amount of people passed by it, few of these were visitors who lingered within the room.

Figures 27-29 show that visitors who used the interactive digital technologies did interact with them for a much longer period of time than they interacted with non-digital exhibits. These decay curves show the percent of visitors who used a specific digital technology left at the technology after a certain period of time and compares this to the same graph for visitors who did not use digital technologies. The decay curves for visitor interaction with the Design a Ring interface and the Style Guides in the 3 rooms differ from those for visitor interaction with the non-digital exhibits. The difference is quite large in the Jewellery Gallery and Room 63, although it is less noticeable in Room 9. Also, as seen in Figure 10, compared to the two non-interactive How It's Made videos in the Jewellery Gallery, visitors use the interactive Design a Ring interface for a much longer period of time. The difference between the Style Guides and the audio benches in Rooms 9 and 63, though, is much less pronounced.

From these decay curves we can see that more than 60% of visitors who used the Design a Ring interface stayed for more than 5 minutes, which is much higher than that for any of the other non-digital exhibits and the How It's Made videos, where less than 10% of visitors dwell at the exhibit after 5 minutes. While visitors left the How It's Made videos much quicker than the Design a Ring interface, these videos had a set time limit, meaning that those who came in during the middle of the video most likely left when it was over rather than waiting for the next video to start up.

These trends can also be seen in the other rooms, with the Style Guide and audio bench in Room 63 keeping 60% of visitors for more than 5 minutes. The difference here though is that compared to the audio bench, the Style Guide had between 10-20% less visitors during the periods between 2-7 minutes. This shows a longer dwell time on average for the non-interactive audio bench rather than the interactive Style Guide. Room 9 however shows a much quicker drop-off with all technologies, though the Style Guide has a longer holding time than the Missal Viewer. While the curve shows 50% of visitors staying at the exhibit for more than a minute, the holding power is only slightly greater than non-digital exhibits.

Figure 27: Time Spent at the Digital Exhibits Compared to Non-Digital Exhibits in the Jewellery Gallery (N=70)

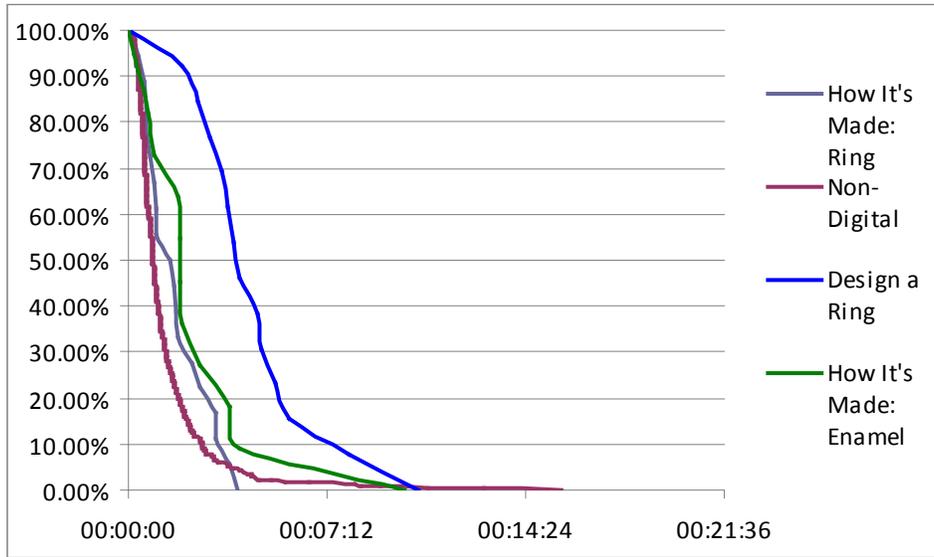


Figure 28: Time Spent at the Digital Exhibits Compared to Non-Digital Exhibits in Room 63 (N=99)

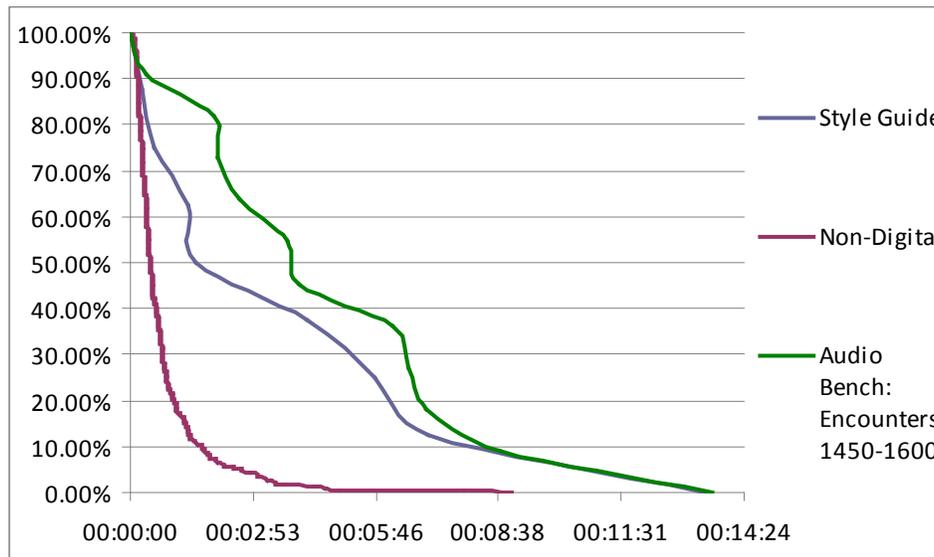
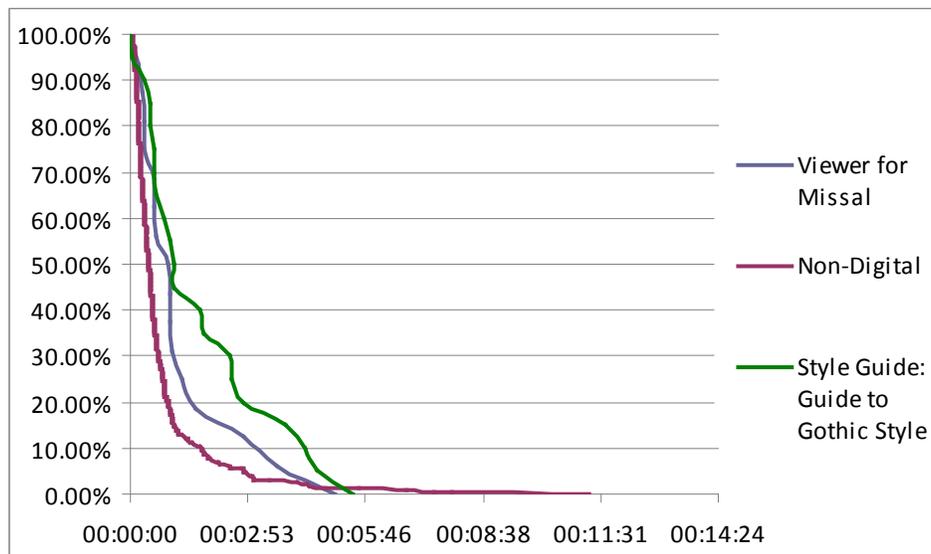


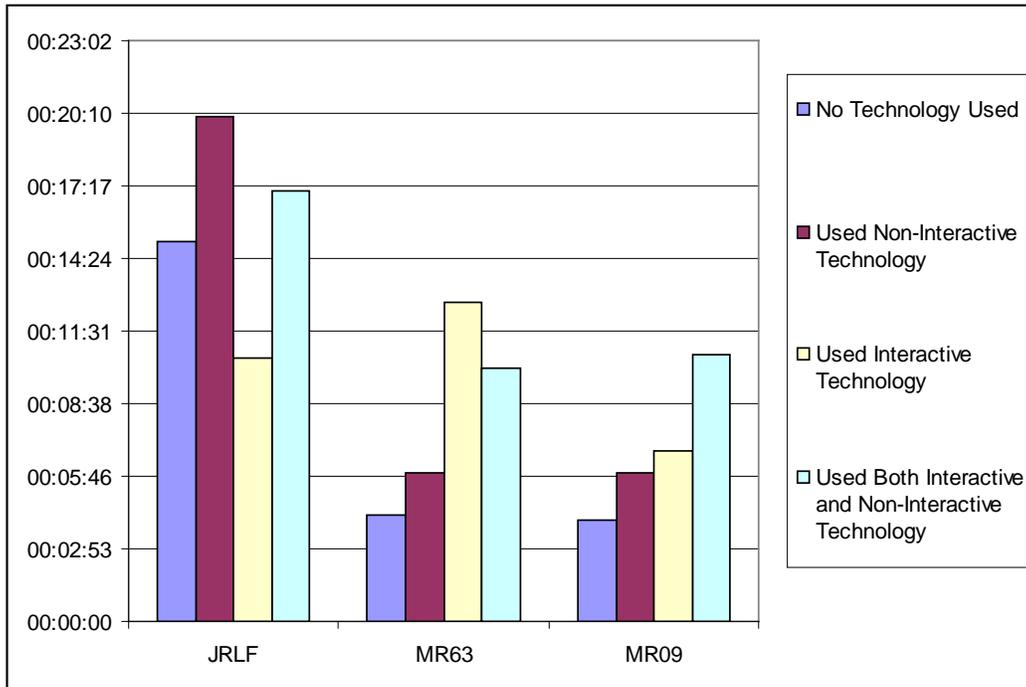
Figure 29: Time Spent at the Digital Exhibits Compared to Non-Digital Exhibits in Room 9 (N=99)



Use of the interactive digital technologies by those who were not tracked varies quite greatly between rooms. In Room 9, 10 instances were recorded where a visitor who was not being tracked used the Style Guide. In the Jewellery Gallery, 30 separate instances were recorded for the Design a Ring interface. However, in Room 63, there were only a few instances of another visitor using the Style Guide. In fact, during a one and a half hour tracking session, no visitors used the Style Guide at all, while during a session of the same time in the Jewellery Gallery, constant visitors were using Design a Ring every time the observer looked at the interface. This discrepancy could be attributed to the fact that many more children visit the Jewellery Gallery and in this gallery they are very likely to go straight to the available digital installations. These observations, while not formally recorded, provide the context that the visitors we tracked are a random sample and the data should not suggest that technology usage in these rooms is limited to those we tracked. There is also the matter of a visitor not being able to use a technology because it is already in use.

Figure 30 shows the average dwell times of visitors in the rooms depending on whether they used no technology, non-interactive technology, interactive technology (Style Guides and the Design a Ring interface) or both forms of technology.

Figure 30: Dwell Time in Rooms in Reference to Digital Technology Usage (N=268)



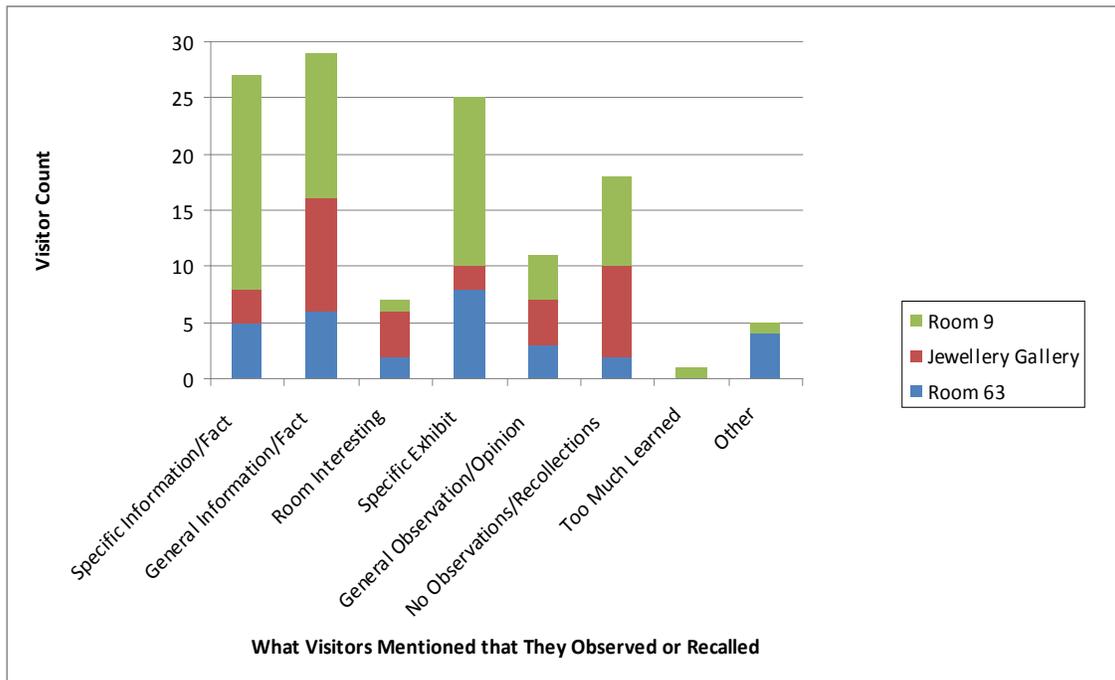
From this there are three distinct observations. First, in Room 9, the dwell time increases with the amount of technology used. This is also shown in Room 63; however visitors who used both types of technologies in the room stayed on average less than those who used solely the interactive technology. In the Jewellery Gallery, those who used the interactive Design a Ring interface stayed a shorter time in the room compared to those who did not use it. However in all these cases the usage of digital technology increased the average time in the room, except for those who used solely the Design a Ring interface in the Jewellery Gallery staying almost 4 minutes less.

4.4 Visitor Recollection and Observations

Survey respondents were asked “Can you please name one specific thing that you learned or observed from this room?” We wanted to know if visitors who interacted with digital technologies recalled different things than visitors who did not interact with interactive technology. Figure 31 shows what types of information visitors who did not interact with the interactive technology recalled. The highest number of visitors recalled information or a fact from the room in general (such as visitors who were impressed by the difference in the design of jewelry among time periods), while the next highest

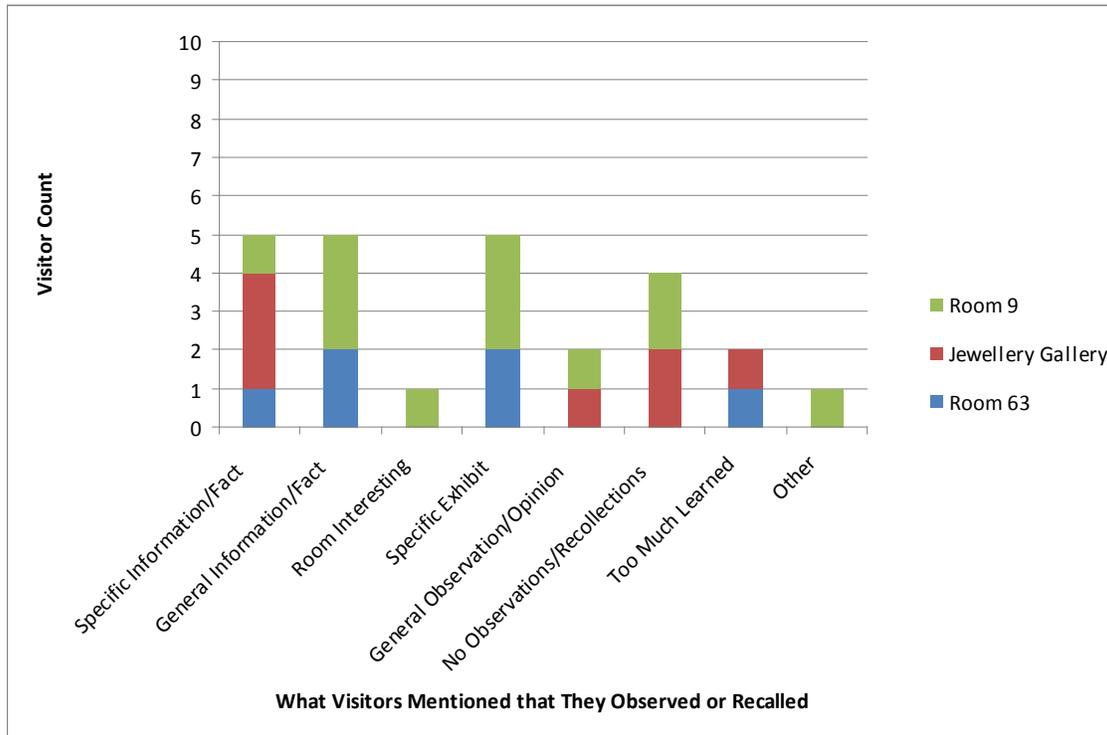
number of visitors recalled information or a fact from a specific exhibit (such as visitors who recalled that bone was used as a substitute for ivory or those who recalled the Venetian technique of using silver wire to engrave copper). These are followed by visitors who recalled a specific exhibit (such as visitors who recalled seeing the Madonna statue or the Japanese lacquer tankard) and visitors who either could not or refused to name something that they recalled or observed.

Figure 31: What Visitors Who Did Not Use the Interactive Digital Technology Recalled or Observed (N=123)



Although the sample size for visitors who used the interactive digital technology is much smaller than that for visitors who did not use the interactive digital technology, Figure 32 shows that the responses for visitors who did use the interactive digital technology are very similar to those who did not. While between the rooms, 22% of visitors who used the interactive digital technology mentioned a fact from the interactive digital technology, no visitors in the Jewellery Gallery mentioned anything from the Design a Ring interface. One visitor did say that they thought that Design a Ring was seen as more of a toy for children to keep them busy. Perhaps this interface is seen more as a technology to play on rather than a technology to learn on.

Figure 32: What Visitors Who Used the Interactive Digital Technology Learned or Observed (N=25)



4.5 Demographics of Digital Technology Usage

Overall, 16% of visitors that were tracked used the interactive digital technologies. The number of visitors who used the digital technology and were in the area (Figures 33-35) that the digital technology is located in shows a more complete image of digital technology usage within the three rooms, as shown in Figures 36-38. We determined the areas for analysis based on visitors' line of site to the digital technology as well as proximity to it.

Figure 33: Map of Areas within Line of Sight of Digital Technology in Room 63

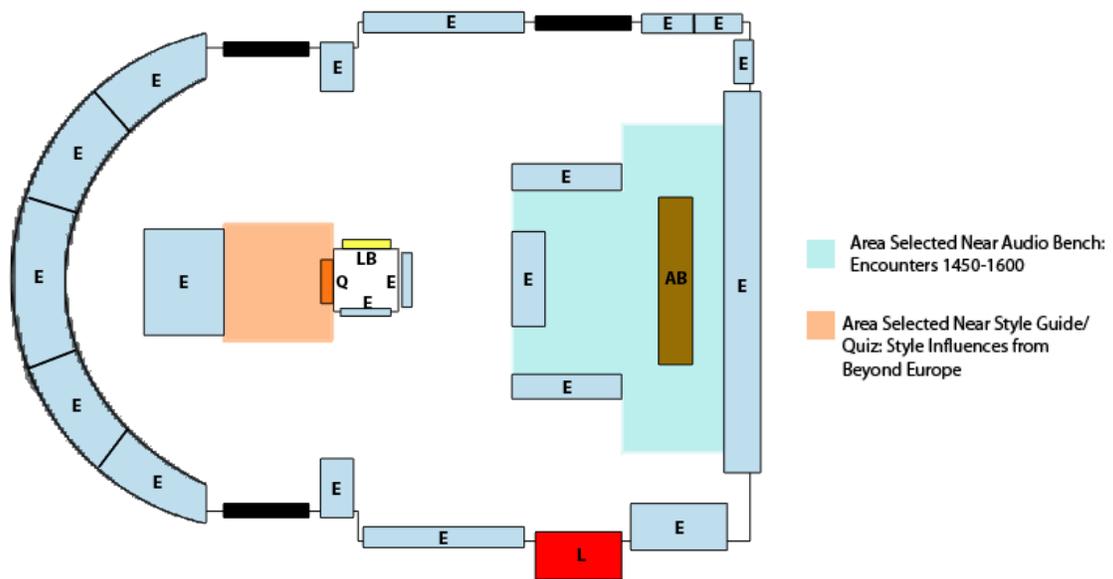


Figure 34: Map of Areas within Line of Sight of Digital Technology in Room 9

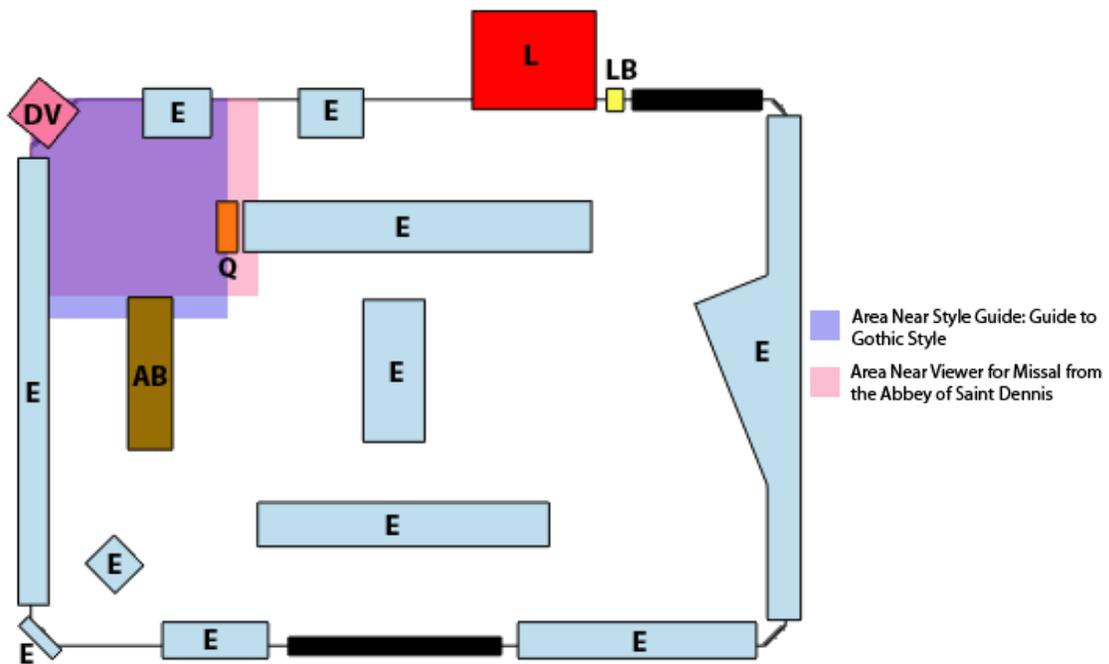


Figure 35: Map of Areas within Line of Sight of Digital Technology in the Jewellery Gallery

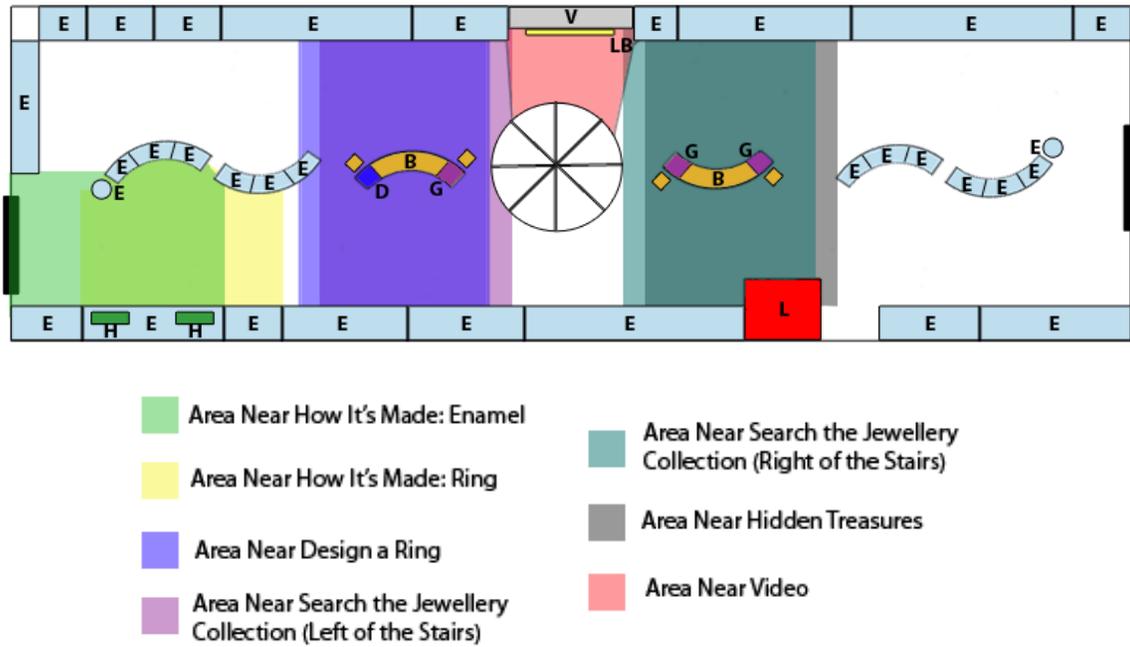


Figure 36: Use of Digital Technology among Visitors Who Were Near Its Location in the Jewellery Gallery (N=71)

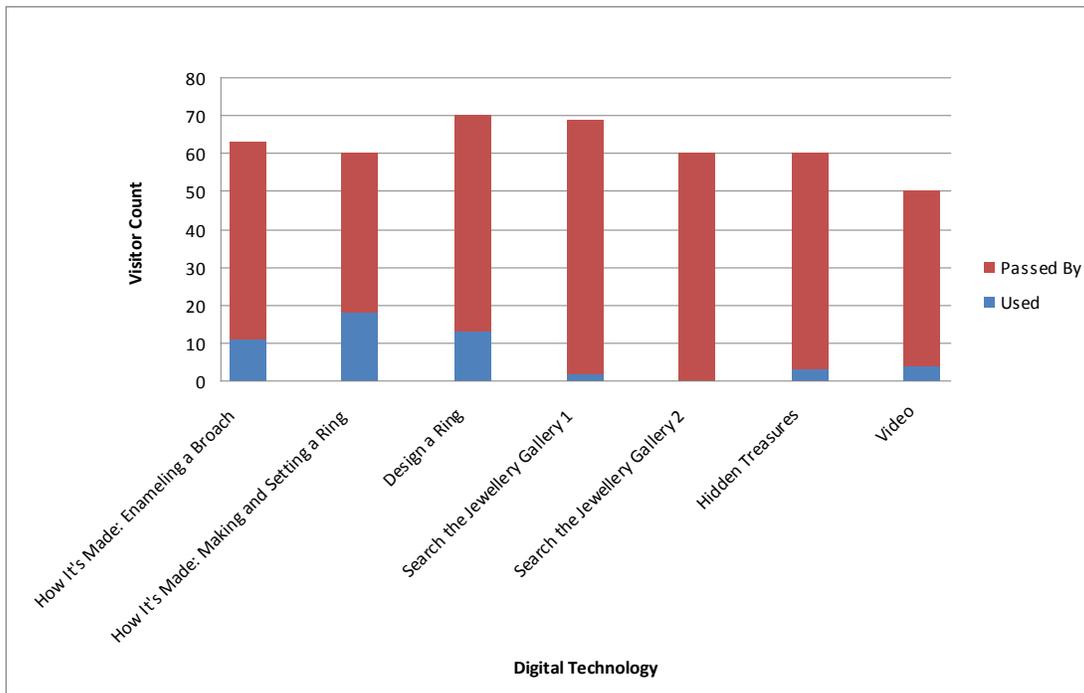


Figure 37: Use of Digital Technology among Visitors Who Were Near Its Location in Room 9 (N=99)

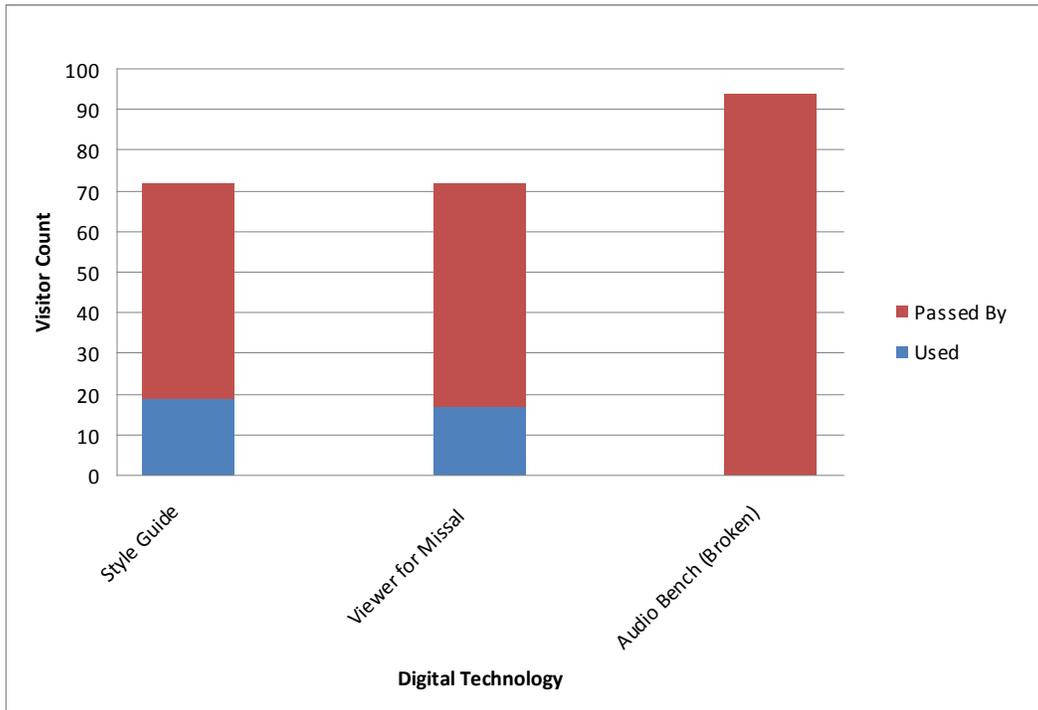
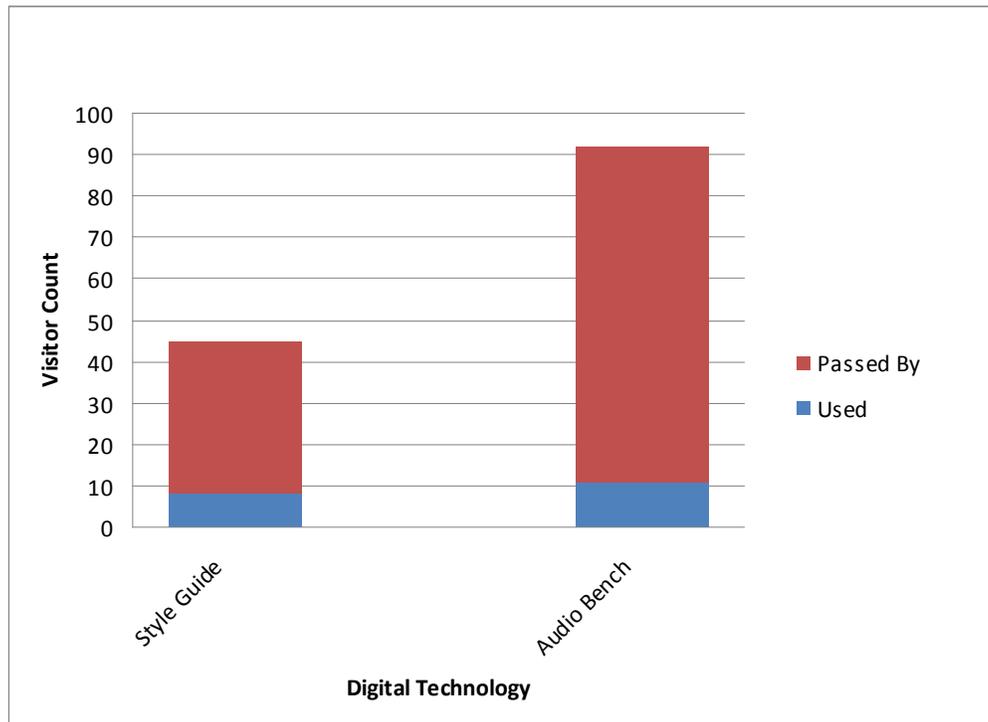


Figure 38: Use of Digital Technology among Visitors Who Were Near Its Location in Room 63 (N=99)



For all of the digital technologies, about 14% of visitors who passed by their location used the digital technology. For the interactive digital technologies in general, 19% of visitors who walked by the Design a Ring interface used it, 26% of visitors who walked by the Style Guide in Room 9 used it and 18% of visitors who walked by the Style Guide in Room 63 used it. In the Jewellery Gallery however, 100% of visitors tracked were in the area of Design a Ring, while in Room 9, 73% of visitors were in the area of the Style Guide and in Room 63, 45% of visitors were in the area of the Style Guide. Although the percentages of visitors who used the digital technology while near its location are about the same for the three rooms, the percentages of visitors who pass by the digital technology are not similar at all. This difference in visitor traffic near the digital technologies can be strongly seen through the traffic patterns in Figures 11-13.

Overall, for visitors who used the interactive digital technologies, the age range distribution is about even between 20-39 year olds, 40-59 year olds and over 60 year olds. There is a lack of users under 20 years old, due to the fact that we could not track visitors under 16 years old. However, this distribution greatly varied between rooms. In Room 9, 53% of users were in the 40-59 year old age range, while in the Jewellery Gallery 53% of users were in the 20-39 year old range, and in Room 63, 62% of users were over 60 years old. This is especially interesting as Room 9 and Room 63 both have a Style Guide but yet different age groups use the technology in the rooms. Both rooms have a majority of visitors in the 40-59 year old range, but the slightly different visitor compositions or the different exhibits of these rooms might be decisive factors causing the great variation.

In the Jewellery Gallery, 62% of users were male and 38% were female while visitors to the room had a composition of 36% male and 64% female. Although more females visited the rooms, it seems that the digital technology appealed to males more. It was observed that some males would enter with their female companions, not know what to look at and appear bored, until they saw the digital technology and ran right over.

Another gender difference occurred in Room 63, where 25% of users in this room were male and 75% were female, while in the room itself, 51% of visitors are male and 49% are female. Therefore, the digital technology, whether the technology itself or the

material it presented, appealed to visitors over 60 years old and females, perhaps at the expense of visitors between 40-59 years old and males.

These percentages of age ranges are quite different from those of the participants we surveyed in the Sackler Centre. As was previously seen in Figure 5, 59% of participants were 40 -59 years old, with 27% 20-39 years old and 5% over 60 years old. The distribution is nowhere near as even as in the galleries; however, Digital Quilt Design, which was where most of our surveys came from, was targeted to families and most parents of young children are in the 20-59 year old range.

4.6 Observations on Child and Family Usage

Though we were unable to track and survey children due to guidelines within the museum, we were still able to record observational notes on the behavior of those under the age of 16. For example, in the Medieval and Renaissance Gallery rooms, very few children were in the rooms and there are few records of the Style Guide and other technology being used by children. This is contrasted by the Jewellery Gallery, where we often recorded children, whether in a school group or not, using the Design a Ring interface. Also, we observed that when large groups of children visited, most likely as a school trip, they used all of the digital interfaces, not just the Design a Ring interface. This proves interesting because aside from this we rarely observed and, even less so, tracked a person using a Hidden Treasures interface, one of the other digital terminals in the Jewellery Gallery, where visitors can search images of the V&A's jewelry collection.

Another point to note is how the Design a Ring interface is used by children. Most often the interface is used within the first few stops, but most adults, especially older adults, simply poke at the interface while standing, either deciding to move on or sit down and continue using the device. Most of those who are younger, especially children, have no hesitations and simply sit down and use the device until finished, often giving those who watched a try.

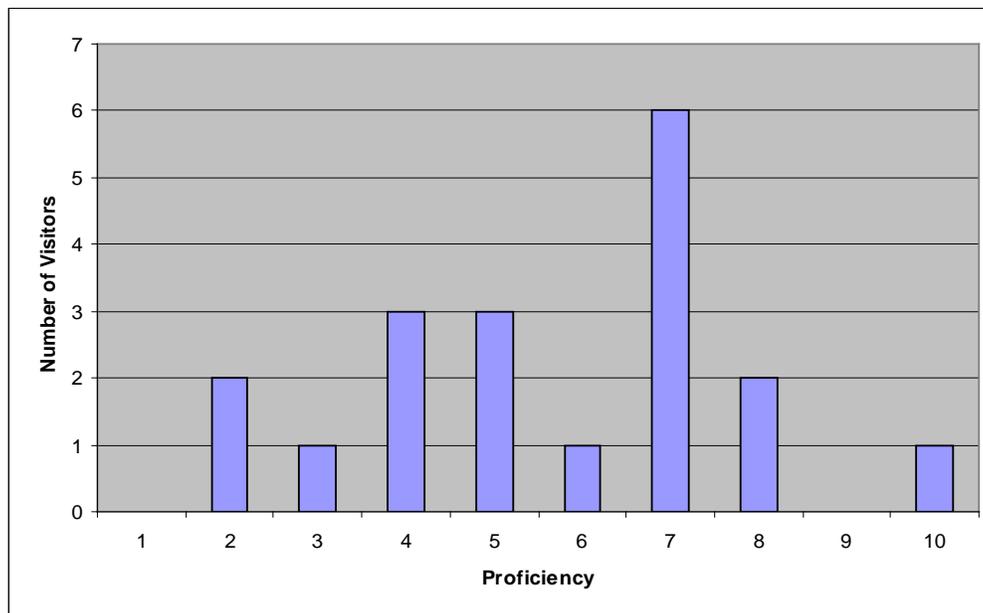
In the Sackler Centre, we also found from observations that children were more likely to use the digital technology in the programs. Children were usually observed taking pictures with the camera and using the computer in Digital Quilt Design, while the parents either sat outside of the room or sat next to the child watching. Similarly, some

parents who we surveyed mentioned that their children really liked the program but gave no indication of how they felt about it, which perhaps shows that the digital technology programs designed for families are seen as more for children.

4.7 Visitor Proficiencies with Digital Technology

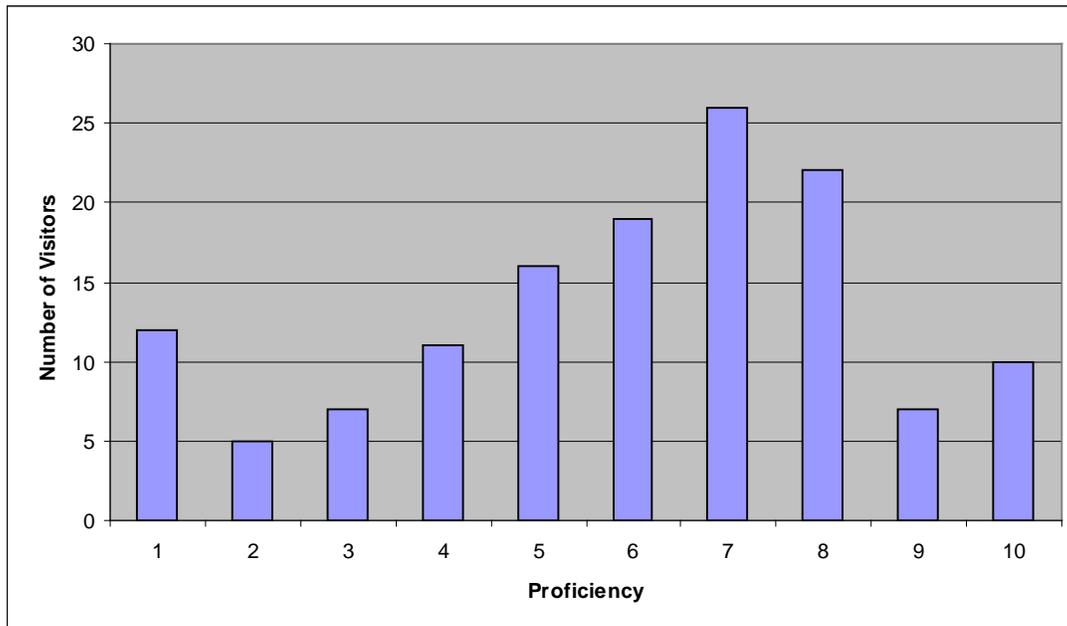
The self-rated proficiencies for the use of technology of visitors who used the interactive digital technologies are displayed in Figure 39. The proficiencies are on a scale of 1 to 10, with one being the lowest proficiency level and 10 the highest. The most commonly chosen proficiency level is 7, but visitors did still choose a wide range of proficiencies. There is a low sample size for this graph, but it can be seen that visitors of all self-rated proficiencies do use the interactive digital technologies.

Figure 39: How Proficient Visitors Who Used the Interactive Digital Technologies Consider Themselves with Technology (N=19)



For visitors who did not use the interactive digital technologies, the whole range of proficiencies existed (Figure 40). The distribution is very similar to those for all of the visitors to the rooms and the visitors who used the technologies.

Figure 40: How Proficient Visitors Who Did Not Use the Interactive Digital Technologies Consider Themselves with Technology (N=135)



Visitors gave a number of reasons for why they did not utilize the technology in the galleries: 38% said that they did not see the technology, 16% said did not have enough time and 13% said they were not interested in the technology. However, we do not know whether those who said they did not see the technology actually did not see it or said that as an excuse. The debate regarding the place of digital technology in non-science museums can be seen as 4% said they didn't like technology and 2% said they were only here to look at the objects. Wariness about whether digital technologies should exist in non-science museums does still exist among visitors, although these responses were not as common as the top three mentioned above.

4.8 Findings from Gallery Interviews

The final element of our methodology was to conduct interviews with relevant personnel from the V&A as well as other museums. There are some elements from these interviews that are related to each other while standing apart from our other findings. The first of these themes is how the use of digital technology, of varying levels of interactivity, at the V&A relates to its usage in other non-science museums. With regards to how other museums are utilizing digital technology, there are several elements that

drive its implementation, the most prominent of these being the goal of the individual museum. Since each museum has its own idea of how best to present its collections and provide a meaningful experience for its visitors, the manner in which digital technology is used varies widely from one museum to the next. For example, the wider usage of digital elements at the V&A, both in temporary exhibitions and in permanent galleries, is contrasted by the more sparing use that the British Museum with more of the interactive digital technology being utilized in temporary exhibitions (Mazda, personal communication, March 29, 2010).

How the museum views digital technology itself is the other important element that separates one museum from another. If a museum views the technology as an after-thought, there is a stark difference in what the visitor experiences between that application of technology and technology that was integrated into the development of the gallery from its inception. The V&A, in order to provide the best educational experience possible, makes sure that, “educators work on the gallery design team from the beginning of the process in the effort to make the thinking about the gallery of a holistic nature” (Fritsch, personal communication, April 9, 2010).

In addition to the philosophies of the museums shaping how digital technologies are being used, there are physical restrictions that play their part in shaping the development of the galleries. Due to the fact that some museums in the United Kingdom depend on government funding, they are publicly accountable for what they use their resources for. Taking a risk on a new technology or a different way of presenting material is one thing, but risk taking for publicly funded institutions, like the V&A, is a serious issue (Fritsch, personal communication, April 9, 2010). Another large contributor to the implementation of digital technology is the planning period for, and the characteristics of, a permanent gallery. Permanent galleries are designed to last for at least 35 years and this includes the technology as well. The design work that needs to go into the digital elements of a gallery needs to ensure that the digital technology not only stands up to the stress of being used on a daily basis by innumerable visitors, but that the qualities of the technology itself need to last for the duration of the gallery without the appearance of being dated (Bates, personal communication, March 31, 2010). These necessary design

elements that must be incorporated into the digital elements being used are a tight restriction on what technologies can and cannot be used for a museum.

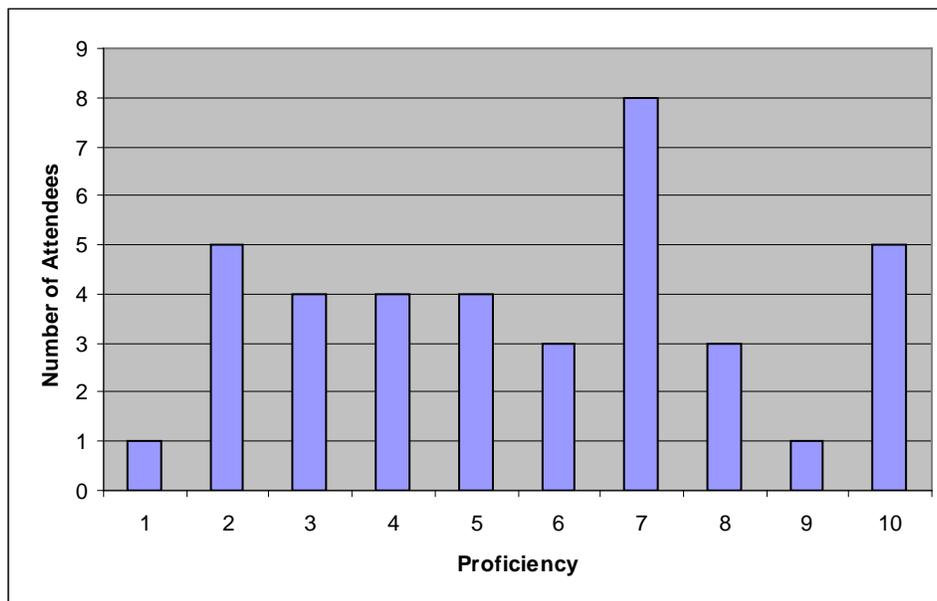
4.9 Sackler Centre Findings

The Victoria and Albert Museum completes its educational offerings through the programs and opportunities in the Sackler Centre. Through our exit surveys of program participants and our interviews with program managers and developers, we have found that there are correlations between the design of the Centre and the educational experience of the visitors.

4.9.1 Survey Findings in Sackler Centre

As seen in Figure 41, the most commonly chosen proficiency for Sackler Centre participants was 7, which is what was also found in the galleries. People of all proficiencies do attend digital technology programs in the Sackler Centre.

Figure 41: How Proficient Participants Consider Themselves with Technology (N=38)



This graph does look very similar to the graph from the galleries. Both consist of the self-rated proficiencies of visitors who used some form of digital technology, so this finding seems believable. Even some of these technologies are in the un-facilitated

galleries while the Sackler Centre is a facilitated environment, perhaps the same amount of visitors with different proficiencies use the technology. For both environments, visitors who consider themselves slightly above average with technology appear to be the most comfortable using it or at least most visitors consider themselves to be at this proficiency level.

Although the Decode Drop-in program in the Sackler Centre that we surveyed was a drop-in program, we found that many of the visitors entered the room at any point throughout the afternoon but then stayed in there throughout the entire program. This is not typical of drop-in events, due to way they are structured as a program that people can sit in on for a little while and leave whenever they like. From our observations, this increased time was the result of both the instructor's teaching ability and the subject of his talk on digital art and design. Drop-in events of this kind are designed so that an individual can spend any amount of time that they want without detracting from the structure of the event (Anne Fay). The topic appeared to interest attendees enough so that they had no motivation to leave at any time. Upon being surveyed, the participants reported that the digital artist presenting was not only engaging, but the content of his presentation, his own work, was engaging in such a way that it captivated his entire audience. Those individuals who did leave before the finish time of the session self-reported that the reason they left was not due to lack of interest but because they had to leave for another engagement. For both the digital technologies in the galleries and the programs at the Sackler Centre, the digital technology did attract visitors for relatively long periods of time.

4.9.2 Findings from Sackler Centre Interviews

In designing the digital programs for the Sackler Centre, the digital managers make sure that the subject of the program is linked, in some way, to the collections in the main museum. This relationship can be as direct as matching the theme of a temporary exhibition or as broad as sending the participants of the program out into the gallery to take photographs (O'Brien, personal communication, April 7, 2010). As one participant said "Each time you do an activity [in the Sackler Centre], it adds more to the museum". It is the incorporation of the main galleries of the V&A that set the Sackler Centre apart

from other education centers in museums (Fay, personal communication, March 25, 2010). If an individual just wanted to learn about digital image manipulation, there are other locations at which those skills can be learned. When an individual attends a digital program in the Sackler Centre, they are given the opportunity to experience so much more than what a computer program can provide. The combination of skilled instructors and combining what is learned in the Sackler Centre with the museum's galleries gives visitors distinct experiences and knowledge that they would otherwise miss out on. Just as in the galleries, both with the digital technology and without it, the programs are designed to increase visitor learning about and enjoyment with the collections and galleries and the exhibits within them.

5. Conclusions and Recommendations

5.1 Conclusions

From our findings we can draw distinct conclusions on the use of digital technology and its effect on visitors, both within the structured environment of the Sackler Centre and within the un-facilitated environment of the Victoria and Albert Museum's galleries. Firstly, we found that the digital technologies in the museum have a longer holding power than their non-digital counterparts. In the galleries, visitors spent longer at the digital technology interfaces than at non-digital exhibits, as was seen in the decay curves (Figures 27-29). Also, in the Sackler Centre, visitors spent much longer than expected at the Decode Drop-In; most participants were so interested that they did not want to leave before the event was over. This is not what is generally expected of drop-in programs, as has been mentioned (Fay, personal communication, March 25, 2010).

Overall, almost everyone surveyed who used the digital technology in the galleries or attended a program at the Sackler Centre enjoyed it. Most users of the technologies in the galleries thought that the technology was easy to use, informative, well-organized, fun and users felt that they learned something. In the Sackler Centre, many participants mentioned that the staff members were great and that the program or course was really informative and fun. Some attendees did wish that they could have done more of the processes on their own, but they recognized that the technology is complicated. The programs and course were so well-liked, in fact, that some participants said that they would have liked the offerings to last even longer.

Our second main finding is that most visitors did not use the digital technologies. The number of visitors we tracked who used the digital technologies is small; however, we recognize that since everyone does not stop at every exhibit, the numbers are not all that low. Still, only 16% of visitors that we tracked did use the interactive digital technologies, and while this number may not be able to be improved by much, it can still be improved. We do not clearly know why visitors did not interact with the technologies. The lack of interaction does not seem to be due to differences in age or proficiency with technology. Visitors of all age ranges and self-rated proficiencies used the digital

technology in both settings. Also, the self-reported proficiencies for visitors who both did and did not use the technology are very similar.

Most survey respondents who did not use digital technology said that they had not seen the digital technology, but it is unknown whether they did actually did not see the technology, they did not want to see the technology or they just said that as an excuse of some sort. Even though fewer visitors were in the area of the digital technology in both Rooms 9 and 63 in comparison to the Jewellery Gallery, about the same number of visitors overall used the technology. Therefore, fewer visitors saw the technology but this did not affect how many visitors used the technology.

We do not know whether the lack of interaction with digital technology in the V&A can be attributed to the technology itself or the visitors. If the technology fails to attract visitors, then perhaps this could hinder visitor usage. In both the Jewellery Gallery and Room 63, the digital technology was often one of the first stops for those who used it, so perhaps it is attracting visitors but not to as high of a degree as necessary. Also, if the visitors are not interested in or have a general dislike for technology, then this could also affect how many visitors use the technology. There is still debate in the museum community about how much of a role, if any, technologies should have in non-science museums, and it is unknown how many visitors think that technology does not belong in non-science museums. The technology seems to be well-designed in that visitors spend a long time using it and seem to really enjoy it, so more research on why the majority of visitors do not interact with the digital technologies offered would be in the V&A's best interest.

The digital technology in both settings did seem to really enhance the museum experience of those who used it, as they were truly happy with what was offered. It is difficult to determine if visitors learned anything, as learning itself is hard to define, but the digital technologies in the V&A are definitely created with education in mind. The installation of digital technologies into non-science museums should not be so hesitant, as technology, when designed to quench visitors' thirst for knowledge, can really enhance the visitor experience and allow visitors to feel more engaged with the museum.

5.2 Recommendations:

Though our conclusions and findings do not provide clear cut answers on how digital technology should be represented within both un-facilitated and facilitated learning environments, we have compiled some recommendations that can help maximize the usage and benefits digital technology has to offer.

It is no surprise that digital technology comes in different varieties; the question is how to incorporate them to better the gallery and room. In the case of the technologies that we surveyed visitors about, there are two recommendations we have to provide. Our first recommendation applies to technologies that are more creative, such as the Design a Ring interface, which are more about playing and designing than the other technologies. It is best to place these types of interfaces near areas that are close to high traffic areas and main entrances, making the technology one of the first things visitors see. This, however, suggests a gear towards a more male audience, and a younger audience. From our findings we found that mostly male and children visitors used the interface first before exploring the rest of the room, whereas older audiences enjoyed poking at the technology as they walk by. Either way, it could benefit both groups to see where the traffic lies and place the technology in an area that optimizes those that see the technology and hence use it.

However, the Style Guides were less likely to be used first and from our findings, the average usage times, in comparison to the Design a Ring interface, are lower. These technologies serve the function as a complement to learning within the gallery and provide a wealth of information that is easier to access. Like the more creative technologies, these could be placed in high “dwell” traffic areas to increase their use. In reference, there is the difference exemplified by Rooms 9 and 63. While in Room 63 the traffic of the area around the guide was high, it was mostly walkthroughs and not those who stayed in the room for an extended amount of time. As shown with Room 9, while most walkthroughs took a different path, those that moved slowly and stopped to look at the objects more were more likely to use the technology.

While the recommendation of placing a digital technology in a more high traffic area is helpful in theory, it is not that useful if one considers room changes once the technology is added. While we did not observe rooms without technology to try and place

the best locations; if possible when designing a gallery, one should try to get some preliminary data on the way the traffic will flow in the room and adjust where one places the interfaces accordingly.

It is important to note, though, that the technology should not be discordant in trying to attract visitor attention. Some visitors wished that there was more creative technology, such as the Design a Ring interface, and surely this would help lessen the impact of when large groups crowd the technologies, but this cannot be the main focus. Although the technology does need to be seen, it should not stand out; it should just be there for visitors to use if they want to (Fritsch, personal communication, April 9, 2010). As one visitor said, in reference to the digital technology in the V&A galleries, “It isn’t the first thing you recognize but that’s okay, it shouldn’t be the main focus; just sort of there if you want it.”

In the Sackler Centre, museum staff try to create programs for all ages, but some programs may not be friendly for all ages. Though most of our data is from a program geared towards families, a couple of responses emerged that said that for the adults and their smaller children the program was great but some of the older children had less to do. The older children may already know about the techniques or programs offered, so what is simple for them may be harder for younger kids. This, however, is a constant problem in education systems which need to teach the most basic principles so everyone is on the same page. Rather than having split instructors teaching the same thing to multiple people, it might be worthwhile to try different levels of teaching even within one drop-in program.

Another recommendation to improve the offerings of the Sackler Centre is to increase publicity and knowledge about its programs. There were a lot of first-time visitors to the Sackler Centre and most made comments that had they not walked down to the Sackler Centre itself and noticed the signs, they would have most likely missed the program entirely. Though the programs are advertised within the Centre, the area it resides in is semi-secluded from the main galleries and there is little to no mention of programs being offered at the main entrance.

Based on the content from multiple interviews and our personal observations, we recommend a more unified approach to digital technology in the museum.

Communication between departments regarding the development and integration of digital technology at the museum will ensure that everyone will be working towards a common objective. Differences in opinion and unique points of view are inherent in a large institution such as the Victoria and Albert Museum. With a definite direction these differences become constructive elements that can further the development of digital technology in the museum for the betterment of the visitor experience.

In general, more research needs to be done to fully understand why many visitors are not using the digital technology that is available within non-science museums. At the V&A, though, the digital technology is well implemented and attracts many different types of visitors. In both un-facilitated and facilitated environments, patrons leave feeling happy and more engaged with the museum and this is the ideal role of technology in non-science museums.

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Appendix A - Museum Interview Questions

Preamble

My group and I are performing research into how the use interactive digital technology at the Victoria & Albert Museum affects the overall learning experience of the visitors. We are interviewing relevant representatives from the V&A as well as several museums in the area to gauge how digital technology is being used to compliment the more traditional exhibits. These interviews will help add context to our research regarding the incorporation of interactive digital technology at the V&A, which is the main focus of our Interdisciplinary Qualifying Project, conducted for Worcester Polytechnic Institute (In the United States).

Your responses today may be included as reference to our findings and conclusions from the V&A. Please let me know if you do not want to be quoted in our report. If you do not mind being quoted, and if one of these quotations is used, you will have the right to review the report before we submit it.

Museum: _____

Name: _____

Position: _____

Museum Interview Questions

-In your own words, could you please give a brief description of your position at the museum?

- What does the museum want to accomplish by integrating digital technologies?

- Do you feel digital technologies complement traditional exhibits and the rest of the museum?

- How do you think digital technologies affect people's learning?

-What do you think are the advantages/disadvantages of digital learning?

- How do you think digital technologies should be used in museums?

- What do you think is the future of digital learning in museums?

- Has the museum conducted any studies in the impact of using digital technologies in exhibits? If so, what has been found?

- Have you noticed any correlation between digital technologies and the number of visitors?

- Have you had any difficulties with the incorporation of digital technologies? If so, what?

Appendix B - Other Museum and Sackler Centre Supplementary Questions

Other Museums

- What digital technologies are offered in the [museum]?
- Are there classes offered at the [museum]? If so, do they use digital technologies?

Sackler Centre

- What would say the Sackler Centre's current goals and future goals look like?
- Would you say the Sackler Centre is "tailored" to a specific audience? If so why, and is that intended?
- Where do the programs and courses at the Sackler Centre come from? What information is gathered in order to determine that a topic would be enhanced by such a program? (Staff, studies, other "similar" programs, suggestions from visitors/artists, etc.)
- What goes into the making of a program/course at the Sackler Centre - Basically walkthrough from Idea → Completion → Beyond?
- Do you feel digital technologies being presented in the Centre's programs complement traditional exhibits and the rest of the [museum]?
- What do you think are the advantages/disadvantages of digital learning? From your perspective do you feel visitors learn more in a structured program that includes digital technology than say a regular museum course?
- How do you think digital technologies should be used in museums (or places like the Sackler Centre)?
- Has the Sackler Centre conducted any studies on its digital programs and courses? If so, what has been found?
- Have you noticed any correlation between the Sackler Centre programs and the effects/number of visitors to both the Centre and to the main museum?
- Has there been one type of program, or topic of a program that seems to draw more participants than the others?

Appendix C - Victoria and Albert Museum Maps (Levels 0-1)

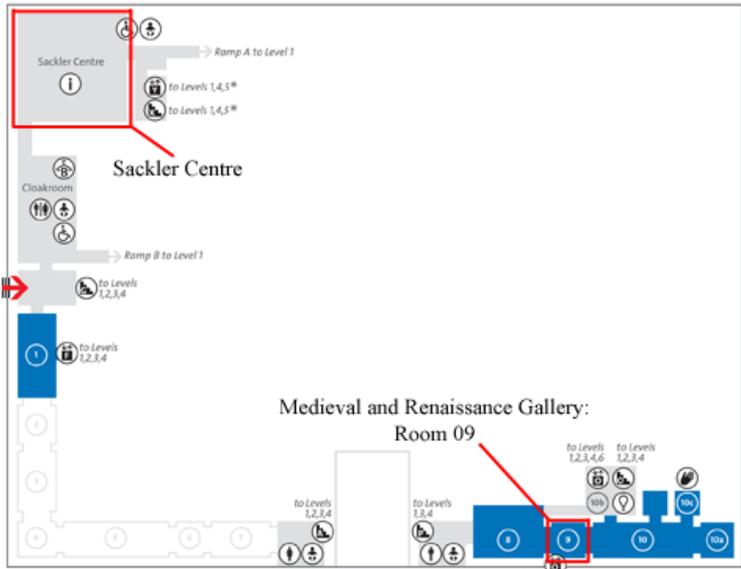
Level 0 (Tunnel Entrance)

EUROPE	Rooms
Europe 1600 – 1800	1
Medieval & Renaissance 300 – 1500	8–10c

FACILITIES

- Cloakroom
- Exit to Tunnel
- Hands-on exhibits
- Information
- Sackler Centre
Sackler Centre for arts education
- Study Area
- Toilets

* Take Left Y or Stair X to access:
Sackler Centre
Level 1
Prints & Drawings Study Room
Level 4
RIBA Architecture Study Rooms
Level 4
Seminar Room 3
Level 5



Level 1 (Street Entrances)

ASIA	Rooms
China The T.T. Yui Gallery	44, 47a
Islamic Middle East The Jameel Gallery	42
Japan The Toshiko Gallery	45
Korea The Samsung Gallery	47g
Sculpture The Robert H.N. Ho Family Foundation Gallery	17–20
South Asia The Nehru Gallery	41
South-East Asia	47a–c

EXHIBITIONS

- Horace Walpole and Strawberry Hill (6 Mar – 4 Jul 2010)
- Quilts 1700 – 2010 (20 Mar – 4 Jul 2010)
- Grace Kelly: Style Icon (17 Apr – 26 Sept 2010)
- 11 – Architects Build Small Spaces (15 Jun – 30 Aug 2010)
The Rural Gallery

FACILITIES

- Bookshop
- Cafe
- Morris, Garbrie & Poynter Rooms
- Cloakroom
- Exit to Cromwell Road
- Exit to Exhibition Road
- Garden
- The John Madejski Garden
- Garden Cafe
- Gift Shop
- Information
- Meeting Point
- Membership
- Tickets
- Toilets

EUROPE	Rooms
Cast Courts	46a
Cast Courts Reopens Spring 2010	46b
Medieval & Renaissance 1350 – 1600	50a–50c
Sculpture 1300 – 1600 Reopens November 2010	25 – 27, 16a
Raphael	48a

MATERIALS & TECHNIQUES	Rooms
Fashion	40
Photography	38a
Sculpture The Dorothy and Michael Hirst Galleries	21–24

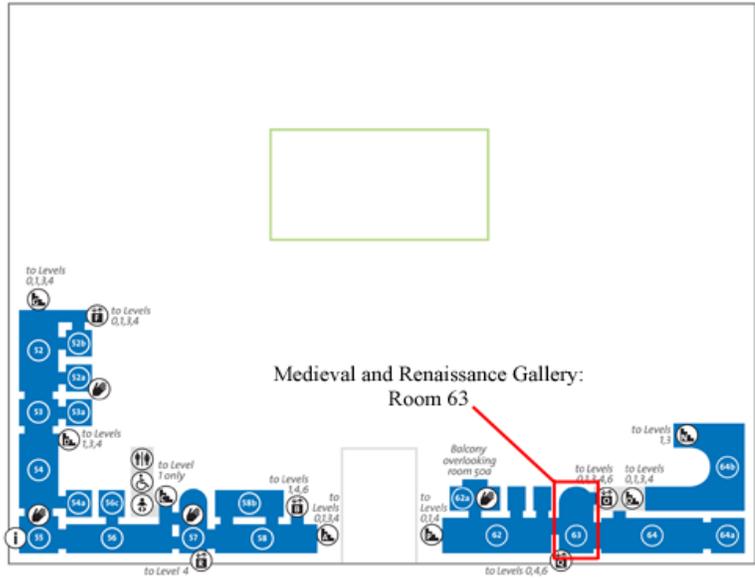


Appendix C - Victoria and Albert Museum Maps Cont. (Levels 2-3)

Level 2

EUROPE	Rooms
British Galleries 1500 – 1760	52 – 58
Medieval & Renaissance 300 – 1600	62 – 64a

FACILITIES
Hands-on exhibits
Information
Toilets



Level 3

MATERIALS & TECHNIQUES	Rooms
Gold, Silver & Mosaics The Maubridge and Arthur Gilbert Galleries	70 – 73
Ironwork 113 – 114a	
Jewellery The Wilson and Judith Bollinger Gallery	91 – 93
Leighton 102, 107	
Metalware The Benkins Centre Gallery	116
Paintings The Edith and Susan Davies Galleries	81, 82, 87 – 88a
Portrait Miniatures The International Music and Art Foundation Gallery	90a
Prints & Drawings The Cole and Albert Swineman Gallery	90
Sacred Silver & Stained Glass The Whitby Galleries	83 – 84
Sculpture The Gilbert Beget Gallery	111
Silver The Whitby Galleries	65 – 70a
Tapestries	94
Textiles	95 – 100
Theatre & Performance	103 – 106

EUROPE	Rooms
Europe & America 1800 – 1900	101

* Lecture Theatre
Take Lift 1, Stair 5 or T to Levels 4 or 5



Appendix C - Victoria and Albert Museum Maps Cont. (Levels 4-6)

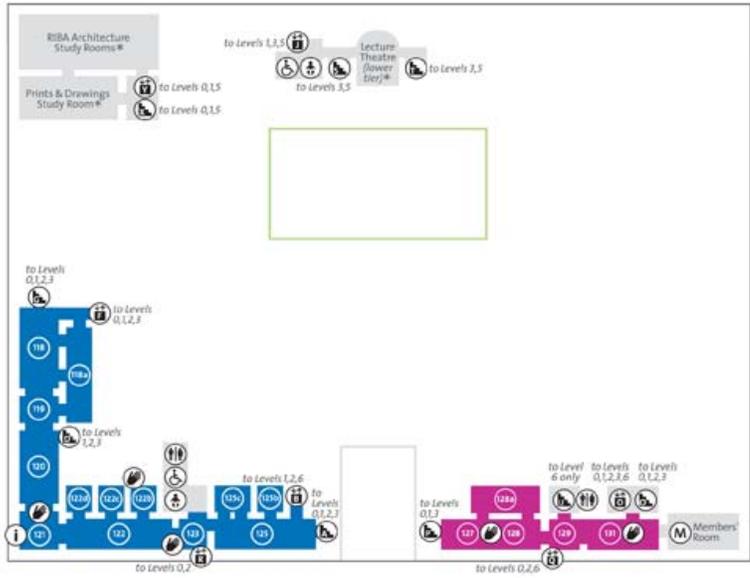
Level 4

EUROPE	Rooms
British Galleries 1760 - 1900	118 - 125

MATERIALS & TECHNIQUES	Rooms
Architecture	127 - 128
Contemporary Glass The Glass Pavilion Gallery	131
Glass	129

FACILITIES

- Hands on exhibits
- Information
- *Lecture Theatre (lower tier) only accessible from Level 3, Lift J, Stair S or T
- Members' Room accessible from Stair P, Q, U or Lift Q or O
- *Prints & Drawings Study Room only accessible from Level 0, Lift Y or Stair X
- *RIBA Architecture Study Rooms only accessible from Level 0, Lift Y or Stair X
- Toilets

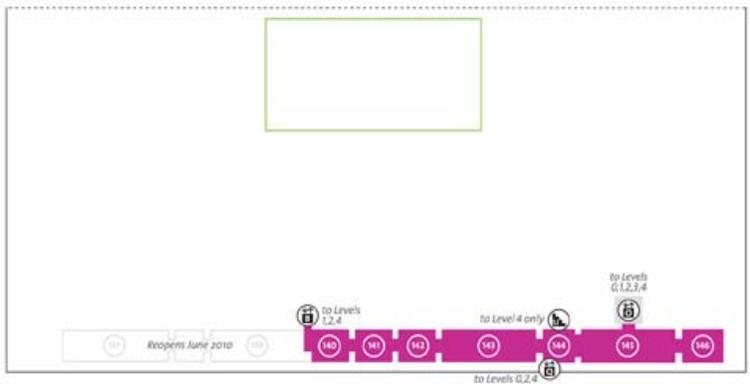


Level 6

MATERIALS & TECHNIQUES	Rooms
Ceramics	140 - 146
Ceramics Reopens June 2010	137 - 139

FACILITIES

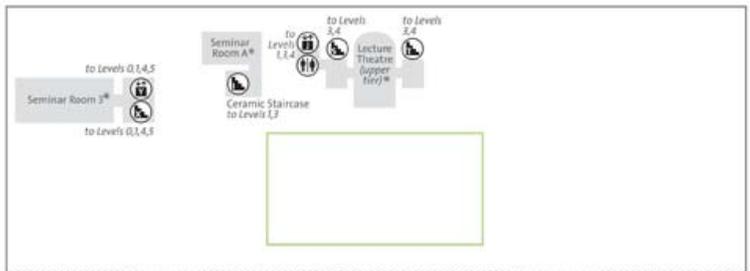
- Seminar Room B (not shown on map) only accessible from Stair S, Level 3



Level 5

FACILITIES

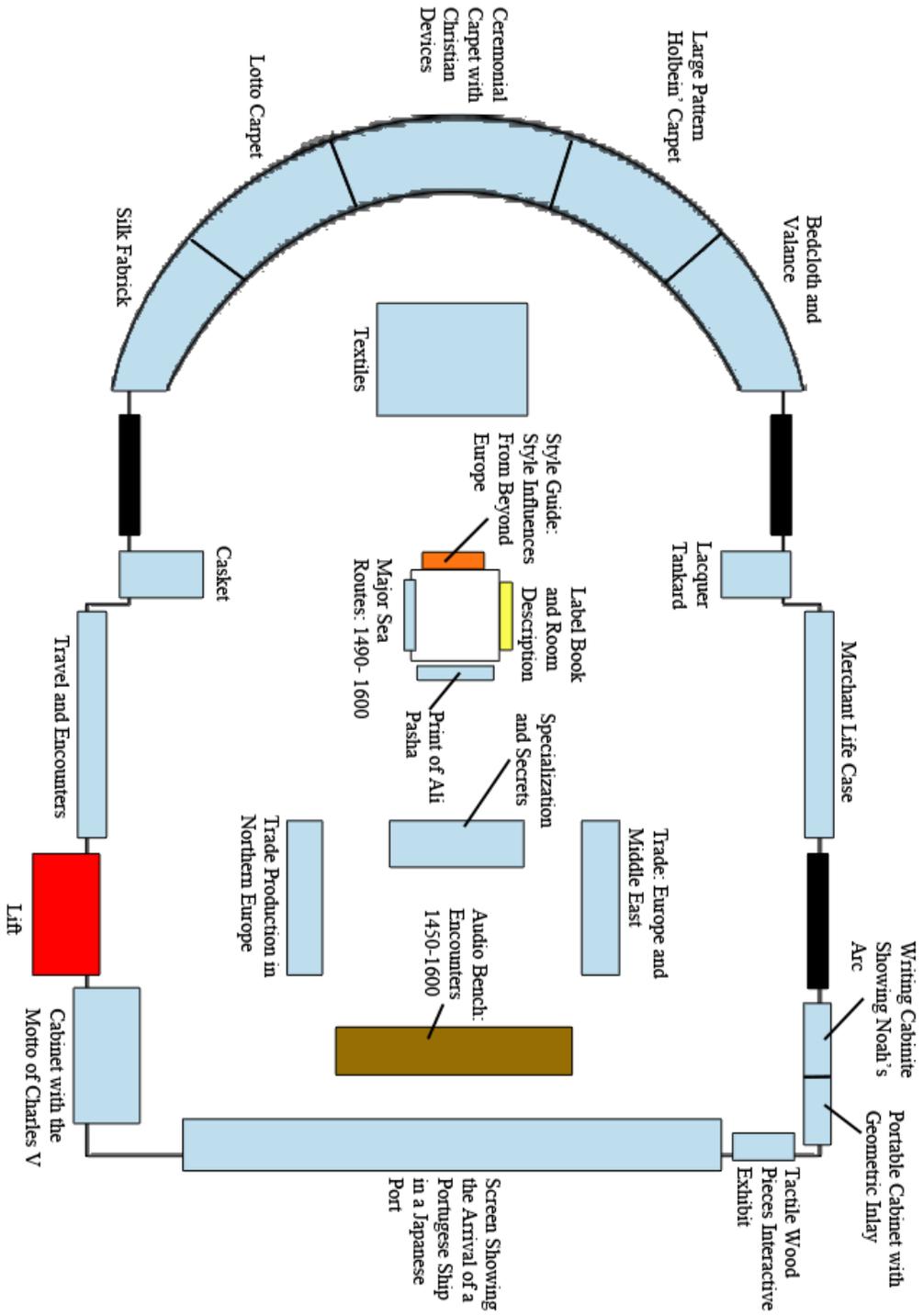
- *Lecture Theatre (upper tier) only accessible from Level 3, Lift J, Stair S or T
- *Seminar Room 3 only accessible from Level 0, Lift Y or Stair X
- *Seminar Room A only accessible from Stair I
- Toilets



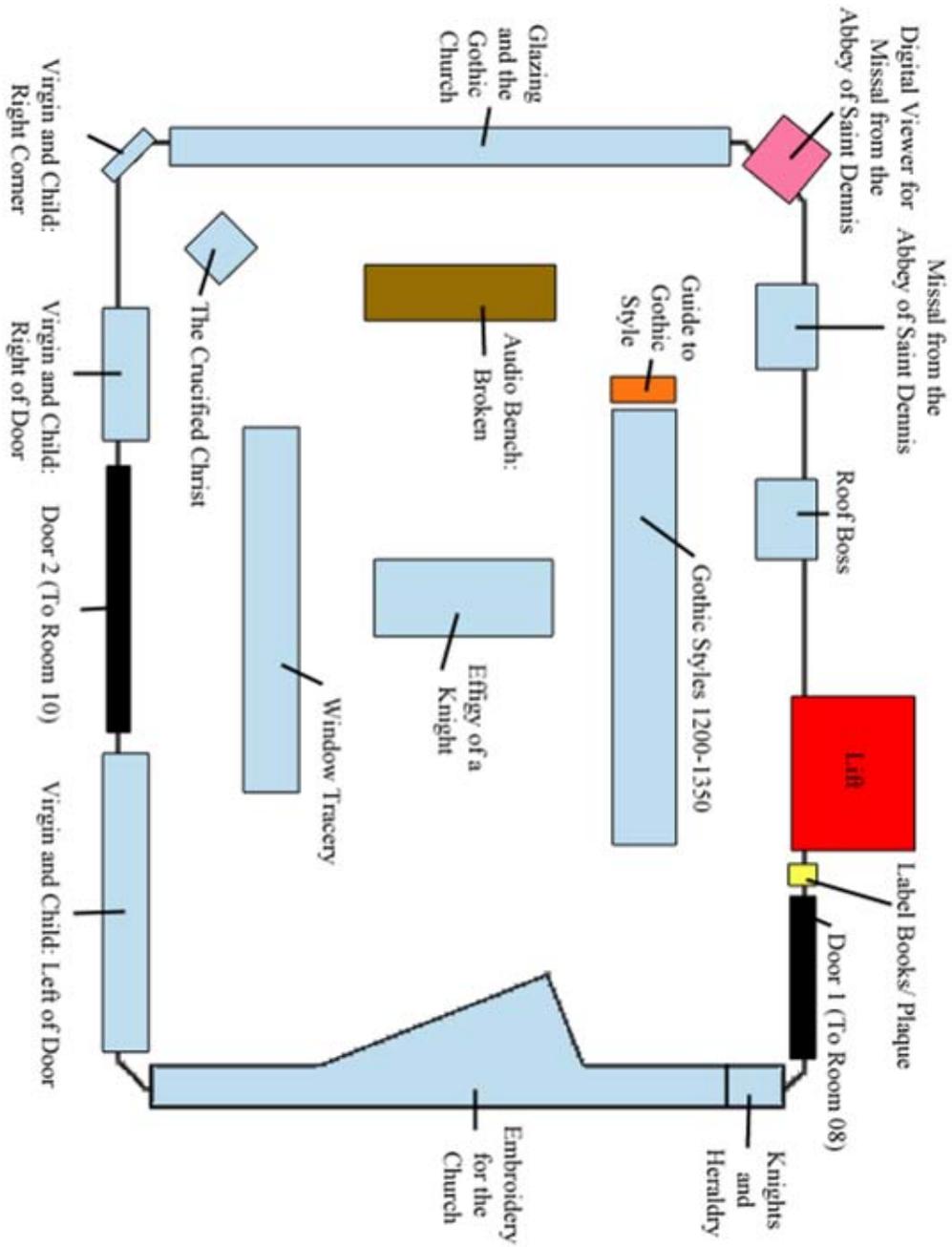
Appendix D – Key for Tracking Maps

	(E) Exhibit
	Door
	(L) Lift
	(DV) Digital Viewer – Lets users view an exhibit digitally with excerpted/translated info
	(Q) Style Guide – Lets users navigate menus with information and take a short quiz.
	(AB) Audio Bench
	(B) Bench
	(D) Design a Ring – Lets users select options to create a ring in 3-Dimensional space.
	(G) Search the Collection/Hidden Treasures. Lets users view the galleries collection.
	(LB) Label Books
	(H) How It's Made Video
	(V) Video/Slide Presentation

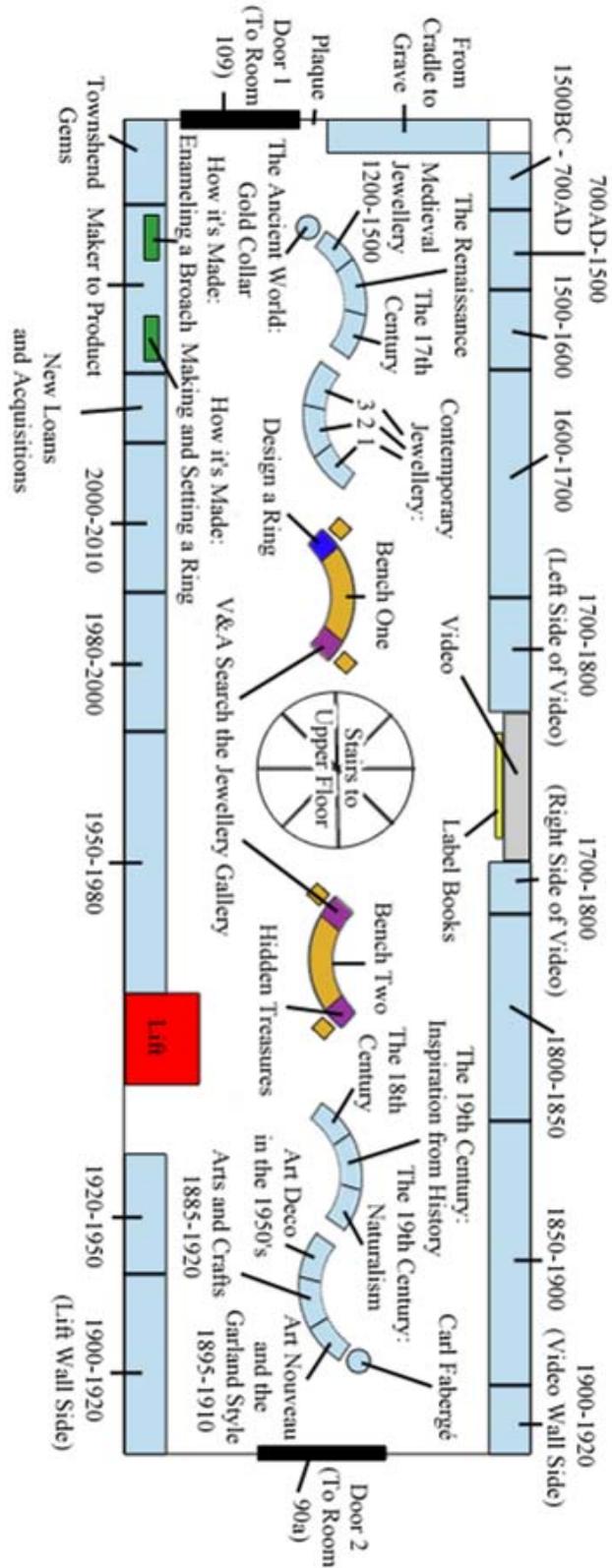
Appendix E – Labeled Map of the Medieval and Renaissance Gallery Room 63



Appendix F –Labeled Map of the Medieval and Renaissance Gallery Room 9



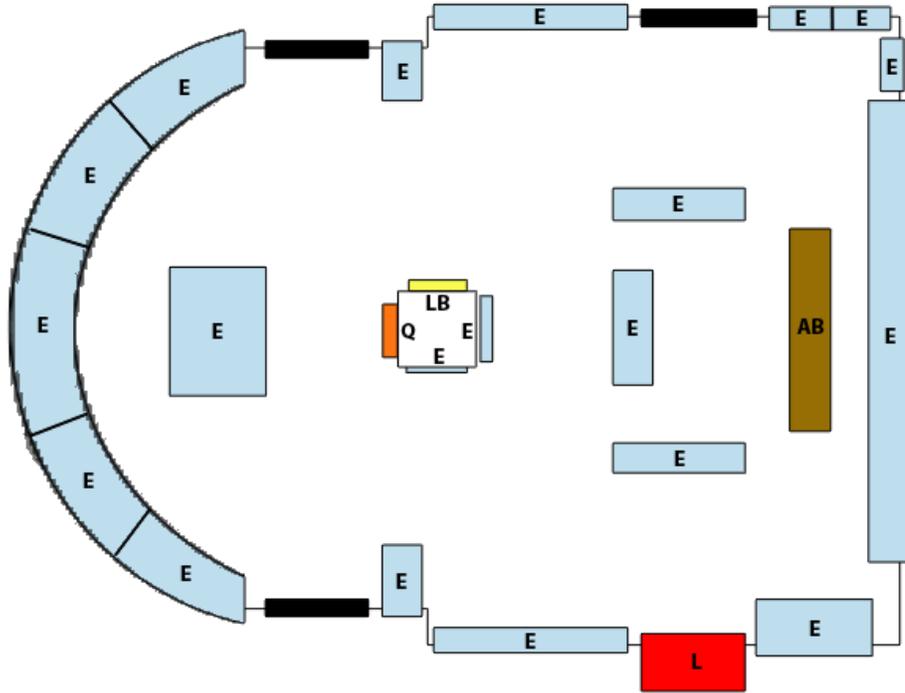
Appendix G – Labeled Map of the Jewellery Gallery Rooms 91-93 (Lower Floor)



Appendix H - Gallery Tracking: Medieval and Renaissance Gallery Room 63

Date: _____ Wall Time Start: _____ Complete? _____ # _____

Investigator: _____ Finish Time: _____



Stops: S-Stop, Add a 'D' after stop number to indicate digital interface usage

- | | |
|--------------------------------|--------------------------------|
| S01__ Start: _____ Stop: _____ | S13__ Start: _____ Stop: _____ |
| S02__ Start: _____ Stop: _____ | S14__ Start: _____ Stop: _____ |
| S03__ Start: _____ Stop: _____ | S15__ Start: _____ Stop: _____ |
| S04__ Start: _____ Stop: _____ | S16__ Start: _____ Stop: _____ |
| S05__ Start: _____ Stop: _____ | S17__ Start: _____ Stop: _____ |
| S06__ Start: _____ Stop: _____ | S18__ Start: _____ Stop: _____ |
| S07__ Start: _____ Stop: _____ | S19__ Start: _____ Stop: _____ |
| S08__ Start: _____ Stop: _____ | S20__ Start: _____ Stop: _____ |
| S09__ Start: _____ Stop: _____ | S21__ Start: _____ Stop: _____ |
| S10__ Start: _____ Stop: _____ | S22__ Start: _____ Stop: _____ |
| S11__ Start: _____ Stop: _____ | S23__ Start: _____ Stop: _____ |
| S12__ Start: _____ Stop: _____ | S24__ Start: _____ Stop: _____ |

Approx Age: <20 yrs. 20-39 yrs. 40-59 yrs. 60+ yrs.

Gender: Male Female Unsure

Grouping: # of Adults (18+) _____ # of Children _____

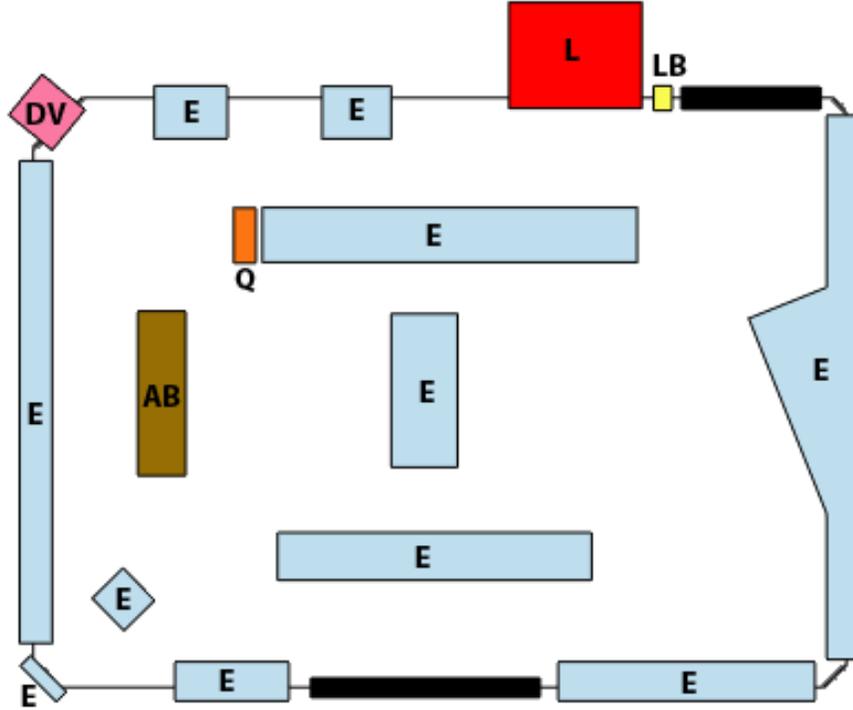
Male _____ # Female _____ # Unsure _____

Comments: _____

Appendix I - Gallery Tracking: Medieval and Renaissance Gallery Room 9

Date: _____ Wall Time Start: _____ Complete? _____ # _____

Investigator: _____ Finish Time: _____



Stops: S-Stop, Add a 'D' after stop number to indicate digital interface usage

- | | |
|--------------------------------|--------------------------------|
| S01__ Start: _____ Stop: _____ | S13__ Start: _____ Stop: _____ |
| S02__ Start: _____ Stop: _____ | S14__ Start: _____ Stop: _____ |
| S03__ Start: _____ Stop: _____ | S15__ Start: _____ Stop: _____ |
| S04__ Start: _____ Stop: _____ | S16__ Start: _____ Stop: _____ |
| S05__ Start: _____ Stop: _____ | S17__ Start: _____ Stop: _____ |
| S06__ Start: _____ Stop: _____ | S18__ Start: _____ Stop: _____ |
| S07__ Start: _____ Stop: _____ | S19__ Start: _____ Stop: _____ |
| S08__ Start: _____ Stop: _____ | S20__ Start: _____ Stop: _____ |
| S09__ Start: _____ Stop: _____ | S21__ Start: _____ Stop: _____ |
| S10__ Start: _____ Stop: _____ | S22__ Start: _____ Stop: _____ |
| S11__ Start: _____ Stop: _____ | S23__ Start: _____ Stop: _____ |
| S12__ Start: _____ Stop: _____ | S24__ Start: _____ Stop: _____ |

Approx Age: <20 yrs. 20-39 yrs. 40-59 yrs. 60+ yrs.

Gender: Male Female Unsure

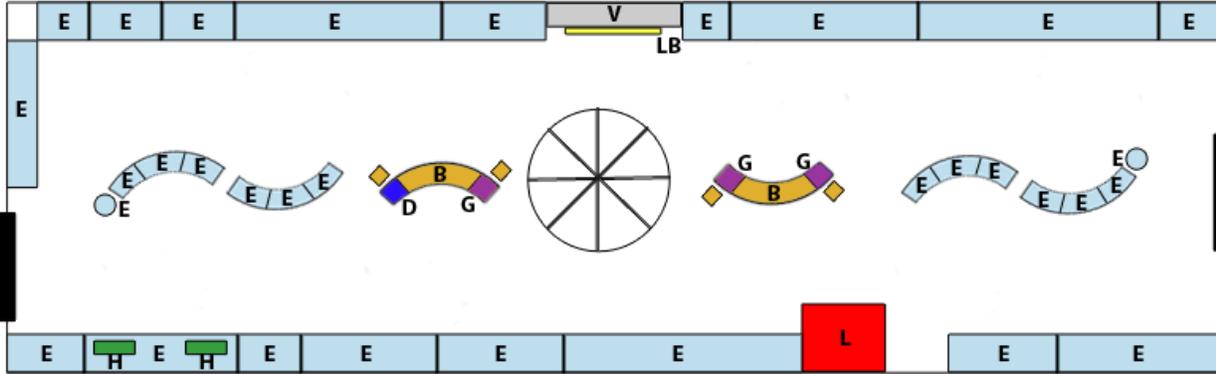
Grouping: # of Adults (18+) _____ # of Children _____
 # Male _____ # Female _____ # Unsure _____

Comments: _____

Appendix J - Gallery Tracking: Jewellery Gallery Rooms 91-93 (Lower Floor)

Date: _____ Wall Time Start: _____ Complete? _____ # _____

Investigator: _____ Finish Time: _____



Stops: S-Stop, Add a 'D' after stop number to indicate digital interface usage, Add a 'ST' to indicate tracked visitor went to upper floor

- | | |
|--------------------------------|--------------------------------|
| S01__ Start: _____ Stop: _____ | S16__ Start: _____ Stop: _____ |
| S02__ Start: _____ Stop: _____ | S17__ Start: _____ Stop: _____ |
| S03__ Start: _____ Stop: _____ | S18__ Start: _____ Stop: _____ |
| S04__ Start: _____ Stop: _____ | S19__ Start: _____ Stop: _____ |
| S05__ Start: _____ Stop: _____ | S20__ Start: _____ Stop: _____ |
| S06__ Start: _____ Stop: _____ | S21__ Start: _____ Stop: _____ |
| S07__ Start: _____ Stop: _____ | S22__ Start: _____ Stop: _____ |
| S08__ Start: _____ Stop: _____ | S23__ Start: _____ Stop: _____ |
| S09__ Start: _____ Stop: _____ | S24__ Start: _____ Stop: _____ |
| S10__ Start: _____ Stop: _____ | S25__ Start: _____ Stop: _____ |
| S11__ Start: _____ Stop: _____ | S26__ Start: _____ Stop: _____ |
| S12__ Start: _____ Stop: _____ | S27__ Start: _____ Stop: _____ |
| S13__ Start: _____ Stop: _____ | S28__ Start: _____ Stop: _____ |
| S14__ Start: _____ Stop: _____ | S29__ Start: _____ Stop: _____ |
| S15__ Start: _____ Stop: _____ | S30__ Start: _____ Stop: _____ |

Approx Age: <20 yrs. 20-39 yrs. 40-59 yrs. 60+ yrs.

Gender: Male Female Unsure

Grouping: # of Adults (18+) _____ # of Children _____

 # Male _____ # Female _____ # Unsure _____

Comments: _____

Appendix K - Gallery Survey
Victoria & Albert Museum -Digital Technology Survey

Date: _____ Time: _____ Investigator: _____ # _____

Hello, my name is _____ and I am a student at Worcester Polytechnic Institute in the United States. My colleagues and I are gathering information about the museum's use of digital technology, in order to suggest improvements to the museum. Would you be willing to take 5 minutes to answer a few questions?

Male Female Unsure

Gallery: _____

Quantity: _____

of Adults (18+) _____ # of Children _____

- Speaks English fluently
- Needs a little help or repetition when trying to understand English
- Needs much help or repetition when trying to understand English
- Does not speak English, survey cannot continue

1. How many times do you visit the V&A per year?

0-1 2-4 5-7 8-10 10+

2. What age category would you fall into?

<20 yrs. 20-39 yrs. 40-59 yrs. 60+ yrs. No answer

3. Why did you come to the museum today?

4. Could you please name one specific thing that you learned/observed from this room?

5. Did you create a teapot/ design a ring/ take the digital quiz (style guide)? Yes No

***If yes skip to #7 *If no skip #7 + 8**

6. If not, why not?

7. What did you like/dislike about the technology in use?

8. If you could change one thing about the digital technology, what would it be?

9. How proficient would you consider yourself with technology, on a scale of 1 to 10?

1 2 3 4 5 6 7 8 9 10

Not Proficient

Proficient

Appendix L - Sackler Centre Classroom Survey

Victoria & Albert Museum -Digital Technology Survey

Date: _____ Time: _____ Investigator: _____ # _____

Hello, my name is _____ and I am a student at Worcester Polytechnic Institute in the United States. My colleagues and I are gathering information about the Sackler Centre's use of digital technology, in order to suggest improvements to the programs being offered. Would you be willing to take 5 minutes to answer a few questions?

Male Female Unsure Program: _____

Quantity: _____ Run Time: _____

of Adults (18+) _____ # of Children _____

- Speaks English fluently
 Needs a little help or repetition when trying to understand English
 Needs much help or repetition when trying to understand English
 Does not speak English, survey cannot continue

1. How many times do you visit the V&A per year?

0-1 2-4 5-7 8-10 10+

2. What age category would you fall into?

<20 yrs. 20-39 yrs. 40-59 yrs. 60+ yrs. No answer

3. Was this your first time participating in a program offered in the Sackler Centre?

Yes No ***If yes skip to #6**

4. Please name the previous program(s) that you have participated in.

5. Do you feel like you learned more or less in this course compared to the previous course and why?

6. Have you used the technology presented in this course before? Yes No

7. What are your motivations for participating in this course?

8. What did you particularly like or dislike about today's course?

9. If you could change one thing about today's course what would it be?

10. How proficient would you consider yourself with technology before the class, on a scale of 1 to 10?

1 2 3 4 5 6 7 8 9 10

11. How proficient would you consider yourself with technology after the class, on a scale of 1 to 10?

1 2 3 4 5 6 7 8 9 10

Not Proficient

Proficient

